Application to Lismore Council

for a

Fourteen Lot Subdivision

on

Lot 4 DP 406893 - 658 Ballina Road

GM Project Development and Management

March 2022

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1. Introduction

This Statement relates to the application for a subdivision of an existing 1.54ha lot creating 14 lots varying in area from 603m^2 to 1,829m^2. The majority of lots will have frontage to an extended Greenwood Drive with 1 lot having frontage to Ballina Road.

All of the lots will retain/gain a dwelling entitlement upon approval of this application. The land is zoned General Residential R1 under Council's Lismore Local Environmental Plan 2012.

This submission assesses the proposal in terms of Council's LEP, relevant DCP's, Relevant State Policies and Section 4.15 of the EPA Act.

The location of the proposal is shown in **Figure 1**.

2. Proposal

The proposal involves the subdivision of Lot 4 DP 406893 to create fourteen lots ranging in area from 603m^2 to 1,395m^2.

The existing and proposed lot sizes are as follows:

<u>Current</u> Lot 4 DP 406893 1.54ha

<u>Proposed</u>

To Access off Ballina Road

Proposed Lot 1	912m^2

To Access off Extended Greenwood Drive

Proposed Lot 2	1,829m^2
Proposed Lot 3	1,395m^2 (existing house on this lot)
Proposed Lot 4	1,125m^2
Proposed Lot 5	903.3m^2
Proposed Lot 6	688.2m^2
Proposed Lot 7	895.3m^2
Proposed Lot 8	1,336m^2

Proposed Lot 9	697.5m^2
Proposed Lot 10	603.3m^2
Proposed Lot 11	1,140m^2
Proposed Lot 12	682.2m^2
Proposed Lot 13	648.1m^2
Proposed Lot 14	901.2m^2 (to be dedicated for public reserve)

The existing and proposed lot configurations are shown in **Figures 2** & **3** respectively**.**

Council Services

Council advised in the Pre Lodgement meeting that … *the local infrastructure for both water supply and sewerage is able to accommodate a proposed subdivision from this locality.*

Water

Water mains are located in Ballina Road and Greenwood Drive and these will be tapped to supply water to the proposed lots.

Sewer

Council's sewer mains are located on the property down its eastern boundary and are located adjacent to a portion of the property's western and northern boundaries.

All lots will be capable of connecting via gravity to these mains (using where necessary inter allotment drainage easements).

Stormwater

All proposed lots will drain by gravity to a proposed detention basin (in Lot 14) in the property's north eastern corner, and thence via an adjacent property to bushland.

Access

One of the created Torrens title lots will have frontage to Ballina Road and thirteen lots will have frontage to an extended Greenwood Drive.

The proposal includes an extension of Greenwood Drive from Lot 67 DP 1060356 to Lots 62 & 65 DP 715333 with the extension reflecting the

dimensions/design of the existing portions of Greenwood Drive (see **Figure 3**). A shared driveway accessing Lots 2, 3 and 4 is included in the road design.

Site Analysis

A site analysis has been prepared and it is contained in **Figure 4**.

Cut and Fill

It is not intended to include lot regrading at subdivisional works stage. New owners are thus given the opportunity to design proposed housing in accordance with Council's recommendations for development on steep slopes.

3. Subject Property and Location

The property that is the subject of this application is known as Lot 4 DP 406893, and has Real Property description of 658 Ballina Road.

The general location of the property could be described as being 500m (direct line) north of Goonellabah Shopping Village.

The subject property's location is illustrated in **Figure 1**.

4. Statutory Considerations

The primary statutory instruments that are applicable to this proposal are:

Lismore Local Environmental Plan 2012;
Lismore Development Control Plan;
Section 4.15 Environmental Planning and Assessment Act 1979;
Biodiversity Conservation Act 2016;
Rural Fires Act 1997;
State Environmental Planning Policy (Resilience and Hazards) 2021; and
State Environmental Planning No 44 - Koala Habitat Protection.

This application is accompanied by separate reports and/or plans on ecology, stormwater, traffic, geotechnical, contamination, bushfire and engineering design matters. The relevant sections and/or conclusions of these reports/plans are referred to in this application and the reports/plans are **separate** to this document.

Compliance with Council relevant DCP Chapters is illustrated in **Attachment 8** and compliance with relevant Acts is demonstrated in **Attachment 10**. Both of these Attachments are **included** in this document.

Lismore Local Environmental Plan 2012

The Lismore LEP 2012 is the primary statutory instrument applying to the land.

Zoning

In terms of the Local Environmental Plan ('LEP') the land is zoned General Residential R1.

The General Residential R1 has the following relevant objectives

To provide for a variety of housing types and densities.
Comment: Complies as the land provides an opportunity to create residential lots that utilise the frontage to Ballina Road and an extended Greenwood Drive.

To provide for the housing needs of the community.
Comment: The proposal is in keeping with Council's Housing Strategy that aims to create additional residential lots.

To enable other land uses that provide facilities or services to meet the day to day needs of residents.
Comment: Not Applicable

To ensure that new development is compatible with the character, and preserves the amenity, of each residential area.
Comment: The proposed residential allotments will be similar in scale to the surrounding residential lots.

Clause 2.6 Subdivision of land

This clause provides that "…*Land to which this Plan applies may be subdivided, but only with development consent,"* hence this application.

Clause 4.1 Minimum Subdivision Lot Size

The objectives of this Clause are as follows:

(1) (a) to provide a minimum lot size for the subdivision of land,
Comment: All proposed residential allotments exceed Council's minimum of 400m^2.

(b) to ensure that lot sizes have a practical and efficient layout to meet the intended use of each lot.

Comment: The proposed lots will be large enough to contain a building envelope and accommodate adequate open space adjacent to each dwelling.

The following controls of this Clause apply:

(2) This clause applies to a subdivision of any land shown on the Lot Size Map that requires development consent and that is carried out after the commencement of this Plan.

Comment: Hence this application**.**

(3) The size of any lot resulting from a subdivision of land to which this clause applies is not to be less than the minimum size shown on the Lot Size Map in relation to that land.

Comment: All proposed residential allotments exceed Council's minimum of 400m^2.

Clause 5.10 Heritage Conservation

A search of the AHIMS registry was undertaken and it showed no items of Aboriginal heritage within 200 m of the subject site (see **Attachment 6**).

It is also noted that there are no state or locally listed heritage items situated on any proposed lot or in the vicinity of the development site.

Clause 6.9 Essential Services

This clause requires that:

Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required:

(a) the supply of water,

Comment: Water is supplied via mains services located in Ballina Road and Greenwood Drive.

(b) the supply of electricity,

Comment: Electricity is will have to be extended from the mains in Ballina Road and Greenwood Drive. Discussions have already been held with Essential Energy about extending the supply.

(c) the disposal and management of sewage,

Comment: All lots will be capable of connecting to a gravity sewer system that would join to Council's system within the property's eastern boundary and on its western and northern boundaries.

(d) stormwater drainage or on-site conservation,

Comment: All proposed lots will be able to drain by gravity to the stormwater detention basin in the property's north eastern corner (Lot 14), and thence to bushland.

(e) suitable vehicular access.

Comment: One of the proposed lots will have frontage to Ballina Road and the remaining thirteen lots will either have direct access to Greenwood Drive or 'indirect' access to Greenwood Drive via a shared driveway.

Lismore Development Control Plan

Chapter 5A Urban Subdivision

The Chapter relates especially multi-lot subdivision rather than to single lot proposals. The Chapter's relevant requirements are reflected in the plans contained at **Attachment 7**, and are discussed below and are also discussed in **Attachment 8.**

Lots created should not be less than 400m^2	Complies – lot sizes are all greater than 400m^2.
Lots are to be connected to gravity sewer.	Complies – all lots can gravity feed into the sewer main within or adjacent to the property.
Lot design ensures suitable vehicle access.	Complies - access for lots will be to Ballina Road or Greenwood Drive.
Utility Services	Currently exist in Ballina Road and Greenwood Drive and/or within the property. Those external to the property will need

	to be extended into the subject property.
Provide a range and mix of lot sizes	The proposed lots comply with the minimum requirements of the zone.
Lots are capable of containing a building envelope of 12 x 15 metres.	All lots comply (see **Figure 3**).

A discussion of the Chapter's Elements and relevant performance criteria follow.

Element – Lot Layout

Objective/Performance Criteria	Comment
To provide a range and mix of lot sizes to suit a variety of dwellings and household types, with areas and dimensions to meet user requirements.	The proposed lots provide an opportunity for residential development of a parcel of suitably zoned land within an existing residential suburb.
To provide lots that are oriented where practicable to enable the application of energy conservation principles.	The proposed lots allow the construction of a north facing dwelling on each.
Size **P1.** Lot size, shape and dimensions: • take into account the constraints of the site and existing surrounding development; • are appropriate for the siting and construction of a dwelling and ancillary outbuildings, the provision of private outdoor space, convenient vehicle access and parking. *A minimum lot size of 400m2 applies for Torrens Title subdivision. Lots are capable See of containing a building envelope of 12 x 15 metres. The building envelope is to be shown on development plans.*	The lots can accommodate a building envelope of 12 x 15m. A suitably designed house with two car parking spaces (and associated manoeuvring space) plus adequate open space could be located on the proposed lots. See **Figure 3**.
P3. Lot sizes meet the projected requirements of people with different housing needs, and provide housing diversity and choice.	The lots with consequent house and appurtenant yard comply with the objectives of Lismore's Housing Strategy 2012 as discussed below.
P4 Lot access is safe for pedestrians, cyclists and vehicles using the access. *Access handle width for battle-axe subdivisions is:*	The private Driveway serving Lots 2, 3 & 4 is a 9m wide driveway.

• 3.6 metres for one (1) lot; *• three (3) metres each for two (2) or more adjoining lots*;	
Orientation and energy **P7.** Lots are orientated to facilitate the siting of dwellings to take advantage of microclimatic benefits, and have dimensions to allow adequate on-site solar access, taking into account likely dwelling size and the relationship of each lot to the Road. *Lot design allows for houses to be built with north facing windows which receive maximum winter sun.* *Lot design ensures that each lot:* *• will not be overshadowed by neighbouring houses to the north.* *• can have a sufficiently long north facade to receive winter sun.*	The 'typical' house design suggests that the lots will permit a north facing house, with a north façade that will not be overshadowed by any houses to the north given the size of each lot and the topography of each lot.

Element – Street networks

Objective/Performance Criteria	Comment
Function **P8**. The street network: • provides a clear structure and component streets conform to their function in the network; • has sufficient capacity to provide safe vehicular access for each lot; • shows clear physical distinctions between each type of street based on function, legibility, convenience, traffic volumes, vehicle speeds, safety and amenity; • incorporates space for the provision of public utility services; • facilitates walking and cycling within the neighbourhood and to local activity centres	The proposed extension of Greenwood Drive from Lot 67 DP 1060356 to Lots 62 & 65 DP 715333 will reflect the dimensions of the existing portions of Greenwood Drive The road reserve is to 16m width with a carriageway width of 9m to conform to Greenwood Drive's existing carriageway width (see **Figure 3** and **Attachment 7**). This will allow space for public utilities
Design **P9** The street network responds to: • existing and future streetscapes; • topography; • significant vegetation; • natural drainage; • site attributes; • solar access.	The proposed extension is a reflection of the existing Greenwood Drive and the topography of the subject site.
Safety and access **P10** Intersections along residential streets are spaced to create safe and convenient	There is a new 'intersection', internal to the property, with the extended Greenwood Drive and the private driveway

movements for motorists, cyclists and pedestrians.	
Environmental protection **P12.1** Traffic generated by a development is within the acceptable capacity of the roads. **P12.2** The street network is designed to reduce traffic speeds and volumes to acceptable levels, with most dwellings fronting streets with low volumes. **P12.3** Streets and lots are located so that dwellings are not subject to unacceptable levels of traffic noise.	The proposed Development creating thirteen residential lots accessing the extended Greenwood Drive would not create traffic volumes in excess of the road's capacity.

Element - Street Design, Construction and On-Street Parking

Function and width **P13** The width of the street reserve is sufficient to cater for all street functions, including: • safe and efficient movement of all users; • vehicle parking; • landscaping; • public utilities; • future carriage way widening; • retaining walls; • cycle paths or overland drainage flow paths.	The road reserve width exceeds that required by this Chapter ie Chapter requires a 15m reserve and a 7m carriageway for a Local Street. The proposal provides a 18m reserve and a 9.m carriageway (reflecting the existing configuration of the Greenwood Drive)
Designing for safety **P14** The street design: • provides for safe pedestrian use for people of all ages and levels of mobility; • includes speed reduction techniques to achieve desire speeds; • achieves safe sight distances based on vehicle speed, exits from property access points, pedestrian and cyclist crossings and at junctions and intersections.	The extended Greenwood Drive is relatively level entering the site from the east but has a grade of about 1:8 when it exists to the north. The road has been designed to meet council's geometric design parameters.
Driveway access **P15.1** Carriageway and verge width allows unobstructed access to individual lots, even when a car is parked on the opposite side of the street. **P15.2** Street and lot design ensures safe vehicle access to all lots.	The width of the reserve vs carriageway indicates adequate driveway access.
Geometric design **P16.6** Street and parking design enables adequate servicing of waste collection vehicles for all lots.	The width of the reserve vs carriageway indicates adequate access for waste collection vehicles.

Street construction **P17.1** The pavement edging and landscaping supports the function and amenity of the street. **P17.2** The pavement edge: • controls vehicle movements by delineating the carriageway for all users; • assists in controlling stormwater runoff; **P17.3** Street pavement surfaces: • have durability suited for travelling and parked vehicles; • ensure the safe passage of vehicles, pedestrians and cyclists; • cater for the discharge of rainfall and the preservation of all-weather access; • allow for reasonable travel comfort.	The pavement and pavement edging will be constructed as required by council. Stormwater runoff measures will be incorporated into the road design as described in **Attachment 1**
On-street parking **P18** Overflow on-street car parking is designed to consider: • the anticipated residential density; • availability of public transport; • likely future on-site parking provisions; • locations of non-residential uses; • safety for all users including pedestrians, cyclists and vehicles; • efficiency, access and manoeuvrability; • compatibility with the street function; • cost effectiveness; • streetscape and residential amenity	The proposed carriageway width within the road reserve will permit on street parking as per the Chapter's requirements ie *2.5m one side staggered to provide passing opportunities*

Element - Pedestrian and Cyclist Facilities

Planning and design **P19.1** A network of footpaths and cycle routes is provided that: • connects to adjoining streets, open spaces and activity centres; • encourages walking and cycling; • caters for all users; • provides opportunities to link open space networks and community facilities, transport, local activity centres and schools; • takes account of the topography	The extended Greenwood Drive will have the capability to incorporate a footpath/cycleway within the road reserve, although it is noted that there is no such facility within the existing portions of Greenwood Drive.
Location **P20** Footpaths and cycleways are located in street reservations where: • vehicle speeds and volumes are low;	Comment as above.

• the use of street pavements by cyclists does not affect the safety of pedestrians; • pedestrians and cyclists are protected from parked vehicles and vehicles moving along the street and on driveways.	

Element - Public Open Space

Local parks - location and site description **P24** Local parks are located to: • create a focal point for adjoining residents; • be accessible to users; • provide opportunities to incorporate existing natural and cultural features; • be free from constraints; • provide an appropriate area for the intended use; • provide high levels of visibility for crime prevention with adequate road frontage.	There is no need to provide any open space within the proposed development as there are two small parks each within 400m of the development, at the western end of Carramar Drive and at the intersection of Greenwood Drive & Gainsborough Way. It is noted that Council is divesting itself of small pocket parks, suggesting one is not required within the proposal.

Chapter 7 Off Road Parking

This Chapter requires a dwelling house to have two parking spaces (one covered).

It is submitted that two cars can be accommodated on each proposed lot. However this is better dealt with at house design stage.

Chapter 11 Buffers

The subject land is surrounded by residentially zoned land that has been developed for 'standard' residential lots. This Chapter is not applicable.

Chapter 14 Tree removal

The proposed subdivision and subsequent house location is proposed in an area that has previously been a banana orchard, and has number of mango, pecan and young eucalypts on site.

A December 2021 by Arbor Ecological identifies that Council's mapping shows *Primary Koala Habitat* in the western and northern portions of the site. Arbor Ecology indicates that

> *These comprise consists of juvenile and semi-mature koala food trees and a large clump of exotic weedy vegetation concentrated to the southwest.*

A report relating to *Threatened Species Test of Significance for the Koala* was prepared in December 2021 by Arbor Ecological as per the *NSW Biodiversity Conservation Act 2016* based on a previous 15 lot subdivision proposal. The Arbor Ecological report found *inter alia* that:

- *Koala food tree removal has been minimised to two trees above 10 cm DBH:*
- *a patch of smaller 122 regenerating koala food tree seedlings/saplings are required to be removed …These trees will be offset in accordance with the KPoM, with replantings proposed for a suitable Council reserve nearby*
- *Remaining scattered regrowth koala food trees (i.e. T1, T2, T3, T4 and T6) will be retained; given legal protection status via a legal covenant on property title, e.g. Section 88B/E;*

The Arbor Report (at **Attachment 2A**) concluded that:

> *The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/compensation measures…*

Chapter 22 Water Sensitive Design

The relevant objectives of this Chapter are:

> *1. To ensure that WSD techniques are incorporated in new developments.*
> *3. To ensure that stormwater discharged from new development minimises adverse impacts on the environment and receiving waters.*
> *4. To utilise natural surfaces and landforms as stormwater flow paths and to allow for on-site treatment where suitable.*
> *5. To ensure that water management is a key consideration in the urban design process to … ensure stormwater management*

infrastructure, in particular, is appropriately integrated with the site design.
6. To protect and restore aquatic ecosystems within the development site and downstream.
7. To ensure the function of the stormwater drainage and flood protection elements of designs are not compromised by incompatible or inappropriate WSD designs.

With regard to subdivisions and the quantity of generated stormwater, the Chapter requires that:

> *Residential subdivisions must be designed in accordance with the Northern Rivers Local Government Development and Design Manual and include an allowance of 300m² impervious area on each proposed residential lot to account for the likely impervious area associated with future residential development on the lots in addition to other constructed impervious areas such as roads.*

Comment: A Hydraulic Assessment prepared in November 2021 is contained at **Attachment 1A** and it concluded that:

> *The* [proposed] *design complies with the On Site Detention requirements of Chapter 22 of the Lismore DCP for both the 10%AEP and 1%AEP design events, by routing post developed peak flows to less than predeveloped levels. The 1%AEP design event was assessed with all internal channels and culverts designed to convey peak flows in a safe low energy manner.*

The Chapter requires the stormwater quality performance criteria as per the following table.

Total Suspended Solids	75% reduction in the mean annual load compared to baseline	Minimise the risk of water quality degradation in downstream waterways and thereby protect aquatic ecosystems
Total Phosphorus	65% reduction in the mean annual load compared to baseline	
Total Nitrogen	40% reduction in the mean annual load compared to baseline	
Gross Pollutants	90% reduction in the mean annual load compared to baseline	
Flow rates (environmental protection)	Limit the post-development peak 1 year average recurrence interval (ARI) discharge from the site to the pre-development peak 1 year ARI discharge.	Reduce the likelihood of increased rates of bed and bank erosion and damage to benthic habitat in waterways
Flow rates (infrastructure protection)	Limit the post-development peak 10 year average recurrence interval (ARI) discharge from the site to the pre-development peak discharge for the same ARI and assess the capacity of existing flow paths to accommodate the	Ensure that the development does not result in increased stormwater flows that exceed the capacity of the external stormwater

	post development 100 year average diversion of stormwater to a discharge location where the increased frequency of discharge will not have a detrimental impact on aquatic ecosystems. Reduce discharge from the site and provide necessary attenuation / infrastructure upgrade to ensure flow paths can accommodate anticipated flows	drainage infrastructure and / or exacerbate overland flow problems

The Plan includes a detention basin with bio retention features, and the accompanying Stormwater Management Plan prepared in March 2022 (**Attachment 1B**) concludes that:

> *This assessment shows that appropriate stormwater treatment can be achieved at the site.*
>
> *Detailed hydraulic assessment has been undertaken by Floodworks (2021) that provide On Site Detention (OSD) volumes required to achieve compliance with relevant section of the LCC DCP.*
>
> *Overland flow from the upslope areas to the west of the subject site will be collected in a surface swale and diverted along the western and northern boundaries and delivered to the legal point of discharge without treatment. Overland flow from an external residential catchment upslope of the development site will be captured in the proposed trunk drainage network and treatment system prior to discharge off site.*

Lismore Comprehensive Koala Plan

Council's Intramaps shows the subject land containing koala habitat on its western and north western boundaries as well as on land to the west, northwest and north.

A report relating to *Threatened Species Test of Significance for the Koala* was prepared in December 2021 by Arbor Ecological as per the *NSW Biodiversity Conservation Act 2016* based on a previous 15 lot subdivision proposal. The Arbor Ecological report (at **Attachment 2A**) concluded that:

> *The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/compensation measures outlined in* ***Sections 3 and 4*** [of the report]. *Thus*

> *preparation of a biodiversity development assessment report by an accredited assessor is not necessary in relation to s.7.3 of the NSW Biodiversity Conservation Act 2016.*

Lismore Council maintained its opinion that the proposal would have a negative impact on koalas. Consequently, the proposal was modified by removal of one lot to give more space for proposed mitigation and a second report on the *Threatened Species Test of Significance for the Koala* was in March 2022 by Cumberland Ecology prepared (see **Attachment 2B**) and it concluded:

> *The proposal is not likely to threaten the survival of the local population or clear significant areas of known habitat. Consistent with the findings of the Arbor Ecological test of significance, this test of … concludes that no significant impact is likely and there is no requirement for a BDAR to be prepared to accompany the development application.*

Div 4.3 S4.15 Environmental Planning & Assessment Act 1979

This section of the EPA Act requires all development applications to be assessed against specified heads of consideration. Such an assessment follows.

<u>The Provisions of:</u>

Any environmental planning instrument

Lismore Local Environmental Plan 2012 is the relevant LEP. In addition, the following are relevant:
Lismore Development Control Plan;
Section 4.15 Environmental Planning and Assessment Act 1979;
Biodiversity Conservation Act 2016;
Rural Fires Act 1997;
State Environmental Planning Policy (Resilience and Hazards) 2021; and
State Environmental Planning No 44 - Koala Habitat Protection.

The proposal's compliance with the LEP, DCP, relevant Act's and SEPP's are addressed elsewhere in this submission.

Any draft environmental planning instrument that is or has been placed on public exhibition

There are no Draft LEP's on exhibition that would affect the subject land.

Any development control plan

Chapters 5A, 7, 11, 14 and 22 of Council's DCP are relevant. The proposal's conformity with the DCP is discussed above.

Any planning agreement that has been entered into under section 93F or any draft planning agreement that a developer has offered to enter into under section 93F

Not applicable

The regulations (to the extent that they prescribe matters for the purposes of this paragraph), that apply to the land to which the development application relates,

Not applicable

The likely impacts of that development, including environmental impacts on all the natural and built environments, and social and economic impacts in the locality

Context and Setting

This proposal is located within an area that has previously been subdivided to create 'standard' suburban lots. Thus the proposal will not be out of character with the surrounding allotments.

The land has been zoned residential for in excess of 30 years and the neighbouring properties would have anticipated a residential subdivision of the subject land at some time.

The land to the immediate east is to be developed for 11 multi unit dwellings (DA 2103.305), and most of the land to the west is bushland (although zoned residential). There are 7 lots to the south, and north that have their backyards fronting the subject land.

It is submitted that the impact on adjoining dwellings will be minimsed given the configuration, and potential development options, of the surrounding properties.

Access

One of the proposed lots will have access to Ballina Road, and the remaining thirteen residential lots will access an extended Greenwood Drive.

Traffic

It is anticipated that there will be an increase in vehicular traffic due to the proposal going ahead. Traffic generation figures by the RMS indicate 7.4 movements per day for dwellings in regional areas. The thirteen lots accessing Greenwood Drive will generate less than 100 additional movements.

Greenwood Drive is a Local Street capable of servicing up to 180 lots and a volume of up to 1,000vpd. The thirteen proposed lots will increase the lots fronting Greenwood Drive to less than 60, well below the capacity of a Local Street. It is thus submitted that the increased traffic volume generated by the proposed development will be able to be accommodated by the local street network.

The layout proposes a single lot with frontage to Ballina Road that is no different to the 'historical' situation, with the existing dwelling (now on Lot 3) accessing the Bruxner Highway. The layout will allow vehicles to enter the property without having to prop on Ballina Road and to enter Ballina Road in a forward direction.

A report by *MCLaren Traffic Engineering* responding to comments made by Council relevant to traffic and parking is at **Attachment 9**, and concluded that:

> *it is considered that the revised plans for the proposed subdivision are considered to functional, safe and fit for purpose. The revised plans are fully supportable in terms of their traffic impacts, road safety outcomes and road design attributes.*

Utilities

There will be a need to extend utility services arising from this proposal. Discussions with telephone and electricity providers have indicated that there is sufficient capacity in the networks to cater for the development with suitable mains extensions.

Carparking

Not applicable.

Koala Habitat Assessment

A report relating to *Threatened Species Test of Significance for the Koala* was prepared in December 2021 by Arbor Ecological as per the *NSW Biodiversity Conservation Act 2016* based on a previous 15 lot subdivision proposal. The Arbor Ecological report (at **Attachment 2A**) concluded that:

> *The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/compensation measures outlined in* ***Sections 3 and 4*** [of the report]. *Thus preparation of a biodiversity development assessment report by an accredited assessor is not necessary in relation to s.7.3 of the NSW Biodiversity Conservation Act 2016.*

Lismore Council maintained its opinion that the proposal would have a negative impact on koalas. Consequently, the proposal was modified by removal of one lot to give more space for proposed mitigation and a second report on the *Threatened Species Test of Significance for the Koala* was in March 2022 by Cumberland Ecology prepared (see **Attachment 2B**) and it concluded:

The proposal is not likely to threaten the survival of the local population or clear significant areas of known habitat. Consistent with the findings of the Arbor Ecological test of significance, this test of … concludes that no significant impact is likely and there is no requirement for a BDAR to be prepared to accompany the development application.

Noise

The proposed development will not create any noise impacts other than those expected during construction.

Land Stability

Given the slope of the land, a Geotechnical Slope Stability Assessment Report (at **Attachment 3**) has been prepared. It concludes:

> *• The proposed earthworks will not have an unacceptable impact on land stability at this site or to adjoining lot owners;*
> *• The proposed earthworks will not have an unacceptable impact on the groundwater (if any);*
> *• A relative susceptibility rating of between 0.2 and 0.6 suggests a slope instability hazard rating of 'low' indicating that the site would remain stable in the long-term conditions and suitable for the proposed residential development and would not create undue risks to life and property;*
> *• Results of the global stability modelling and analysis indicates that the proposed development would achieve a suitable long-term global stability FoS greater than 1.5 and would not create undue risks to life and property;*
> *• It is considered that the proposed development and site conditions do not lend themselves to landslide;*
> *and*
> *• The natural ground slopes greater than 35% (approximately 1V:2.9H or 19.5 degrees) are considered compatible with the residential dwelling type proposed.*

Economic Impact

The economic benefit of the proposal will be positive in that new urban lots will come onto the local market promoting housing choice.

Social Impact

This proposal will have a positive social impact via the provision of a new urban lot in the Lismore area.

The suitability of the site for the development

The site is considered to be suitable for the development as it will comply with the relevant requirements of the LEP and DCP, is in harmony with the lot sizes and residential uses in the immediate vicinity.

Any submissions made in accordance with this Act or the regulations

Nil

The public interest

The public interest will be served by this proposal as it will provide an opportunity for increased housing opportunities in Lismore Council's urban area.

State Environmental Planning Policy (Resilience and Hazards) 2021

Section 4.6 of the SEPP requires that "*A consent authority must not consent to the carrying out of any development on land unless … it has considered whether the land is contaminated.*"

Further the SEPP requires that

> *Before determining an application for consent to carry out development that would involve a change of use on any of the land specified in subsection (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines*

A Contamination Assessment has been carried out. It concluded that

> *Based on the findings of this preliminary investigation, considered the Subject Site is not considered to represent a significant risk of harm to end users of future residential development.*

A copy of the Assessment is included at **Attachment 4**.

State Environmental Planning No 44 - Koala Habitat Protection

A report relating to *Threatened Species Test of Significance for the Koala* was prepared in December 2021 by Arbor Ecological as per the *NSW Biodiversity Conservation Act 2016* based on a previous 15 lot subdivision proposal. The Arbor Ecological report (at **Attachment 2A**) concluded that:

> *The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/compensation measures outlined in* ***Sections 3 and 4*** [of the report]. *Thus preparation of a biodiversity development assessment report by an accredited assessor is not necessary in relation to s.7.3 of the NSW Biodiversity Conservation Act 2016.*

Lismore Council maintained its opinion that the proposal would have a negative impact on koalas. Consequently, the proposal was modified by removal of one lot to give more space for proposed mitigation and a second report on the *Threatened Species Test of Significance for the Koala* was in March 2022 by Cumberland Ecology prepared (see **Attachment 2B**) and it concluded:

The proposal is not likely to threaten the survival of the local population or clear significant areas of known habitat. Consistent with the findings of the Arbor Ecological test of significance, this test of … concludes that no significant impact is likely and there is no requirement for a BDAR to be prepared to accompany the development application.

5. Housing Strategy 2012

Council's 2012 Housing Strategy has a number of themes and Outcomes with which the proposal complies. The relevant components of the Strategy are as follows.

Theme 1 Dwelling and land supply

Issue 1 - Need to increase the rate of housing supply

The need to increase the rate of housing supply is the most important issue for Lismore.

Outcome 2
Additional housing is provided within infill areas that are close to shops, community services and facilities, employment and transport options.

Theme 2 Housing choice and diversity at a range of prices

Issue 2 - Need for a mix of new housing stock at a range of prices

The Lismore LGA requires a mix of new housing stock at a range of prices. Smaller detached houses, units, flats and apartment style housing with 1 or 2 bedrooms are undersupplied and will be the major segment of the Lismore housing market needed over the next 20-25 years.

Outcome 4
A mix of housing options (in terms of housing type and design, lot size, number of bedrooms, quality of fit out and dwelling tenure) is available and reflects the financial capacity of households with different income levels.

Comment: The proposal conforms to with the above relevant Issues and Outcomes of the Strategy.

6. Bushfire Assessment

Section 100B of *the Rural Fires Act 1997* requires that all applications for subdivisions are required to be assessed in terms of the document "Planning for Bushfire Protection" issued by Planning NSW. A portion of the land is in the bushfire zone and bushfire buffer zone so an assessment is undertaken - see **Attachment 5.**

The assessment concludes:

> *Provided the recommendations herein are applied, including construction of the road as per the supporting engineered designs and site plan, including ongoing management of the roads proposed to be handed over to Council upon completion, it is in my professional opinion the proposed performance solution for property access presented herein, satisfies the objectives, performance criteria and the intent of measures as per s.5.3.2 (PBP).*

7. Conclusion

This submission has demonstrated that the proposal is one that complies with the relevant requirements of Council's:

- Lismore Environmental Plan 2012;
- Lismore DCP Chapters 5A, 7, 14 and 22;
- Council's Housing Strategy;
- Section 4.15 Environmental Planning and Assessment Act 1979;
- Biodiversity Conservation Act 2016;
- Rural Fires Act 1997;
- State Environmental Planning Policy (Resilience and Hazards) 2021; and
- State Environmental Planning No 44 - Koala Habitat Protection

Council is respectfully requested to approve the proposal to:

- subdivide Lot 4 DP 406893;
- create 1 lot with an area of 912m^2 fronting Ballina Road;
- create 13 lots (ie 12 residential and a public reserve) ranging in area from 603m^2 to 1,829m^2 gaining access from the extended Greenwood Drive;
- retain 3 koala food trees within Lot 8 to be protected by a S88B instrument;
- offset koala food tree seedlings/saplings that are required to be removed, with replantings proposed for a compensatory works in accord with Appendix 5 – Habitat Compensation Policy and outlined in the CKPoM approved by Council.
- undertake associated infrastructure works.

Graham Meineke MPIA
March 2022

8. Figures and Attachments

Figure 1	Site Locality
Figure 2	Existing Configuration
Figure 3	Proposed Lot Layout
Figure 4	Site Analysis

Note that all of the Attachments are separate to this document, except Attachments 6, 8 and 10 that are included in this document.

Attachment 1A	Stormwater Management Plan (dated November 2021)
Attachment 1B	Stormwater Management Plan (dated March 2022)
Attachment 2A	Biodiversity Conservation Act Report (dated December 2021)
Attachment 2B	Biodiversity Conservation Act Report (dated March 2022)
Attachment 3	Geotechnical Report
Attachment 4	Contamination Report
Attachment 5	Bushfire Assessment
Attachment 6	AHIMS search
Attachment 7	Civil Engineering Plans
Attachment 8	Response to DCP Chapter 5A
Attachment 9	Traffic Engineering
Attachment 10	Jurisdictional Compliance

Figure 1 Site Locality

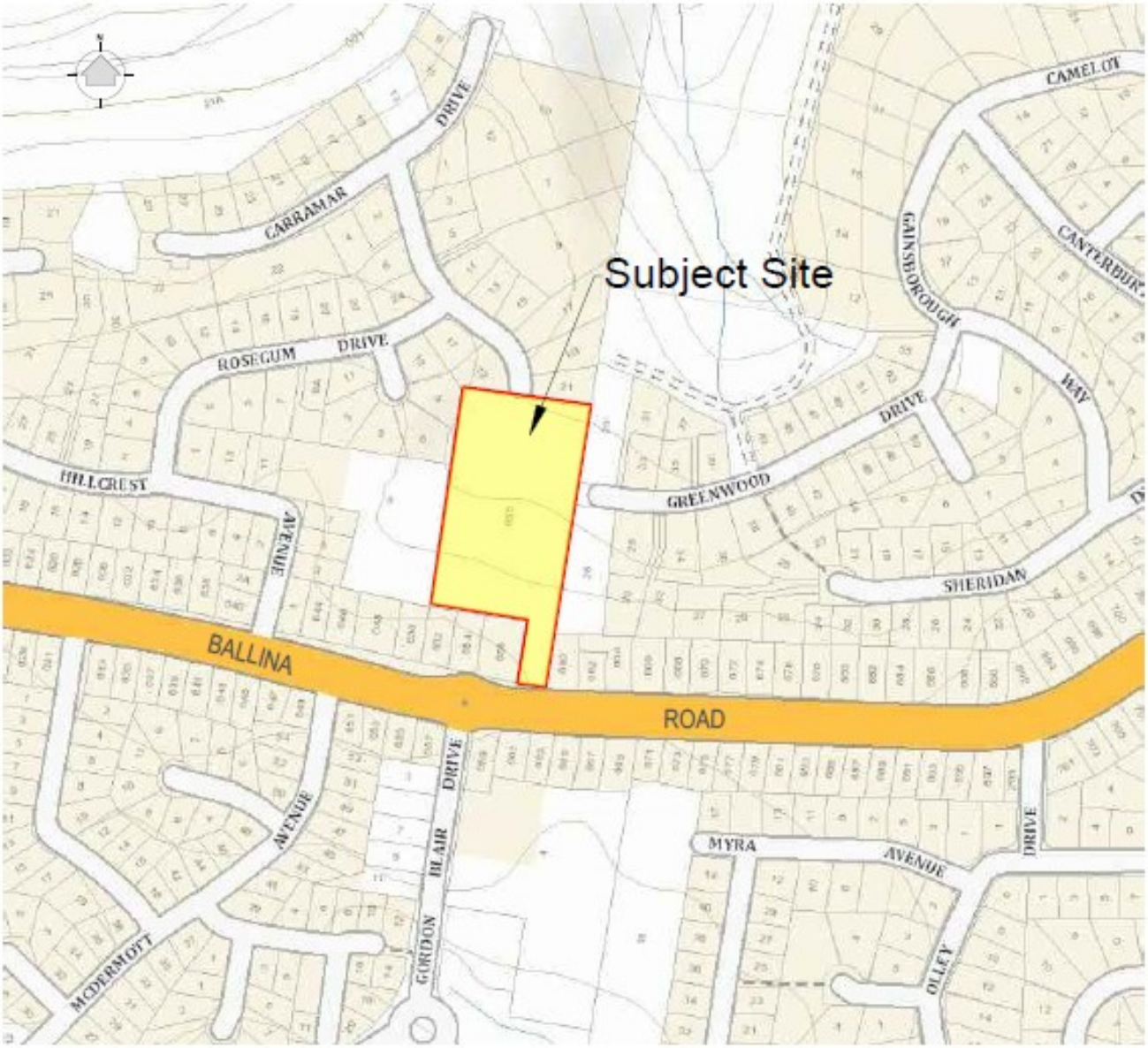
Subject Site
BALLINA
ROAD
CARRAMAR
DRIVE
ROSEGUM
DRIVE
HILLCREST
AVENUE
GREENWOOD
DRIVE
GAINSBOROUGH
WAY
CAMELOT
SHERIDAN
MYRA
AVENUE
DRIVE
BLAIR
DRIVE
GORDON
AVENUE
MCDERMOTT
OLLEY

Figure 2 Existing Configuration

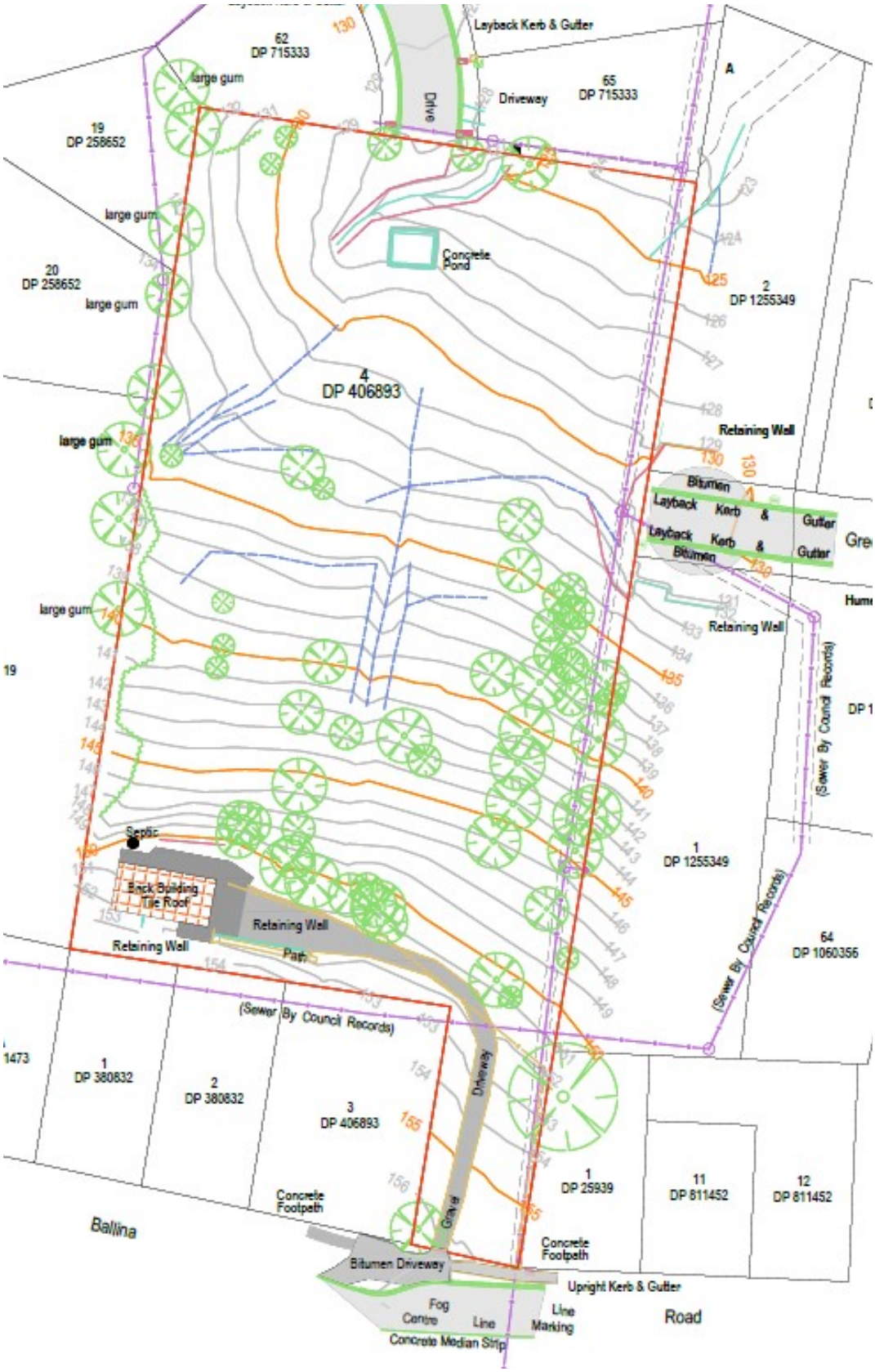
Layback Kerb & Gutter
62
DP 715333
large gum
Drive
Driveway
65
DP 715333
19
DP 258652
large gum
Concrete Pond
20
DP 258652
large gum
2
DP 1255349
4
DP 406893
Retaining Wall
large gum
Bitumen
Layback Kerb & Gutter
Layback Kerb & Gutter
Bitumen
large gum
Retaining Wall
(Sewer By Council Records)
Septic
Back Building Tile Roof
Retaining Wall
Path
Retaining Wall
1
DP 1255349
64
DP 1060356
(Sewer By Council Records)
(Sewer By Council Records)
1
DP 380832
2
DP 380832
3
DP 406893
Driveway
Concrete Footpath
Grass
1
DP 25939
11
DP 811452
12
DP 811452
Ballina
Concrete Footpath
Bitumen Driveway
Upright Kerb & Gutter
Fog Centre Line
Line Marking
Concrete Median Strip
Road

Figure 3 Proposed Lot Layout

Jasmine Court
Greenwood Drive (Existing)
PUBLIC RESERVE (Council street)
Overland flow diversion drain
(Council street)
Greenwood Drive (Existing)
Humeceptor
large gum
Sewer By Council Records
Sewer By Council Records
Sewer By Council Records
Ballina
1
2
3
4
5
6
7
8
9
10
11
12
13

Figure 4 Site Analysis

Cooling North Easterly breezes in summer
North facing slope takes advantage of winter sun
658 Ballina Road
Goonellabah
Sheltered from S and SW winter winds by vegetation and north facing slope
Slopes will insulate house from Bruxner Hwy traffic noise
N
BALLINA RD
BRUXNER HWY

Attachment 1A Stormwater Management Plan (dated November 2021)

(attached separately to this document)

Attachment 1B Stormwater Management Plan (dated March 2022)

(attached separately to this document)

Attachment 2A Biodiversity Conservation Act Report (dated December 2021)
(attached separately to this document)

Attachment 2B Biodiversity Conservation Act Report (dated March 2022)

(attached separately to this document)

Attachment 3 Geotechnical Report
(attached separately to this document)

Attachment 4 Contamination Report
(attached separately to this document)

Attachment 5 Bushfire Assessment
(attached separately to this document)

Attachment 6 AHIMS search

Office of Environment & Heritage
NSW GOVERNMENT

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : SKM 658
Client Service ID : 455988

Graham Meineke
43 Beaumont Dr
East Lismore New South Wales 2480
Attention: Graham Meineke
Email: graham@gmproject.com.au

Date: 13 October 2019

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 4, DP:DP406893 with a Buffer of 200 meters, conducted by Graham Meineke on 13 October 2019.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

Attachment 7 Civil Engineering Plans
(attached separately to this document)

Attachment 8 Response to DCP Chapters 5A, 7, 14, & 22

Statement re compliance with Council's DCP Chapters:

5A (Urban Subdivision);

7 (Off Street parking);

14 (Tree Removal); and

22 (Water Sensitive Urban Design)

Chapter 5A (Urban Subdivision)

The Chapter relates especially multi-lot subdivision rather than to single lot proposals. The Chapter's relevant requirements are reflected in the plans contained at **Attachment 7**, and are discussed below and are also discussed in **Attachment 8.**

Lots created should not be less than 400m^2	Complies – lot sizes are all greater than 400m^2.
Lots are to be connected to gravity sewer.	Complies – all lots can gravity feed into the sewer main within or adjacent to the property.
Lot design ensures suitable vehicle access.	Complies - access for lots will be to Ballina Road or Greenwood Drive.
Utility Services	Currently exist in Ballina Road and Greenwood Drive and/or within the property. Those external to the property will need to be extended into the subject property.
Provide a range and mix of lot sizes	The proposed lots comply with the minimum requirements of the zone.

Lots are capable of containing a building envelope of 12 x 15 metres.	All lots comply (see **Figure 3**).

A discussion of the Chapter's Elements and relevant performance criteria follow.

Element – Lot Layout

Objective/Performance Criteria	Comment
To provide a range and mix of lot sizes to suit a variety of dwellings and household types, with areas and dimensions to meet user requirements.	The proposed lots provide an opportunity for residential development of a parcel of suitably zoned land within an existing residential suburb.
To provide lots that are oriented where practicable to enable the application of energy conservation principles.	The proposed lots allow the construction of a north facing dwelling on each.
Size **P1.** Lot size, shape and dimensions: • take into account the constraints of the site and existing surrounding development; • are appropriate for the siting and construction of a dwelling and ancillary outbuildings, the provision of private outdoor space, convenient vehicle access and parking. *A minimum lot size of 400m2 applies for Torrens Title subdivision. Lots are capable See of containing a building envelope of 12 x 15 metres. The building envelope is to be shown on development plans.*	The lots can accommodate a building envelope of 12 x 15m. A suitably designed house with two car parking spaces (and associated manoeuvring space) plus adequate open space could be located on the proposed lots. See **Figure 3**.
P3. Lot sizes meet the projected requirements of people with different housing needs, and provide housing diversity and choice.	The lots with consequent house and appurtenant yard comply with the objectives of Lismore's Housing Strategy 2012 as discussed below.
P4 Lot access is safe for pedestrians, cyclists and vehicles using the access. *Access handle width for battle-axe subdivisions is:* • *3.6 metres for one (1) lot;* • *three (3) metres each for two (2) or more adjoining lots*;	The private Driveway serving Lots 2, 3 & 4 is a 9m wide driveway.
Orientation and energy **P7.** Lots are orientated to facilitate the siting of dwellings to take advantage of microclimatic benefits, and have	The 'typical' house design suggests that the lots will permit a north facing house, with a north façade that will not be

dimensions to allow adequate on-site solar access, taking into account likely dwelling size and the relationship of each lot to the Road. *Lot design allows for houses to be built with north facing windows which receive maximum winter sun.* *Lot design ensures that each lot:* *• will not be overshadowed by neighbouring houses to the north.* *• can have a sufficiently long north facade to receive winter sun.*	overshadowed by any houses to the north given the size of each lot and the topography of each lot.

Element – Street networks

Objective/Performance Criteria	Comment
Function **P8**. The street network: • provides a clear structure and component streets conform to their function in the network; • has sufficient capacity to provide safe vehicular access for each lot; • shows clear physical distinctions between each type of street based on function, legibility, convenience, traffic volumes, vehicle speeds, safety and amenity; • incorporates space for the provision of public utility services; • facilitates walking and cycling within the neighbourhood and to local activity centres	The proposed extension of Greenwood Drive from Lot 67 DP 1060356 to Lots 62 & 65 DP 715333 will reflect the dimensions of the existing portions of Greenwood Drive The road reserve is to 16m width with a carriageway width of 9m to conform to Greenwood Drive's existing carriageway width (see **Figure 3** and **Attachment 7**). This will allow space for public utilities
Design **P9** The street network responds to: • existing and future streetscapes; • topography; • significant vegetation; • natural drainage; • site attributes; • solar access.	The proposed extension is a reflection of the existing Greenwood Drive and the topography of the subject site.
Safety and access **P10** Intersections along residential streets are spaced to create safe and convenient movements for motorists, cyclists and pedestrians.	There is a new 'intersection', internal to the property, with the extended Greenwood Drive and the private driveway
Environmental protection **P12.1** Traffic generated by a development is within the acceptable capacity of the roads.	The proposed Development creating thirteen residential lots accessing the extended Greenwood Drive would not

P12.2 The street network is designed to reduce traffic speeds and volumes to acceptable levels, with most dwellings fronting streets with low volumes. **P12.3** Streets and lots are located so that dwellings are not subject to unacceptable levels of traffic noise.	create traffic volumes in excess of the road's capacity.

Element - Street Design, Construction and On-Street Parking

Function and width **P13** The width of the street reserve is sufficient to cater for all street functions, including: • safe and efficient movement of all users; • vehicle parking; • landscaping; • public utilities; • future carriage way widening; • retaining walls; • cycle paths or overland drainage flow paths.	The road reserve width exceeds that required by this Chapter ie Chapter requires a 15m reserve and a 7m carriageway for a Local Street. The proposal provides a 18m reserve and a 9.m carriageway (reflecting the existing configuration of the Greenwood Drive)
Designing for safety **P14** The street design: • provides for safe pedestrian use for people of all ages and levels of mobility; • includes speed reduction techniques to achieve desire speeds; • achieves safe sight distances based on vehicle speed, exits from property access points, pedestrian and cyclist crossings and at junctions and intersections.	The extended Greenwood Drive is relatively level entering the site from the east but has a grade of about 1:8 when it exists to the north. The road has been designed to meet council's geometric design parameters.
Driveway access **P15.1** Carriageway and verge width allows unobstructed access to individual lots, even when a car is parked on the opposite side of the street. **P15.2** Street and lot design ensures safe vehicle access to all lots.	The width of the reserve vs carriageway indicates adequate driveway access.
Geometric design **P16.6** Street and parking design enables adequate servicing of waste collection vehicles for all lots.	The width of the reserve vs carriageway indicates adequate access for waste collection vehicles.
Street construction **P17.1** The pavement edging and landscaping supports the function and amenity of the street. **P17.2** The pavement edge: • controls vehicle movements by	The pavement and pavement edging will be constructed as required by council.

delineating the carriageway for all users; • assists in controlling stormwater runoff; **P17.3** Street pavement surfaces: • have durability suited for travelling and parked vehicles; • ensure the safe passage of vehicles, pedestrians and cyclists; • cater for the discharge of rainfall and the preservation of all-weather access; • allow for reasonable travel comfort.	Stormwater runoff measures will be incorporated into the road design as described in **Attachment 1**
On-street parking **P18** Overflow on-street car parking is designed to consider: • the anticipated residential density; • availability of public transport; • likely future on-site parking provisions; • locations of non-residential uses; • safety for all users including pedestrians, cyclists and vehicles; • efficiency, access and manoeuvrability; • compatibility with the street function; • cost effectiveness; • streetscape and residential amenity	The proposed carriageway width within the road reserve will permit on street parking as per the Chapter's requirements ie *2.5m one side staggered to provide passing opportunities*

Element - Pedestrian and Cyclist Facilities

Planning and design **P19.1** A network of footpaths and cycle routes is provided that: • connects to adjoining streets, open spaces and activity centres; • encourages walking and cycling; • caters for all users; • provides opportunities to link open space networks and community facilities, transport, local activity centres and schools; • takes account of the topography	The extended Greenwood Drive will have the capability to incorporate a footpath/cycleway within the road reserve, although it is noted that there is no such facility within the existing portions of Greenwood Drive.
Location **P20** Footpaths and cycleways are located in street reservations where: • vehicle speeds and volumes are low; • the use of street pavements by cyclists does not affect the safety of pedestrians; • pedestrians and cyclists are protected from parked vehicles and vehicles moving along the street and on driveways.	Comment as above.

Element - Public Open Space

Local parks - location and site description **P24** Local parks are located to: • create a focal point for adjoining residents; • be accessible to users; • provide opportunities to incorporate existing natural and cultural features; • be free from constraints; • provide an appropriate area for the intended use; • provide high levels of visibility for crime prevention with adequate road frontage.	There is no need to provide any open space within the proposed development as there are two small parks each within 400m of the development, at the western end of Carramar Drive and at the intersection of Greenwood Drive & Gainsborough Way. It is noted that Council is divesting itself of small pocket parks, suggesting one is not required within the proposal.

Chapter 7 (Off Street parking)

2 car spaces required per dwelling	The lot sizes suggest that two cars can be accommodated on each proposed lot. However this is better dealt with at house design stage

Chapter 14 (Tree Removal)

Consent required for tree removal	*Hence this application –* *Trees to be removed will be offset in accordance with the KPoM, with replantings proposed for a suitable Council reserve*

Chapter 22 (Water Sensitive Urban Design)

Objective 3 *To ensure that stormwater discharged from new development minimises adverse impacts on the environment and receiving waters*	The Hydraulic Report concluded that *The* [proposed] *design complies with the On Site Detention requirements of Chapter 22 of the Lismore DCP for both the 10%AEP and 1%AEP design events, by routing post developed peak flows to less than predeveloped levels. The 1%AEP design event was assessed with all internal channels and culverts designed to convey peak flows in a safe low energy manner.*

	The Stormwater Management Plan prepared in March 2022 concludes that: *This assessment shows that appropriate stormwater treatment can be achieved at the site*

Attachment 9 Traffic Engineering
(attached separately to this document)

Attachment 10 Jurisdictional Compliance

Statement re compliance with relevant Environmental Planning Instruments

#	Jurisdictional Matter	Provision	Compliant (Y/N)	Comments
1	*Biodiversity Conservation Act 2016* (NSW)	Section 7.2 Development or activity "likely to significantly affect threatened species"	Y	Cumberland Ecology's report concluded *The proposal is not likely to threaten the survival of the local population or clear significant areas of known habitat. Consistent with the findings of the Arbor Ecological test of significance, this test of significance (**Chapter 5**) concludes that no significant impact is likely and there is no requirement for a BDAR to be prepared to accompany the development application.*
		Section 7.7 Test for determining whether proposed development or activity likely to significantly affect threatened species or ecological communities, or their habitats	Y	Cumberland Ecology's report determined *The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of*

				extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/ compensation measures outlined in [the report's Chapter 4]
2	State Environmental Planning No 44 - Koala Habitat Protection	Clause 7 - Is the land potential koala habitat	Y	Arbor Ecology determined that *the land would have satisfied requirements for recognition of the site as core koala habitat.*
		Clause 8 - Is the land core koala habitat?	Y	Arbor Ecology determined that *the land would have satisfied requirements for recognition of the site as core koala habitat.*
3	State Environmental Planning Policy (Resilience and Hazards) 2021 * formally the *State Environmental Planning Policy No 55 – Remediation of Land.*	Clause 4.6 (Contamination)	Y	EAL's Report determined that *Based on the findings of this preliminary investigation, considered the Subject Site is not considered to represent a significant risk of harm to end users of future residential development.*
4	*Lismore Local Environmental Plan 2012*	Clause 2.6 (subdivision of land)	Y	DA Required for Subdivision – hence this Application
		Clause 4.1 (minimum lot size)	Y	Minimum area of 400m^2 exceeded by

				all lots
		Clause 5.10 (Heritage Conservation)	Y	AHIMS Search and Council's LEP's Schedule 5 (Environmental Heritage) do not show the land as containing any aboriginal or European heritage
		Clause 6.10 (Essential Services)	Y	Council's Pre Lodgement Minutes indicate that *… the local infrastructure for both water supply and sewerage is able to accommodate a proposed subdivision from this locality.*
5	*Rural Fires Act 1997*	Section 100B	Y	The Bushfire assessment concludes: *Provided the recommendations herein are applied, including construction of the road as per the supporting engineered designs and site plan, including ongoing management of the roads proposed to be handed over to Council upon completion, … the proposed performance solution for property access presented herein, satisfies the objectives, performance criteria and the intent of measures as per s.5.3.2 (PBP).*

REPORT

658 BALLINA ROAD, GOONELLABAH NSW

Hydraulic Assessment

658 Ballina Road Pty Ltd atf 658 Ballina Road Trust

Contact us to design the sustainable towns and cities of tomorrow.

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Our Ref: FW00086

Revision: 01.1 DRAFT

Date: 05 November 2021

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					Signature	Date
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DRAFT

Executive Summary

Floodworks has been engaged by *658 Ballina Road Pty Ltd atf 658 Ballina Road Trust* to prepare a Hydraulic Assessment (HA) for the proposed Residential Subdivision Development over 658 Ballina Road Goonellabah, NSW 2480, properly described as Lot 4 DP406893, known here in as the subject site. The subject site is within the Lismore Local Government Area (LGA).

Specifically, the development will incorporate:

- Stormwater quantity objectives will be achieved through routing of site based runoff through rainwater tanks and an On Site Detention basin for the 10%AEP and 1%AEP design events
    - On Site Detention basin volume of 109 m^3
    - Rainwater tanks volume 13 x $3m^3$
- Post developed 1%AEP and 10%AEP design events have been successfully routed to predevelopment levels

The above design complies with Lismore City Councils DCP Chapter 22 for stormwater water quantity.

DRAFT

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DRAFT

1. Introduction

1.1. Background

Floodworks has been engaged by *658 Ballina Road Pty Ltd atf 658 Ballina Road Trust* to prepare a Hydraulic Assessment (HA) for the proposed Residential Subdivision Development over 658 Ballina Road Goonellabah, NSW 2480, properly described as Lot 4 DP406893, known here in as the subject site.

1.2. Scope

Specifically, this report details the following:

1. Conceptual Hydraulic Assessment (HA)
    a. Pre and post developed hydrology and hydraulics of the site (DRAINS) in satisfaction of chapter 22 of Lismore Council DCP for both 10%AEP and 1%AEP design events
    b. On Site Detention (OSD) basin design

To minimise the impact of the proposed development on the external sensitive environment the proponent shall implement this HA. To avoid significant and/or sustained deterioration to the downstream receiving environment, this HA may be amended as required.

1.3. Objectives

The objective of this Hydraulic Assessment is to ensure that there is no worsening of stormwater discharge to downstream receiving waters as a result of activities on the subject site in compliance with the Lismore City Council (LCC) Development Control Plan (DCP) 2012.

1.4. Description of Subject Site

The subject site occupies a total site area of approximately 1.54 ha. The site is bounded by Ballina Road to the South, a natural reserve to the west, and residential lots to the east and north. A significant natural gully runs from the western boundary to the northeastern boundary. The subject site is mostly vacant with four existing dwellings located to the south of the site adjoining Ballina Road. The site is relatively steep with an equal area slope of 15%, is primarily covered by thick grasses , and sparce and irregularly spaced trees and shrubs. The site reaches a maximum elevation of 159m AHD to the south falling to 123m AHD to the north east.

Refer to Figure 1.1 for the location and aerial imagery of the subject site.

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Figure 1.1 Aerial Imagery of Subject Site

1.5. Rainfall

Intensity Frequency Duration (IFD) data has been derived using the Bureau of Meteorology (BOM) IFD generator. The IFD data is derived in accordance with Australian Rainfall and Runoff 2019 (ARR, 2019) and has been used in determining the peak flow rates from the site.

1.6. Description of Development

The proposed development is for 13 lots and two internal roads. One of the site entries will be from Ballina Road, with the other connecting Greenwood Drive.

The proposed development will result in an increase in impervious area from the proposed roof and road areas over the pre-developed case. The proposed development layout is illustrated in Figure 1.2 below.

Figure 1.2 Proposed Plan of Development

2. Stormwater Quantity Assessment

2.1. Hydrologic and Water Quantity Objectives

The following section of this report outlines the measures required to meet the water quantity objectives as per the Chapter 22 of Councils DCP. In order to meet these objectives, it is necessary to ensure that post development discharge from the site will not create a worse situation for downstream property owners than that which existed prior to the development (i.e. non-worsening).

Due to the increase in impervious areas within the proposed development, peak stormwater flow rates will increase. In order to mitigate these increased flow rates from the developed site it is proposed to implement an On-Site Detention (OSD) system. OSD systems temporarily store stormwater runoff and release flows at a controlled rate that is no greater than the pre-developed peak rate.

2.2. Conveyance of Site Flows

It is proposed to connect roof runoff from all new dwellings to 3KL rainwater tanks, with excess runoff directed via Inter Allotment Drainage (IAD) to an On site Detention basin (i.e. Biobasin) located in to the north east corner of the lot.

The proposed road flow will be conveyed via a standard kerb and channel piped stormwater system to the designated OSD basin for all events up to and including the 10%AEP design event.

Overland 1%AEP peak runoff will also be routed through the OSD basin.

The legal point of discharge is to the north east of the subject site and is covered by an easement.

A focus is to ensure that all design events up to and including the 1%AEP design event are routed to predevelopment levels in recognition of the constrained nature of the receiving gully located immediately downstream of the site (Lot2 DP 1255349).

Refer to *RCS Civil Drawings Rev2 28/10/21* for additional detail.

2.3. Water Quantity Objectives

As indicated in Lismore DCP, Part A, Chapter 22, the proposed development shall be designed to meet the water quantity objectives as per Figure 2.1 below. Additional 1% peak flows will be detained to ensure no worsening in recognition of the sensitive downstream receiving environment.

Stormwater Quantity		
Flow rates (environmental protection)	Limit the post-development peak 1 year average recurrence interval (ARI) discharge from the site to the pre-development peak 1 year ARI discharge.	Reduce the likelihood of increased rates of bed and bank erosion and damage to benthic habitat in waterways
Flow rates (infrastructure protection)	Limit the post-development peak 10 year average recurrence interval (ARI) discharge from the site to the pre-development peak discharge for the same ARI and assess the capacity of existing flow paths to accommodate the post development 100 year average diversion of stormwater to a discharge location where the increased frequency of discharge will not have a detrimental impact on aquatic ecosystems. Reduce discharge from the site and provide necessary attenuation / infrastructure upgrade to ensure flow paths can accommodate anticipated flows.	Ensure that the development does not result in increased stormwater flows that exceed the capacity of the external stormwater drainage infrastructure and / or exacerbate overland flow problems

Figure 2.1 Lismore City Council Stormwater Quantity Objectives

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3. Hydrologic Assessment

3.1. Methodology

DRAINS software was utilised to model the performance of the proposed stormwater quantity control measures. This modelling software is a link-node model capable of performing hydrology and hydraulics of stormwater drainage systems simultaneously. ILSAX Hydrology has been adopted as the runoff routing method within DRAINS.

The Drains model was used to estimate the 10% AEP and 1% AEP design runoff as per Australian Rainfall and Runoff 2019 methodologies. A numerical check has been undertaken using the Rational Method.

3.2. Hydrologic Model

3.2.1. Configuration

Figure 3.1 illustrates the extent of the Drains model. There are 3 subcatchments (the total area is 4.31ha) which were used to represent runoff contributing to the hydraulic function of the subject site. These catchments were delineated to accurately represent the inflow location and its impact on the subject site.

Figure 3.1 DRAINS Model Extents

3.2.2. Hydrologic Routing

Hydrologic modelling has been undertaken using the Ilsax runoff routing method, which is a time area hydrology model using Horton Losses. The Ilsax method requires the catchment to be divided into a

grassed and paved portions, and assumes that the losses (or infiltration) of runoff decreases over the duration of the storm. Friends method was employed to determine time of concentration (T_c).

3.2.3. Catchment Retardation Coefficient n*

The Retardation Coefficient n* (similar to Manning's roughness n) values are applied to represent the different land uses of the catchment. Drains allows a range to be applied to represent the varied degree of roughness that could be expected within the catchment.

3.2.4. Rainfall Losses and Soil Type

Depression storage has been included in addition to Horton infiltration losses. The following loss rates have been adopted:

- Paved area depression storage 1mm
- Supplementary depression storage 1mm
- Grassed depression storage 5mm

Soil type C (slow infiltration rate) was chosen to reflect the steep nature of the lot and the constrained infiltration potential of the soils. Furthermore, antecedent moisture conditions of 3 (Rather Wet) was selected as conservative.

3.2.5. Existing Conditions Parameters

Table 1 summarises the ILSAX parameters adopted for the existing catchment conditions. The catchments equal area slope was calculated directly from 1m LIDAR.

The percentage impervious was determined directly from the aerial imagery.

The total contributing catchment area is 4.31ha. The hydrologic factors adopted are summarised in Table 1.

Table 1 ILSAX Hydrologic Model Parameters

Sub-Catchment	Area (Ha)	Paved Area %	Grassed Area %	Equal Area Slope (%)
Cat 1 (Predev)	1.84	7%	93%	15%
Cat 1 (Postdev)	1.84	29%	71%	15%
Cat 2	2.06	27%	73%	16%
Cat 3	0.410	47%	53%	4%

3.3. ARR 2019 Hydrologic Results - 10%AEP and 1%AEP

The 10%AEP and 1%AEP design events have been simulated for all temporal patterns and durations up to 2hrs, with the median event being selected as per ARR2019 methodology.

The Drains storm generator allows importation of ARR Data Hub and BOM information including global storm definition, rainfall temporal patterns, and Bureau of Meteorology (BOM) IFD tables which are used to produce ensembles of rainfall/runoff for each Annual Exceedance Probability (AEP) across the prescribed durations.

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Ten (10) temporal patterns were assessed per duration for each design event with the results statistically assessed to determine the critical storm duration and temporal pattern for the catchment. The plot below easily demonstrates whether a distribution is skewed and whether there are potential outliers in the data set, especially for a large number of observations.

Figure 3.2 and Figure 3.3 below demonstrates that the highest median storm duration for the developed case Catchment 1 is:

- **10% AEP is the 30minute storm using the standard temporal pattern 8, producing a peak discharge of 0.391m^3/s**
- **1% AEP is the 20minute storm using the standard temporal pattern 10, producing a peak discharge of 0.621m^3/s**

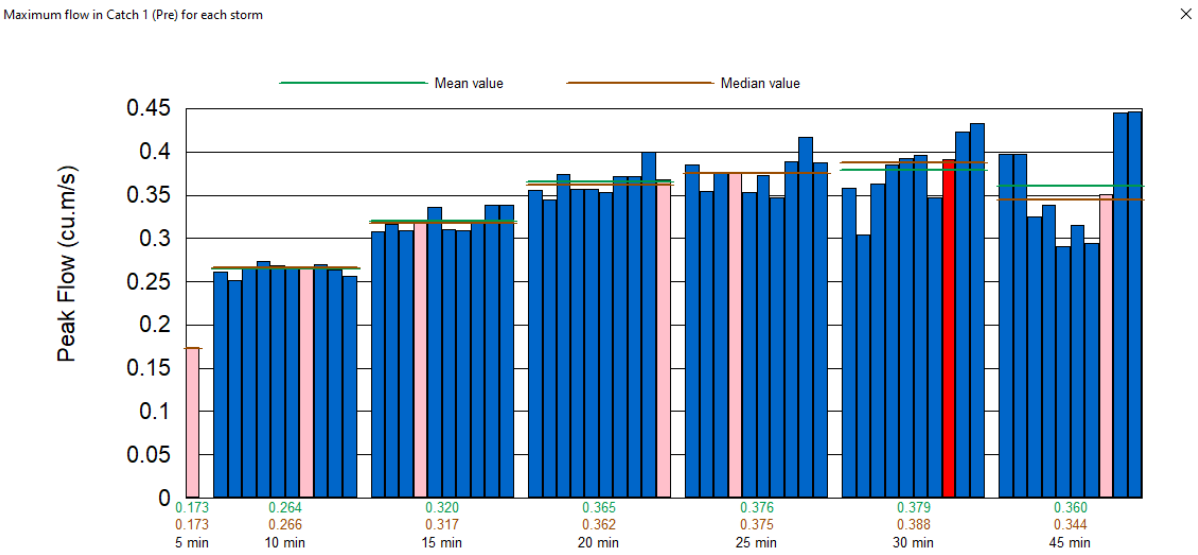

Figure 3.2 Catchment 1 plot of Ensemble results (10% AEP)

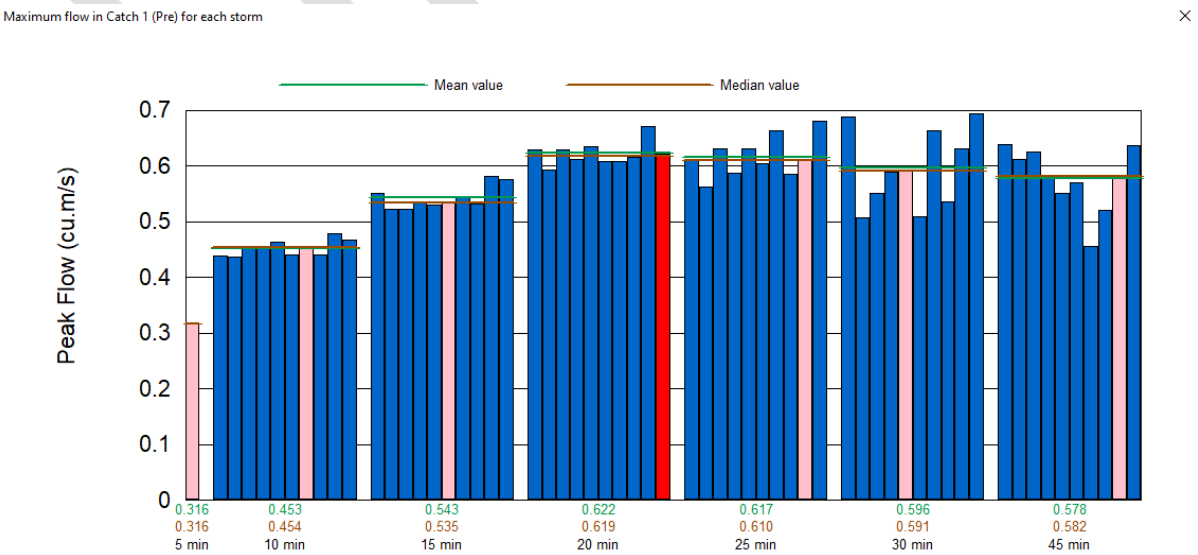

Figure 3.3 Catchment 1 plot of Ensemble results (1% AEP)

3.4. Peak Discharge Check – 10%AEP and 1%AEP

Table 3.2 and Table 3.3 shows a comparison for the pre-development peak discharge for the Drains model against the Rational Method.

Table 3.2 Comparison of Drains Hydrologic model to Rational method – 10%AEP

Sub Catchment	AEP Event	Pre-Development (m3/s)	
		DRAINS	Rational Method
1	10%	0.391	0.394
2	10%	0.482	0.422
3	10%	0.134	0.142

Table 3.3 Comparison of Drains Hydrologic model to Rational method – 1%AEP

Sub Catchment	AEP Event	Pre-Development (m3/s)	
		DRAINS	Rational Method
1	1%	0.621	0.686
2	1%	0.767	0.733
3	1%	0.198	0.254

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4. Hydraulic Assessment

4.1. Objectives

To confirm the performance of the proposed OSD system, a pre- and post-development model was constructed. These models compare the discharge hydrographs for a range of storm durations at the existing Lawful Points of Discharge.

4.2. 1D Model Set Up

4.2.1. Model Schematic for 10%AEP and 1%AEP

The model extent for the Drains model is presented in Figure 4.1 showing inflow locations and the boundary locations. The extents were set at an appropriate distance from the subject site such that they did not unduly affect the results.

The modelling scheme has split the subject site into

- "Roof" node which includes and 13 x 180m^2 roof area and 13 x 3KL rainwater tanks and has been modelled with a separate OSD system
- "Catch 1 (post)" which includes the balance of the catchment (existing buildings, internal roads, pervious area) will be routed through the OSD basin for all design events up to the 1%AEP.

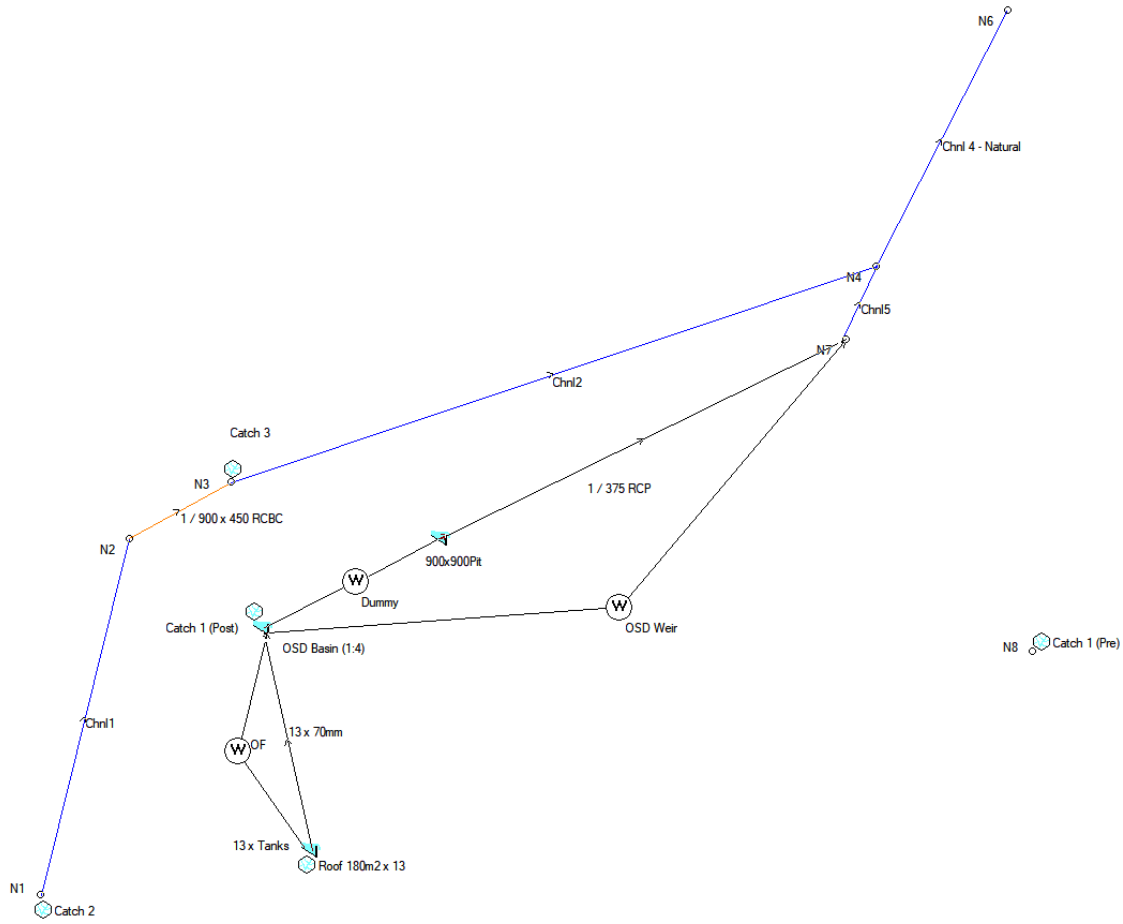

Figure 4.1 DRAINS Schematic for 10%AEP and 1%AEP

4.2.2. On-Site Detention Basin Details

The proposed OSD system is to be implemented to ensure a non-worsening of peak discharges at the Legal Point of Discharge (LPD). Figure 4.2 shows the location of the proposed OSD basin.

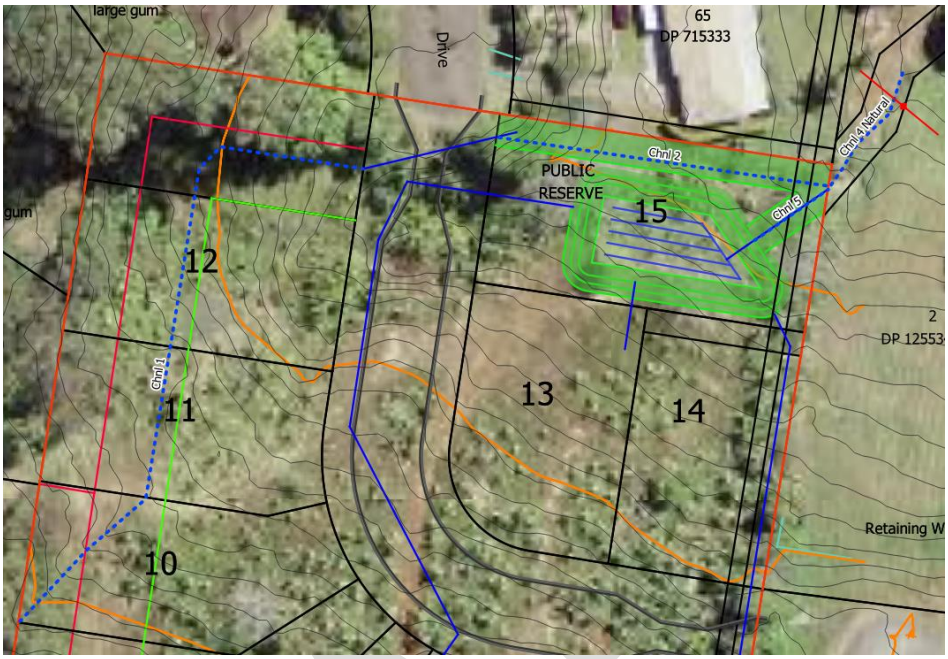

Figure 4.2 Proposed Detention Basin

Table 4.1 below details the proposed OSD systems. Please note that these figures supersede drawing detail outlined in *AWC Stormwater Managing Plan October 2021.*

Table 4.1 OSD Details

Detention ID	Details	Total Volume (m^3)
OSD Basin	• 350mm of OSD storage depth • OSD basin outlet set at 125.05m AHD • 1 / 375 RCP outlet pipe • High level weir 125.40m AHD • Top of Bund 125.85m AHD	109
Rainwater Tanks	• 13 x 3KL • 70mm outlets	39
TOTAL		***148***

**Detention volume excludes extended detention depth required for biobasin treatment function*

Storage within the On Site Detention (OSD) basin is based on the following stage storage relationship extracted from the civil design and is shown in Figure 4.3.

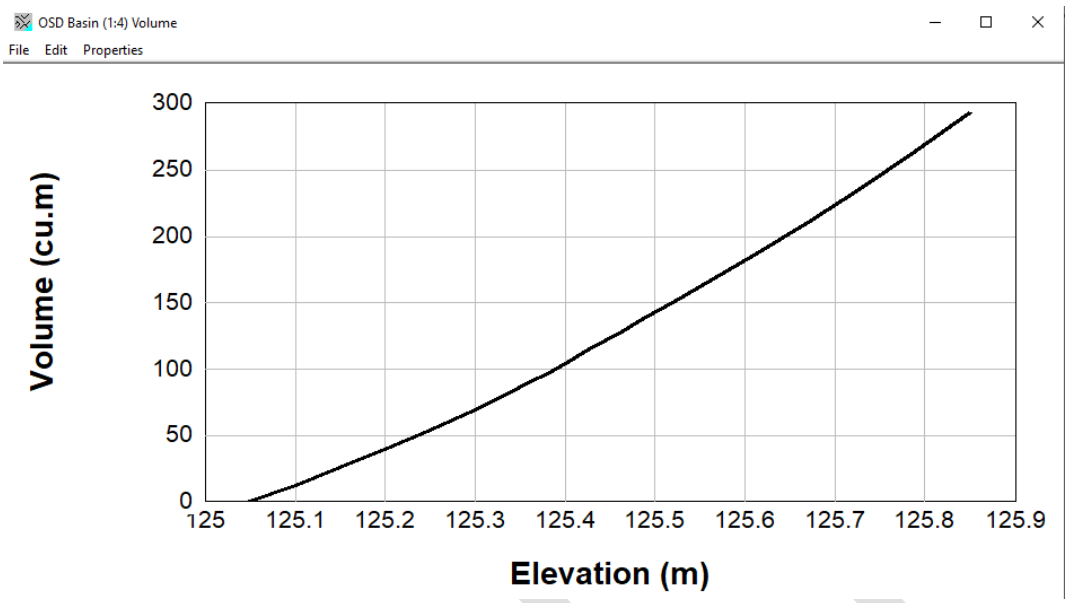

Figure 4.3 OSD Stage Storage Relationship

The general arrangement of the OSD outlet is as per Figure 4.4, with the pit inlet level set at 125.05mAHD, and the high flow weir set at 125.4m AHD, providing 350mm of storage. 1/375mm RCP outlet pipes provide sufficient control to achieve predevelopment levels for both the 10%AEP and 1%AEP design events. Figure 4.4 outlines the preferred arrangement for the OSD outlet. Please note that this drawing supersedes drawing detail outlined in *AWC Stormwater Managing Plan October 2021.*

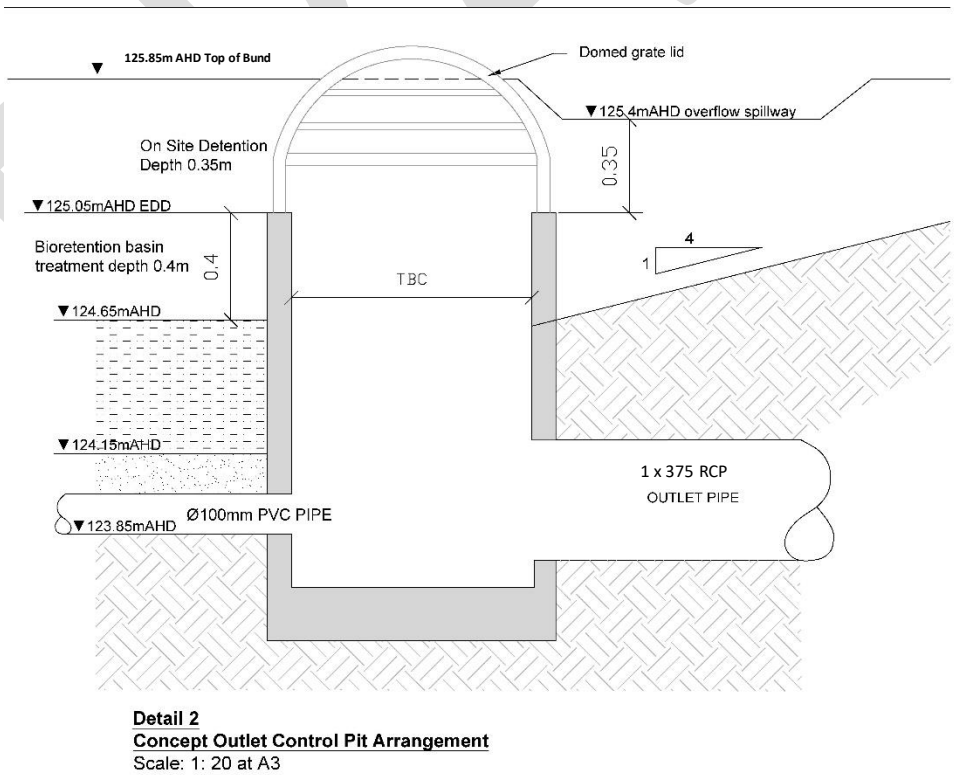

Figure 4.4 OSD General Arrangement

Refer to *RCS Civil Drawings Rev2 28/10/21* for additional detail of OSD basin.

4.3. Model Results for 10%AEP

Results shown in Figure 4.5 below show a maximum depth of 125.44m AHD within the OSD basin. Maximum post developed discharge 0.449m^3/s (0.359m^3/s + 0.090m^3/s) has been successfully routed to 0.330m^3/s, and is less than predeveloped peak discharge of 0.391m^3/s.

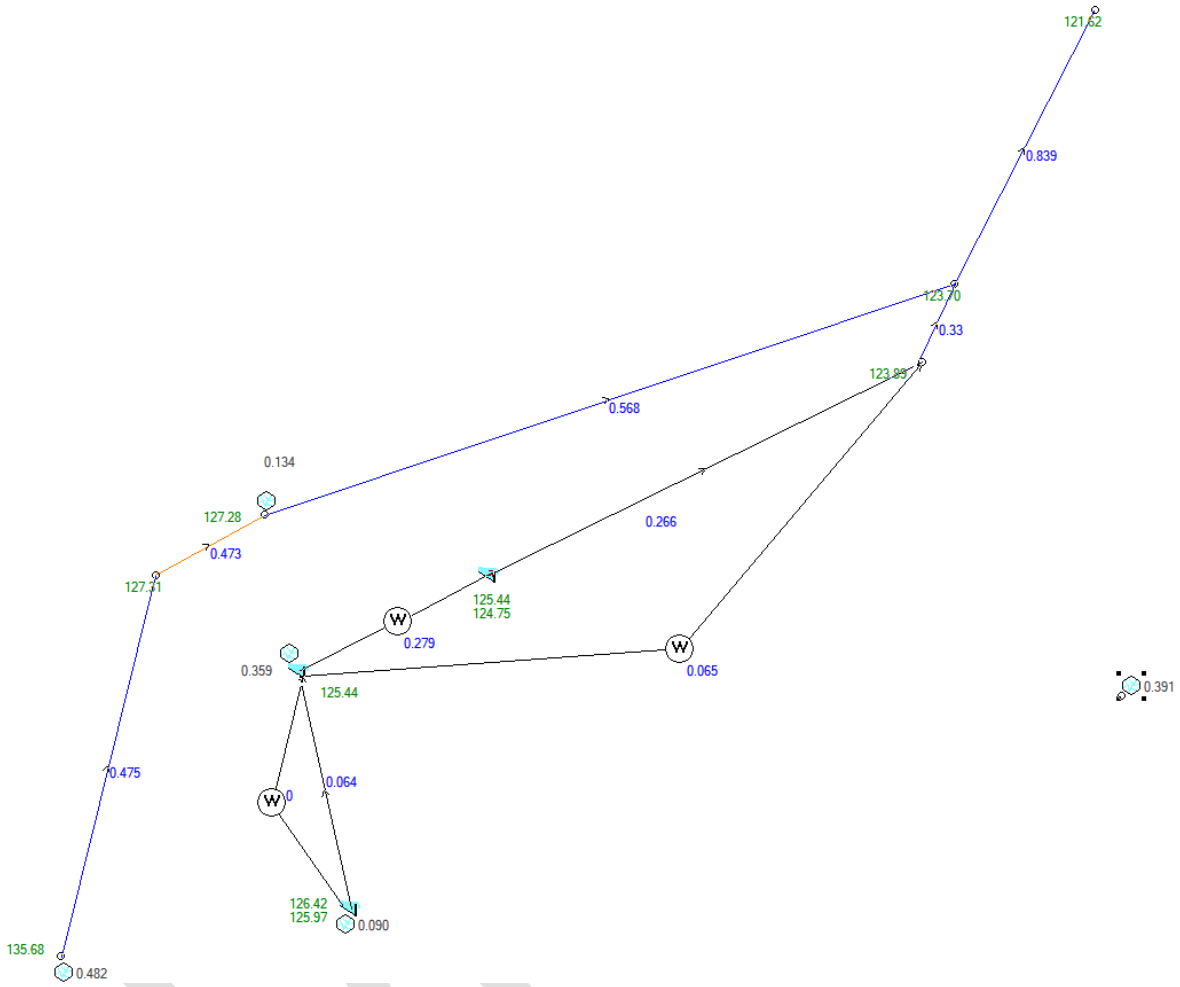

Figure 4.5 Maximum Results for 10%AEP

10%AEP Initial routing occurs within 13 x 3KL rainwater tanks, with 70mm orifice, Figure 4.6 showing with post developed peak discharge from roofs of 0.090m^3/s for the 10%AEP, routed to 0.064m^3/s.

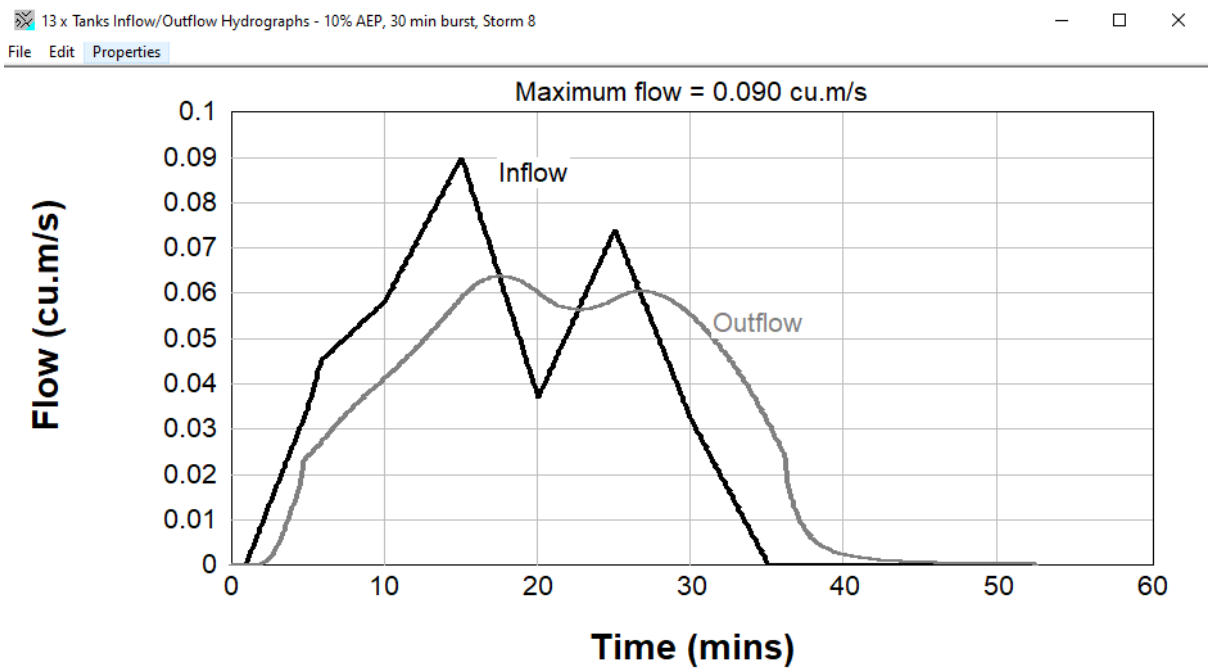

Figure 4.6 Rainwater Tank Routing - Catchment 1 (10% AEP)

Figure 4.7 shows the 10%AEP routing through the OSD basin with post developed inflows of 0.418m^3/s routed to 0.331 m^3/s (0.266m^3/s outflow pipe + 0.065m^3/s weir).

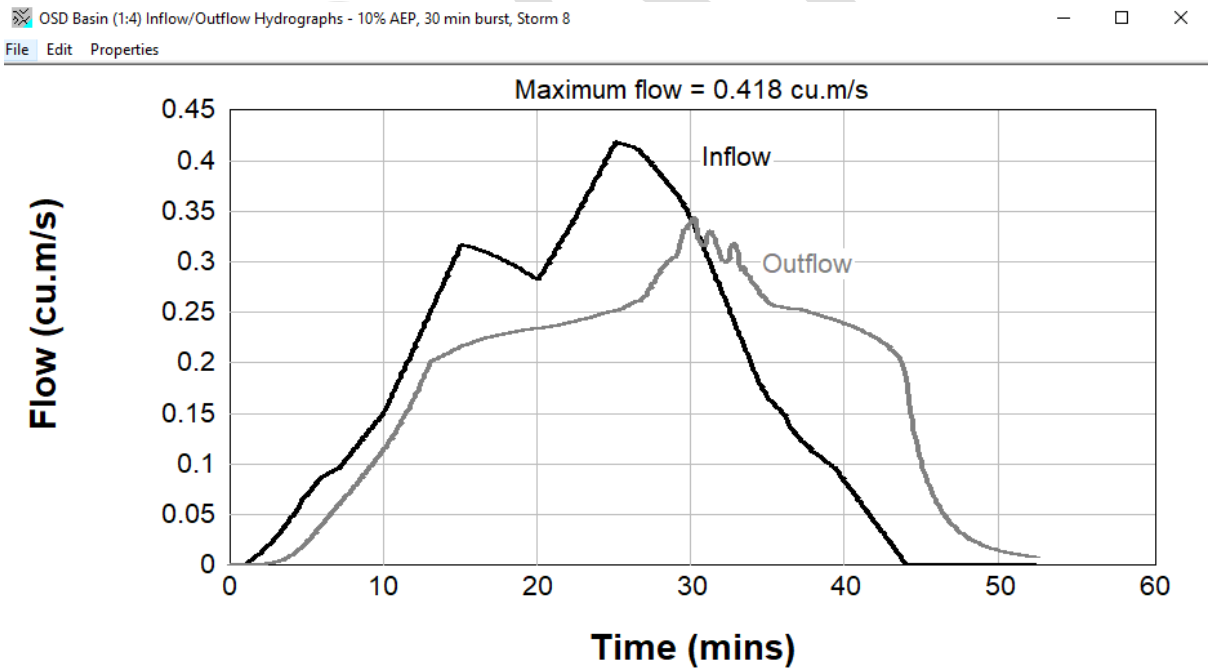

Figure 4.7 OSD Basin Routing - Catchment 1 (10% AEP)

A summary of the modelling results for the different ARI events is contained in Table 4.2. Results of the modelling indicate the proposed system is capable of maintaining the pre-development peak discharges for the 10% design events at the sites LPD.

Table 4.2 Pre-Development vs Post-Development (Mitigated) Peak Discharges at LPD (10%AEP)

Sub Catchment	AEP Event	Pre-Development (m^3/s)	Post-Development (Un-mitigated) (m^3/s)	Post-Development (Mitigated) (m^3/s)	Comply?
1	10%	0.391	0.449	0.330	Yes

It should be noted that the above calculated volumetric requirements are conceptual and are to be confirmed during detailed design phase of the development (Construction Certificate).

4.4. Model Results for 1%AEP

Figure 4.1 (Section 4.2.1) shows the 1%AEP concept design. All overland flow originating from Catchment 2 and 3 bypass the OSD basin, whilst piped and overland flow from Catchment 1 are routed through the OSD basin as per Figure 4.8 below.

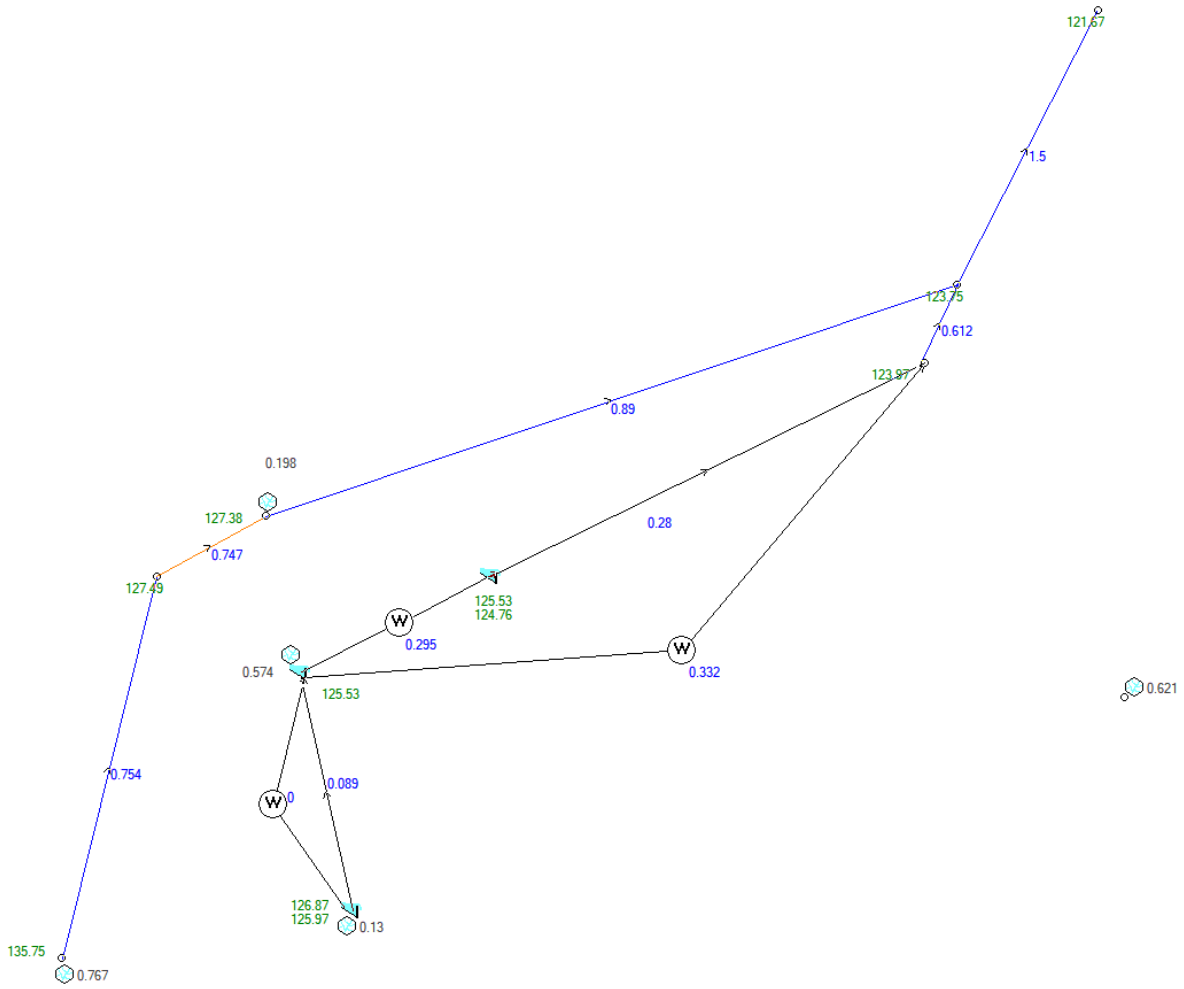

Figure 4.8 Maximum Results for 1%AEP

1%AEP initial routing occurs within 13 x 3KL rainwater tanks, with 70mm orifice, Figure 4.9 showing with post developed peak discharge from roofs of 0.130m^3/s routed to 0.089m^3/s.

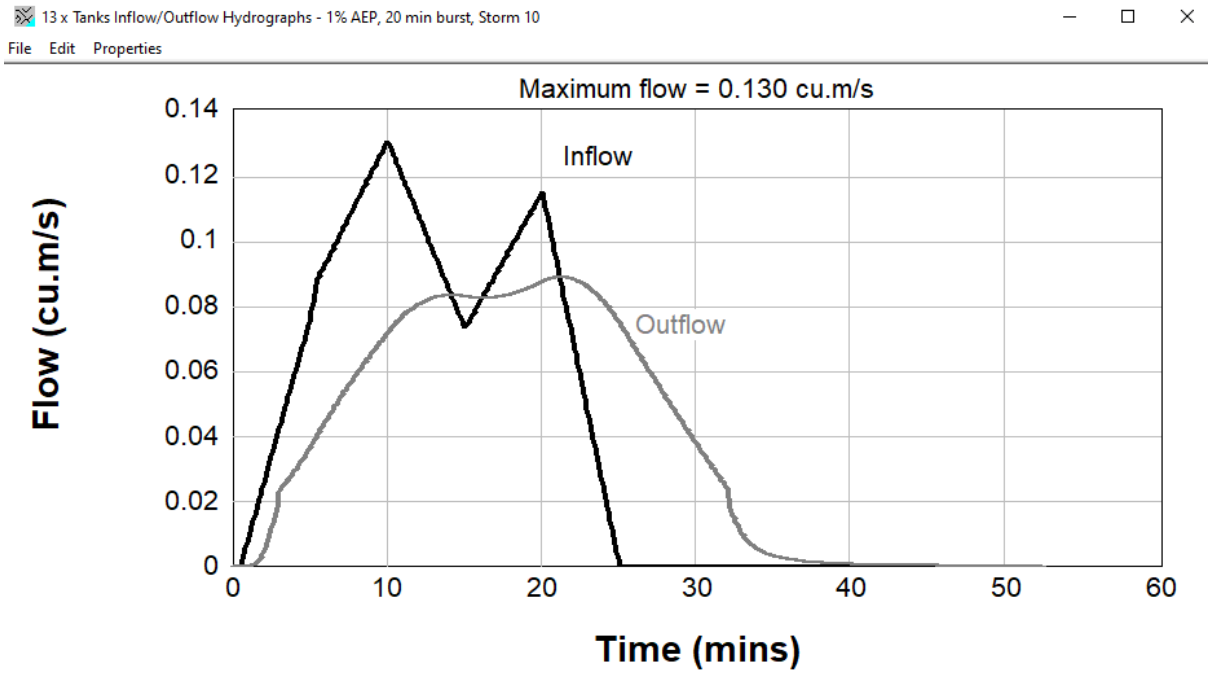

Figure 4.9 Rainwater Tank Routing - Catchment 1 (1% AEP)

Figure 4.10 shows the 1%AEP routing through the OSD basin, with post developed OSD basin inflows of 0.661m^3/s routed to approximately 0.612 m^3/s (0.280m^{3}s piped outlet + 0.332m^3/s weir).

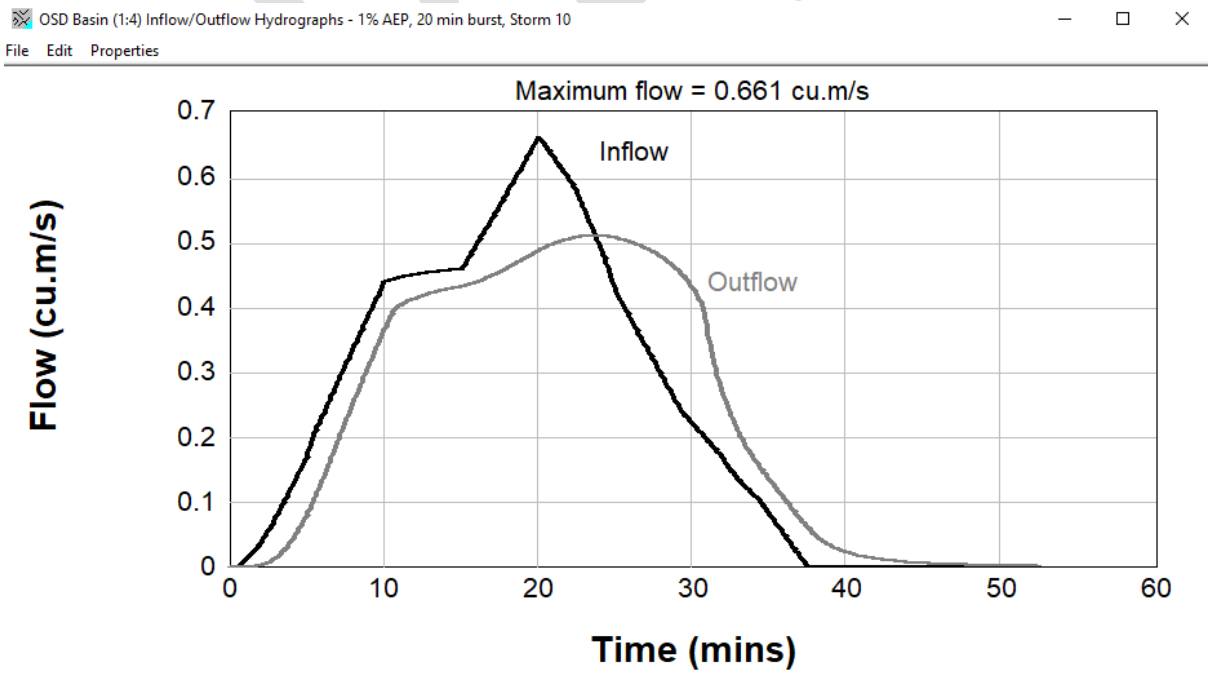

Figure 4.10 OSD Basin Routing - Catchment 1 (1% AEP)

A summary of the modelling results for the different ARI events is contained in Table 4.2. Results of the modelling indicate the proposed system is capable of maintaining the pre-development peak discharges for the 1% design events at the sites LPD.

Table 4.3 Pre-Development vs Post-Development (Mitigated) Peak Discharges at LPD (1%AEP)

Sub Catchment	AEP Event	Pre-Development (m^3/s)	Post-Development (Un-mitigated) (m^3/s)	Post-Development (Mitigated) (m^3/s)	Comply?
1	1%	0.621	0.704	0.612	Yes

It should be noted that the above calculated volumetric requirements are conceptual and are to be confirmed during detailed design phase of the development (Construction Certificate).

4.4.1. Open Channel

A series of open channels (Figure 4.1 and Figure 4.2) have been designed to convey the 1%AEP design event safely through the site. Channels have been designed as follows:

- **Chnl 1** - V-Drains with 1:3 batters n = 0.10– Results in Figure 4.12 and Figure 4.13
- **Chnl 2** - V-drain with 1:2 batters n = 0.15 – Results in Figure 4.14 and Figure 4.15
- **Chnl 4** – Natural section taken from 1m Lidar n = 0.05- Results in Figure 4.16 and Figure 4.17
- **Chnl 5** – Trapezoidal Drains with 1:3 batters and 2m base n = 0.1 – Results in Figure 4.18 and Figure 4.19

It is recommended that channels be naturalised with rock and vegetation lining as per Figure 4.11 below. Manning n = 0.1 has been modelled as per BCC design guidelines.

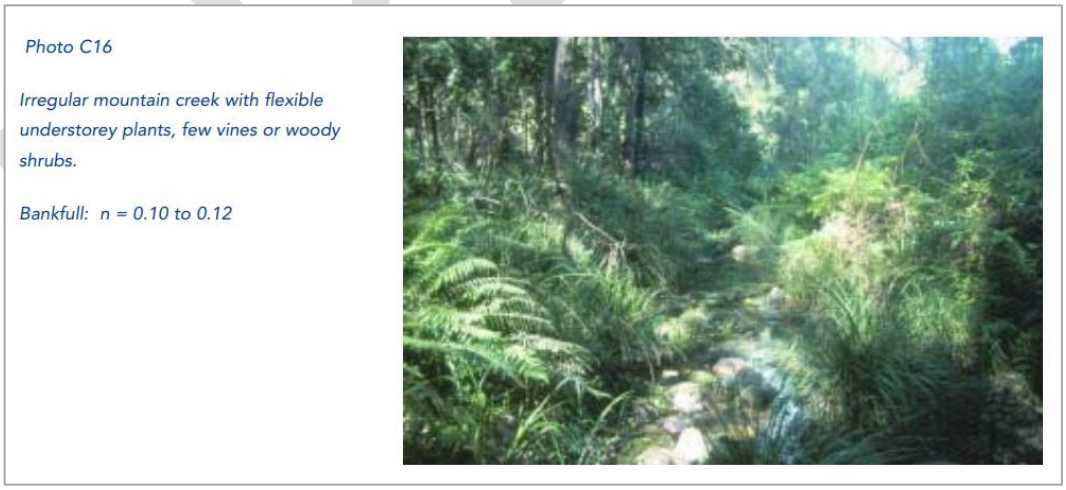

Figure 4.11 Proposed Channel Lining

Cross section of *Chnl 1* are shown in Figure 4.12 and Figure 4.13 with 1%AEP peak flows of 0.754m^3/s, depth at approximately 600mm, velocity at 1.15m/s and freeboard of 200mm (as measured form the downstream). All flows are contained within design channels for the 1%AEP design event.

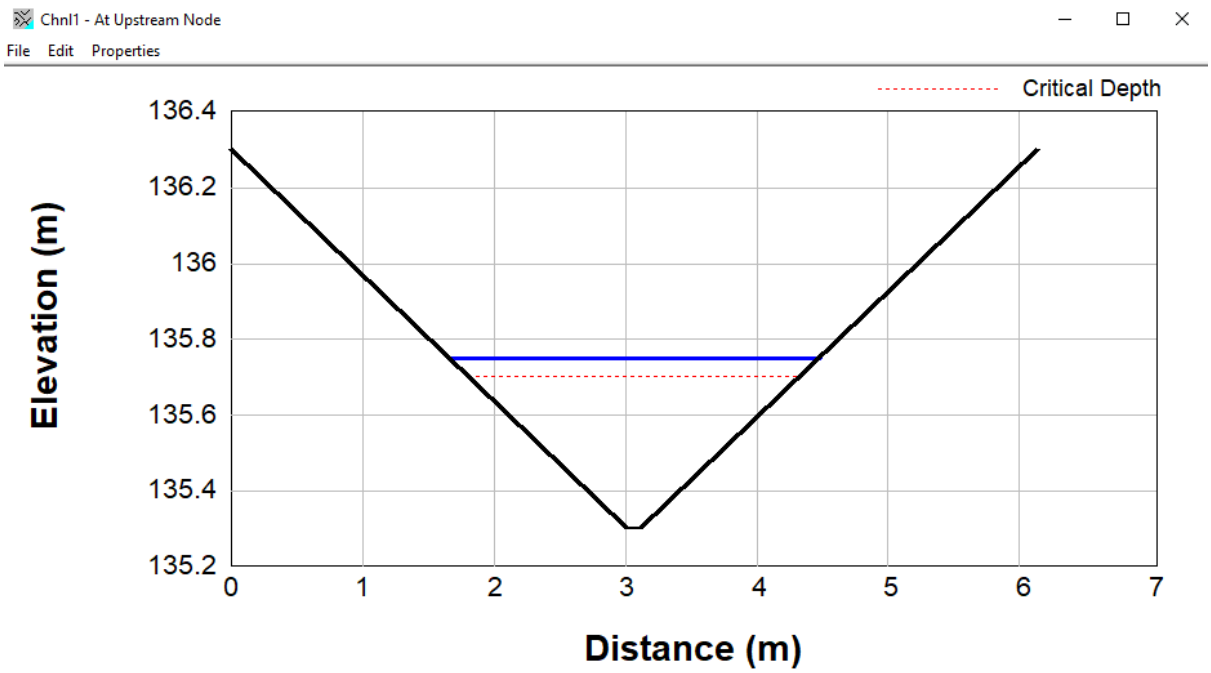

Figure 4.12 Chnl 1 - 1%AEP (Upstream)

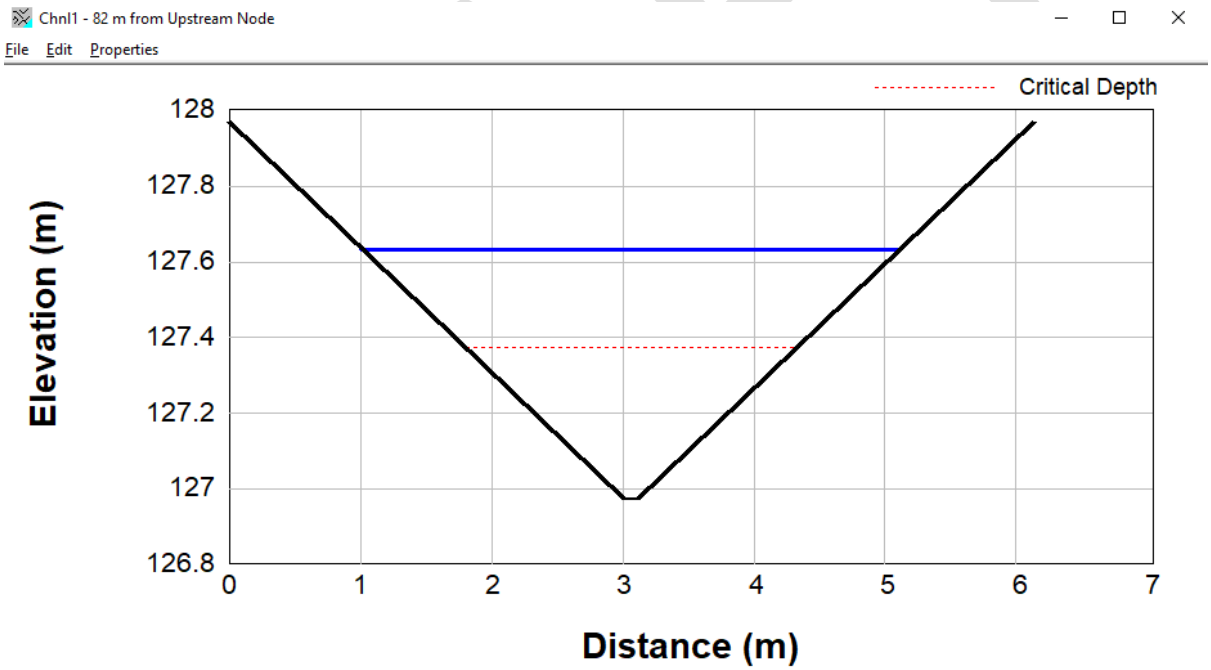

Figure 4.13 Chnl 1 - 1%AEP (Downstream)

Cross sections of *Chnl 2* are shown in Figure 4.14 and Figure 4.15, with 1%AEP peak flows of 0.879m^3/s, depth at approximately 200mm, velocity at 8.04m/s and freeboard greater than 800mm (as measured downstream). All flows are contained within design channels for the 1%AEP design event.

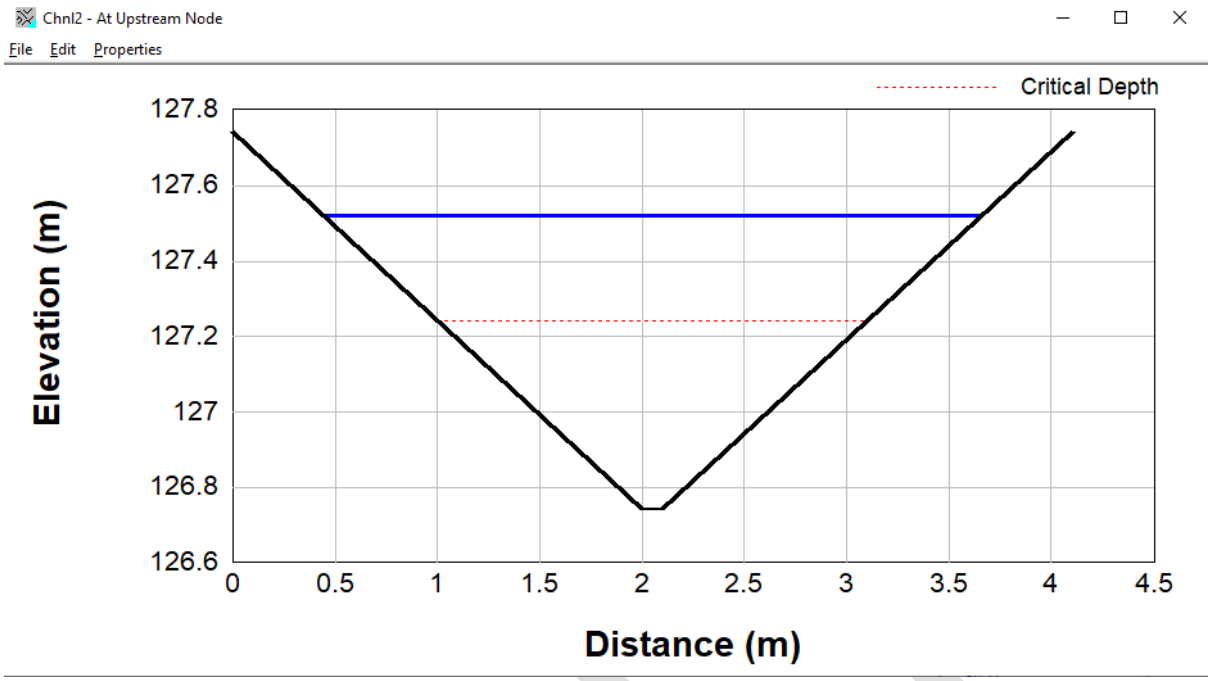

Figure 4.14 Chnl 2 - 1%AEP (upstream)

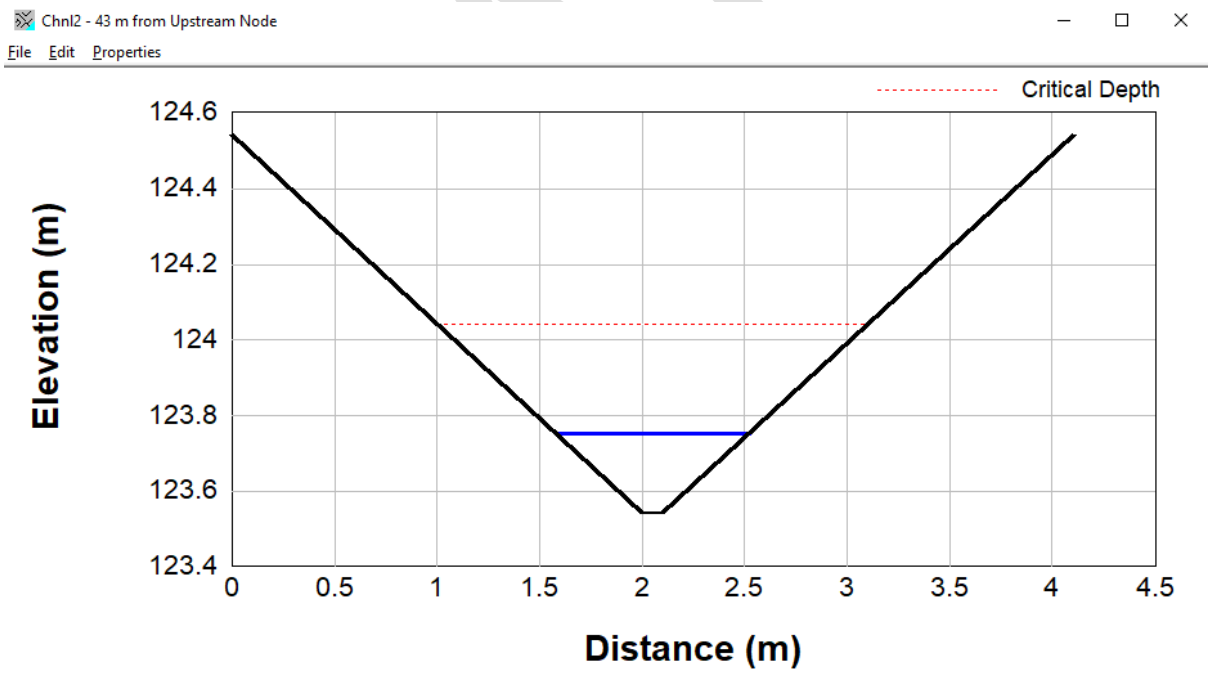

Figure 4.15 Chnl 2 - 1%AEP (downstream)

Cross sections of *Chnl 4 – Natural* (Lot 2 DP 1255349) are shown in Figure 4.16 and Figure 4.17, with 1%AEP peak flows of 1.485m^3/s, depth at approximately 200mm, maximum velocity of 3.51m/s and freeboard of greater than 350mm (as measured downstream). All flows are contained within design channels for the 1%AEP design event.

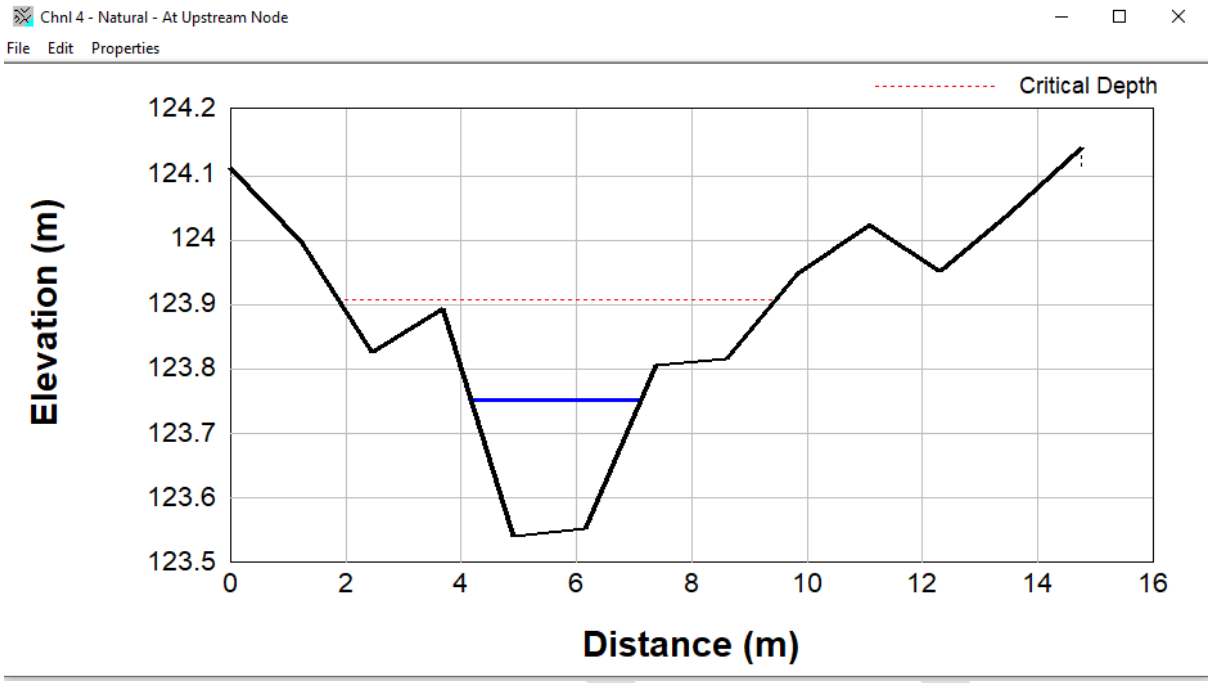

Figure 4.16 Chnl 4 Natural - 1%AEP (Upstream)

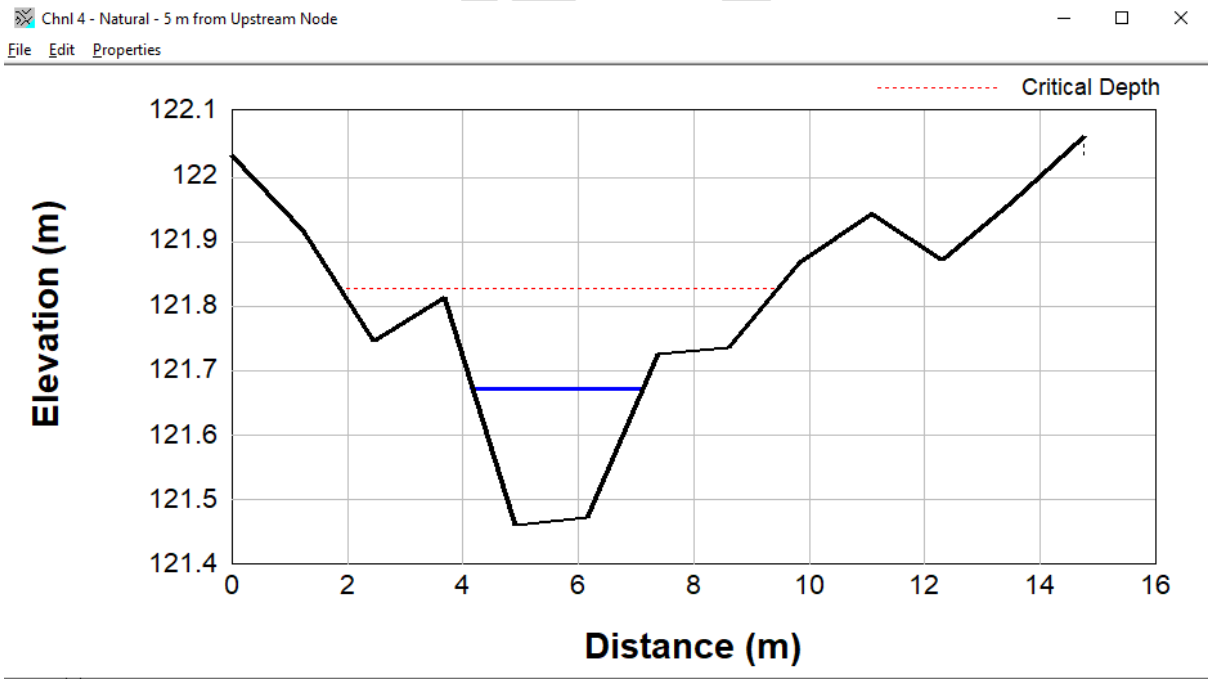

Figure 4.17 Chnl 4 Natural - 1%AEP (Downstream)

Cross sections of *Chnl 5* are shown in Figure 4.18 and Figure 4.19, with 1%AEP peak flows of 0.612m^3/s, depth at approximately 200mm, velocity at 1.14m/s and freeboard greater than 800mm (as measured from the downstream). All flows are contained within design channels for the 1%AEP design event.

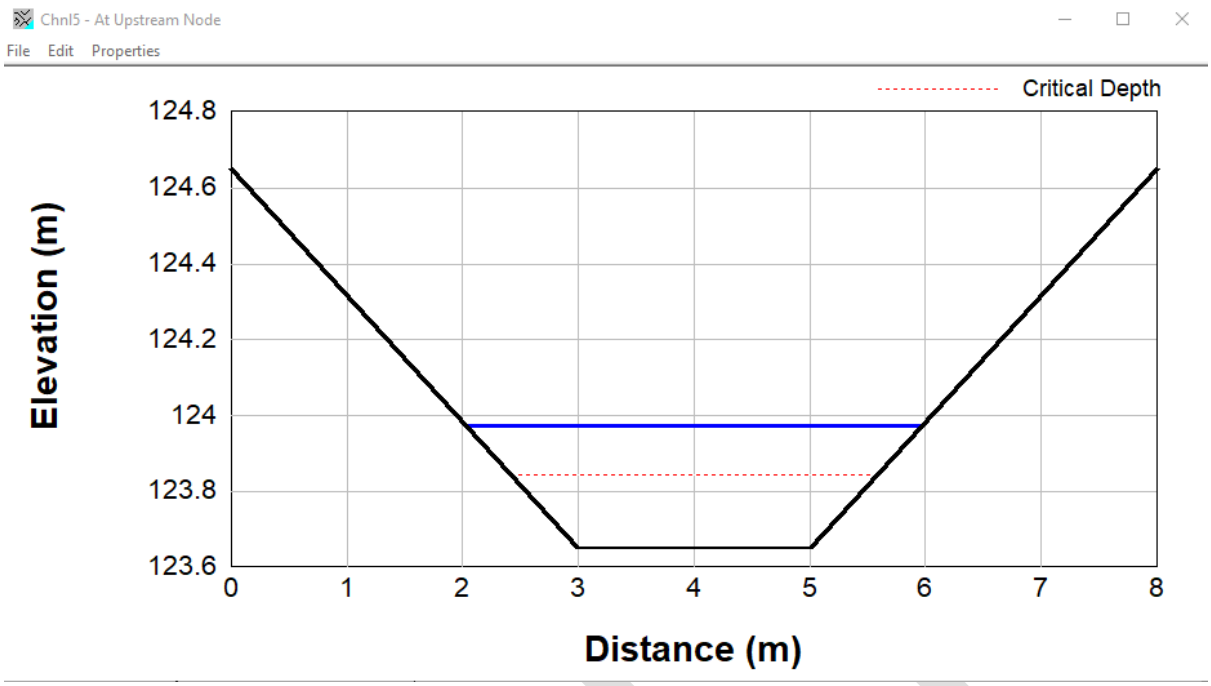

Figure 4.18 Chnl 5 - 1%AEP (Upstream)

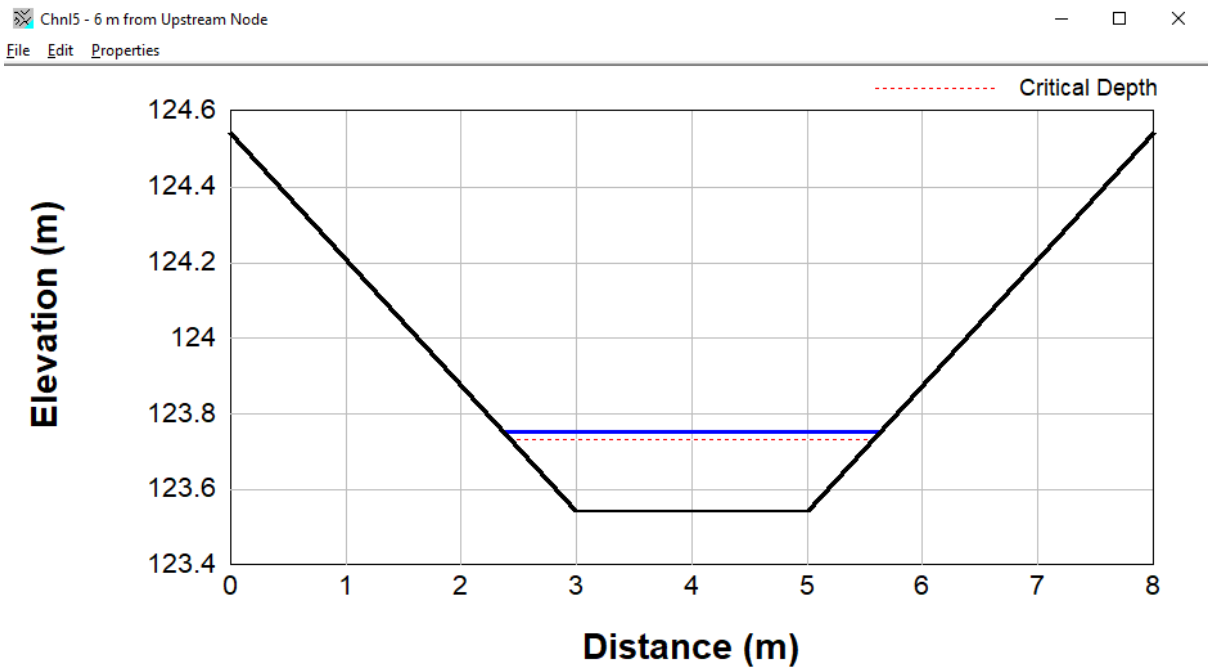

Figure 4.19 Chnl 5 - 1%AEP (Downstream)

4.4.2. Culverts under Greenway Drive Extension

Proposed culverts under the Greenway drive extension have been designed to convey the 1%AEP design flow. A single 1/ 900 x 450 RCBC has been modelled within the Drains software to show hydraulic function (Figure 4.20), however a 2 / 900 x 450 RCBC configuration is recommended to be constructed to reflect for the potential of up to 50% blockage from debris.

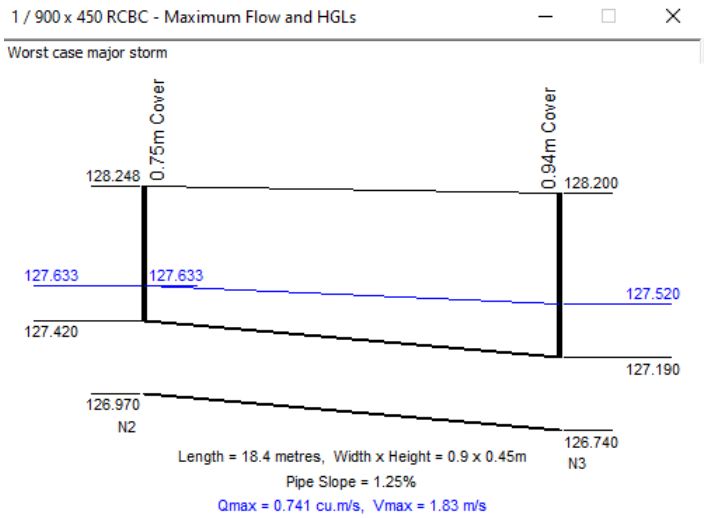

Figure 4.20 Long Section of Culvert Under Greenway Drive

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5. Summary

This Hydraulic Assessment (HA) has been designed in accordance with *Lismore City Council Comprehensive Guidelines for Stormwater Management* and complies with *Chapter 22 of the DCP.*

Specifically, the development will incorporate:

- 13 x 3KL rainwater tanks with 70mm outlets
- 109m^3 detention volume within OSD basin
    - 1/375 RPC outlet
    - Low flow weir height 125.05mAHD
    - High flow weir height 125.4m AHD
    - Top of Bund 125.85m AHD
- 2 / 900 x 450RCP culverts is recommended for the proposed Greenwood Drive extension to allow safe conveyance of the 1%AEP design event
- Post developed 10%AEP peak flow 0.449m^3/s was successfully routed to less than predeveloped peak discharge (0.391m^3/s), with a combined weir and orifice outflow of 0.330m^3/s achieved.
- Post developed 1%AEP peak flow 0.704m^3/s, was successfully routed to less than predeveloped peak discharge (0.621m^3/s), with a combined weir and orifice outflow of 0.612 m^3/s achieved.
- Post developed 1%AEP peak flows are successfully contained within design channels
    - Recommended naturalised rock and vegetation lining used as velocity control
    - All channels successfully convey the 1%AEP peak flow

The above design complies with the On Site Detention requirements of Chapter 22 of the Lismore DCP for both the 10%AEP and 1%AEP design events, by routing post developed peak flows to less than predeveloped levels. The 1%AEP design event was assessed with all internal channels and culverts designed to convey peak flows in a safe low energy manner.

Final location and arrangement of stormwater infrastructure to be confirmed during detail design/construction certificate approval.

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6. References

- *BCC Manning n Values for Catchments and Channels, City Plan 2014*
- *Lismore City Council DCP Chapter 22*
- *QUDM 2017*
- *ARR 2019*
- *AWC Stormwater Managing Plan October 2021.*

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Date 11/12/21

Praedium Partnership
Attn. Craig Adams

Re: Threatened Species Test of Significance for the Koala (*Phascolarctos cinereus*) in relation to proposed residential subdivision of lot 4 DP 406893

1. Background

Arbor Ecological was engaged by Praedium Partnership to prepare a test of significance report for a proposed residential subdivision of lot 4 DP 406893, 658 Ballina Road, Goonellabah in the Lismore Local Government Area, hereafter referred to as the site[1], refer to **Figure 1**.

The following test of significance has been undertaken in response to provisions of s.7.3 of the *NSW Biodiversity Conservation Act 2016* to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. The test is also referred to as the 5-part test.

This assessment follows the *Threatened Species Test of Significance Guidelines* (NSW Office of Environment and Heritage (OEH), 2018, *Threatened Species Test of Significance Guidelines*, including assessment criteria definitions and guiding principles. It is understood that no threatened species likelihood of occurrence assessment was required in this instance since the Koala (*Phascolarctos cinereus*) was identified as the sole species requiring further assessment and inclusion in a test of significance.

Potential impacts to the Koala and koala habitat are the focus of this assessment. Impact assessment focuses on proposed vegetation clearing; land subdivision and construction of dwellings and infrastructure; and intensified human occupation of the site. A number of impact avoidance, minimisation and offset compensation measures are proposed as outlined below.

[1] **The site** is the total area which may be directly affected by the proposal. The **study area** refers to the site and any additional areas that are likely to be affected by the proposal, either directly or indirectly. For the purposes of this assessment the site area and study area are considered to be the same.

It is understood that the proposed development was incorrectly assessed as a *small impact development* and should have been assessed as a *large impact development* in relation to the Comprehensive Koala Plan of Management for south-east Lismore (CKPoM)[2]. This is because of its potential impact on koala habitat connectivity. If the large-scale impact assessment pathway is followed, then the existing koala record from the site would have satisfied requirements for recognition of the site as core koala habitat.

A field assessment of koala habitat was undertaken by ecologist Michael Hallinan on 09/11/21. This followed koala habitat assessments by Birdwing Ecological Services (2021)[3] and North Coast Environmental Services (2018)[4]. The field assessment by Michael Hallinan found no signs of koala use or occupation of the site including koala scats or characteristic pock/ scratch marks on smooth-barked trees. Similarly, there were no signs of koala site use or occupation by Birdwing Ecological Services (2021) and North Coast Environmental Services (2018).

The site is currently clear of mature native forest vegetation having been cleared some time ago for horticultural pursuits. Since the time of clearing, the site has been managed partly as an orchard, and regularly mown.

The conservation status, habitat requirements and listed threats for the Koala are outlined as follows:

2. Koala Ecology

2.1. Conservation Status

NSW status: Vulnerable, Protected - *Biodiversity Conservation Act 2016*
Commonwealth status: Vulnerable - *Environment Protection and Biodiversity Conservation Act 1999*

2.2. Habitat and Ecology Notes[5]

- Inhabit eucalypt woodlands and forests.
- Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.
- Inactive for most of the day, feeding and moving mostly at night.
- Spend most of their time in trees, but will descend and traverse open ground to move between trees.
- Home range size varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size.

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[2] Lismore City Council (2013) *Comprehensive Koala Plan of Management for south-east Lismore*. Lismore City Council, Lismore, NSW
[3] Birdwing Ecological Services, 2021, *Additional information – addressing requirements of the Lismore Comprehensive Koala Plan of Management, Proposed residential subdivision at 658 Ballina Road, Goonellabah*. 20 September 2021, unpublished report.
[4] North Coast Environmental Services, 2018, *Koala Habitat Assessment Report, v1, Lot 4 DP 406893, 658 Ballina Road, Goonellabah*. September 2018, unpublished report.
[5] **Species habitat, ecology and threat notes** sourced from NSW Office of Environment & Heritage threatened species profiles at www.environment.nsw.gov.au

- Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.
- Females breed at two years of age and produce one young per year.

2.3. Threats[5]

Koalas are threatened by a number of human-induced threats and these have been documented in the KPoM, including:

- Loss, modification and fragmentation of habitat.
- Vehicle strike.
- Predation by roaming or domestic dogs.
- Intense prescribed burns or wildfires that scorch or burn the tree canopy.
- Koala disease (e.g. *Chlamidia*).
- Heat stress through drought and heatwaves.
- Human-induced climate change.
- Inadequate support for fauna rehabilitation.
- Poor understanding of sources of trauma and mortality.
- Poor understanding of population distribution and trend.
- Poor understanding of animal movements and use of habitat.

2.4. Records from the locality[6]

As described in the KPoM a viable local population of koalas occurs in the locality.

Bionet search results show 2711 koala records within a 10km^2 area centred on the site since 1960. The following information was noted from an analysis of records in the vicinity of the site, refer to **Figure 2**:

- Koalas have been recorded within or close to the site between 1991 and 2019. The 1991 record was of an animal observed as "*Dead* and *Cause of death unknown"*. It is understood that Council's representative is aware of three additional BioNet koala records from the site from the period between 1991 and 2019. These records are however not available to registered Bionet public account holders.
- Several koala records from adjoining and nearby properties and the long term persistence of a koala population in the locality of the site is acknowledged.
- The majority of nearby koala records occur to the west and northwest of the site and most records are from the past 9 years since 2012.

[6] **The locality** refers to land within a 10km x 10km area centred on the site.

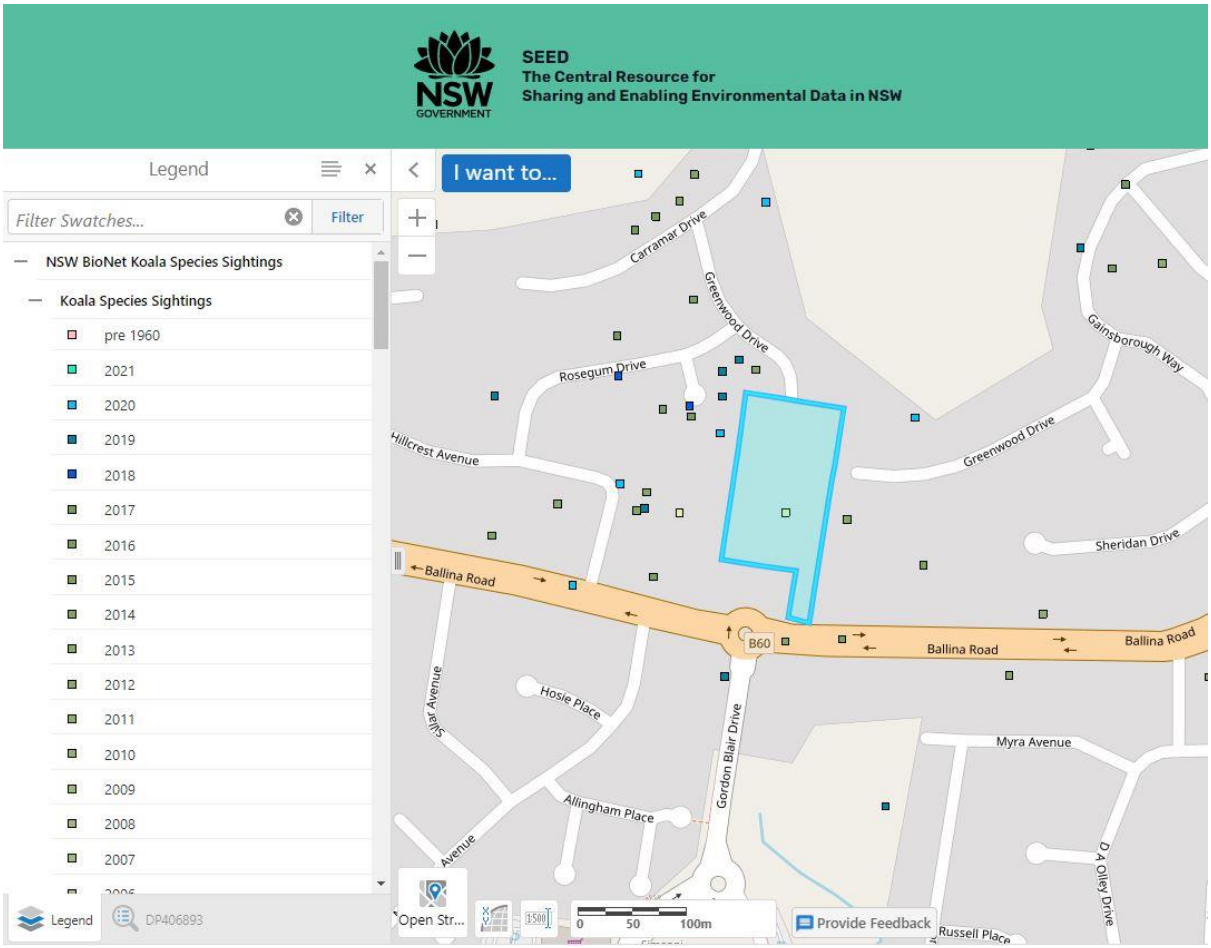


Figure 2. Koala records within and surrounding the site, source SEED, NSW Government.

2.5. Habitat mapping for the site and surrounds

The following information was noted from an analysis of Lismore City Council environmental mapping of the site and surrounds, refer to **Figure 3**:

- The area of the site is included in the Koala Planning Area of the CKPoM.
- Sizeable areas of koala habitat occur on adjoining properties to the north and west of the site. These are mapped by Lismore City Council as *Primary Koala Habitat* and *HCV Vegetation and Habitats*. Well developed, tall mature koala food trees occur on these properties. Mapped *Primary Koala Habitat* also exists to the north of the site amongst residential properties and further to the north on larger rural lots.
- Mapped *Primary Koala Habitat* in the western and northern portions of the site consists of juvenile and semi-mature koala food trees and a large clump of exotic weedy vegetation concentrated to the southwest.
- No mapped *Wildlife Corridors* occur in the area of the site or surrounding properties.

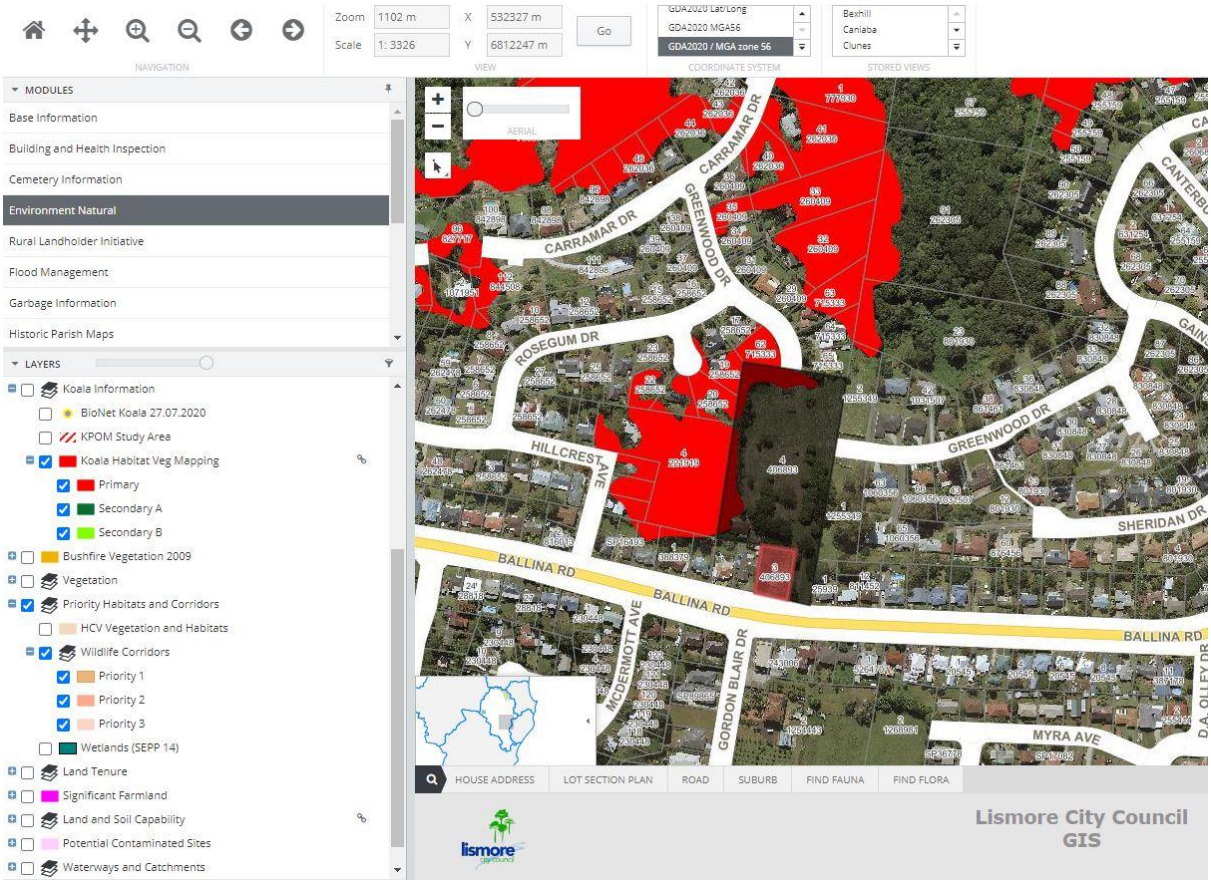


Figure 3. Koala records within and surrounding the site, source Lismore City Council.

2.6. Koala habitat connectivity and movement corridor values

Despite the largely cleared nature of the site, the land is recognised as a movement corridor for the local koala population and therefore represents core koala habitat. There are patches of forest habitat to the north and west of the subject site that contain koala feed trees and it is likely that koalas are traversing the site to move between these patches. It is also likely to be used by younger animals, particularly males, to disperse to other habitat areas.

An analysis of koala records and koala habitat in the vicinity of the site indicates that the western and northern portions of the site offer the best opportunities to support koala movement through and around the site. The following information supports this finding:

- The Bruxner Highway directly adjoins the site to the south creating a barrier to free and safe koala movement south of the site where a highly built and urbanised environment exists. Biolink (2017)[7] identify this area as *Black Spot 4 West* for koala vehicle-strike in the Lismore LGA. A number of NSW BioNet koala vehicle strikes are recorded locally including one on the Bruxner Highway

[7] Biolink, 2017, *Koala Habitat & Population Assessment, Lismore Local Government Area (part)*. Final Report to Lismore City Council, September 2017, accessed 07/12/21, www.lismore.nsw.gov.au/managing-the-health-and-habitat-of-our-koala-population-in-south-east-lismore.

directly adjacent to the southern portion of the site. Poor Koala habitat connectivity and movement corridors occur to the south of the site.

- NSW BioNet and Biolink (2017) note numerous records of dog attacks of koalas within urbanised areas surrounding the site. The persistence of forested areas of koala habitat to the west and north of the site offer some protection against dog attack.

In recognition of the importance of the thoroughfare that the subject land provides for koalas, the proposed development has been modified to make the site permeable to koalas post development. The suite of impact avoidance and impact mitigation measures proposed if the site is developed are outlined below to support koala movement through and around the site, particularly to the west and north where the best koala habitat connectivity and movement corridor values exist.

3. Impact Avoidance and Minimisation

The proposed development has been modified to facilitate continued movement across it by the local koala population.

Proposed impact avoidance and minimisation measures are as follows:

- The subdivision layout has been carefully planned to avoid the need for removal of koala food trees; permit free koala access to retained trees and koala habitat plantings; and allow free and safe koala movement through the site and between areas of adjoining habitat, particularly to the west and north where the best koala habitat connectivity and movement corridors exist.
- Koala food tree removal has been minimised to two trees above 10 cm DBH: T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH).
- Additionally, a patch of smaller 122 regenerating koala food tree seedlings/saplings are required to be removed within an area of approximately 112m^2. The extremely crowded growing environment for these saplings would likely lead to natural thinning of juvenile/sapling trees if trees were not removed. The DBH of saplings range from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH. These trees will be offset in accordance with the KPoM, with replantings proposed for a suitable Council reserve nearby (see below).
- Remaining scattered regrowth koala food trees (i.e. T1, T2, T3, T4 and T6) will be retained; given legal protection status via a legal covenant on property title, e.g. Section 88B/E; and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 1**.
- Free and safe movement of koalas will be facilitated across the west and northern portions of the site and between adjoining areas of koala habitat via a Koala Corridor (refer to **Figure 1**) which will effectively incorporate all retained scattered regrowth koala food trees and proposed plantings in the vicinity of proposed lots 8 to 15.
- Lot boundary fences to the west and north and between lots 8 and 9 are to be koala permeable fences that does not impede koala movement as outlined in s.4.6.2 of the CKPoM, e.g. post and wire fence with bottom strand being plain wire placed a minimum of 300 mm above the ground. This will be achieved via a legal covenant on property title, e.g. Section 88B/E.
- No stormwater engineering works will be carried out in the Koala Corridor.
- The keeping of domestic dogs on the site is to be prohibited via a legal covenant on property title, e.g. Section 88B/E, to minimise the risk of harm to koalas.

- Development consent for the installation of any swimming pools on the site will be conditional on the provisions outlined in s.4.6.2 of the CKPoM to minimise the risk of harm to koalas.
- Road traffic management within the site will be in line with the provision outlined in s.4.6.2 of the CKPoM to minimise the risk of harm to koalas, i.e. *appropriate road design standards, warning signage, traffic calming devices, and roadside lighting which restrict motor vehicles to a maximum speed of 40 kilometres per hour within the subject site*.
- All retained koala food trees on site will have Tree Protection Zone (TPZ) fence specifications (e.g. fence locations and performance criteria) detailed in a tree protection plan drawing for the duration of the construction process. The tree protection plan drawing will be prepared in accordance with *AS4970 protection of trees on development sites* by a minimum AQF level 5 Arborist.
- To ensure that no koalas are directly impacted, ecologist pre-clearing surveys will be undertaken immediately prior to clearing on each day of clearing and spotter catcher/ ecologist monitoring of clearing works will be undertaken throughout the clearing process.
- The following unexpected fauna find procedure will be followed in the case of an unexpected fauna find during clearing works:
  - Immediately stop works.
  - Do not approach the animal.
  - If necessary, the project ecologist will contact a local wildlife care group (e.g. WIRES Ph 1300094737 or Friends of the Koala Ph 6622 1233) and/ or veterinarian who can organise for the care of any injured fauna.
  - A 10m no-work exclusion zone would be established around any non-threatened fauna encountered during works; and a 25m exclusion zone established around any threatened fauna (e.g. koala) until the animal/s voluntarily moves on.
- Koala habitat values and protection measures will be clearly communicated to machinery operator/s and project personnel during pre-start/ toolbox meetings.

4. Impact Offset/ Compensation

The clearance of koala feed tree species will be offset according to measures from the KPoM.

Proposed impact offset/ compensation measures are as follows for residual impacts that cannot practically be avoided or minimised:

- *For removal of T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH)*, ten (10) Parramatta Red Gum/ Drooping Red Gum (*Eucalyptus parramattensis*) are to be planted on the site in strategic locations within the street verge and public reserve in the northern portion of the site in the vicinity of proposed lots 8 to 15. These plantings are planned to create koala habitat islands and linkages to promote free and safe koala movement with traffic calming measures, permeable fences and without domestic dog threats. The planting design will be subject to Council review and approval. No plantings are to occur within the Koala Corridor due to APZ performance requirements. No plantings are to occur in the southern portion of the site so as to not encourage

koala movement in the area of the Bruxner Highway which is recognised as a koala vehicle collision black spot.

- *For removal of 122 koala food tree saplings (DBH from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH) within an area of approximately 112m^2*, compensatory works will be undertaken in line with *Appendix 5 – Habitat Compensation Policy* and outlined in a VMP/PoM approved by Council and fully funded by the proponent with a minimum five-year management period, as per the CKPoM. Habitat compensation works are proposed to be undertaken on a public reserve of Council's choice, e.g. the nearby Camelot Reserve Goonellabah. Site constraints prohibit further tall koala food tree plantings on the site.

5. Test of Significance Assessment Criteria

The following matters are to be taken into account for the purposes of determining whether a proposed development is likely to significantly affect the Koala or its habitat:

(a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposed development will not significantly impact the habitat of the koala population described in the KPoM such that the local population would be likely to be placed at risk of extinction.

The subject land is important to the local population of koalas as it is a thoroughfare and some koalas from the local population would periodically traverse the site when dispersing and/or moving between areas of primary habitat, such as occur to the north and west of the subject land.

There is also regenerating saplings of primary feed tree species on the subject land that could, in time provide more substantial foraging opportunities for koalas.

As explained above (in **Sections 3 and 4**), the proposal has been modified to permit koalas to continue to move across the site, maintaining habitat connectivity between primary habitats to the north and west of the subject land.

Feed trees will be largely maintained and additional specimens of red gums (*Eucalyptus paramattensis*) replanted. Dogs are not permitted to be kept on site, and there will be traffic calming measures installed along the interior roads to slow traffic.

Land to the west, north and forested areas elsewhere in the locality support relatively large areas of well-developed koala habitat that will not be affected by the proposal and will continue to provide habitat for resident koalas in the locality.

Removal of dense exotic weed cover in the southwest portion of the site to be cleared for bushfire protection will permit improved koala access to tall mature koala food trees on the adjoining lot to the southwest. Exotic weed species include Lantana, Camphor Laurel, Broad-leaved Privet, Easter Cassia/ Senna, Yellow Bells, Coffee, Loquat, White Sapote, Tobacco Bush, Passionfruit species; and the native weed Umbrella Tree.

The feed tree species to be cleared as a result of the proposal will be offset as per the KPoM, with replanting to occur in a local Council reserve that is within the land used by the local population.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. Eleven endangered ecological communities are recorded in the locality of the site on NSW BioNet. However, the field assessment determined that vegetation in the study area did not have the structural and floristic integrity to be consistent with any NSW listed Endangered Ecological Community (EEC) or Commonwealth EPBC Act listed Threatened Ecological Community (TEC).

Cleared open areas, a dense exotic weed cover area to the southwest and exotic orchard trees are not consistent with any NSW BioNet listed Plant Community Type (PCT). Isolated areas of native vegetation most closely matches the NSW BioNet listed Plant Community Type (PCT) 1073 *Pink Bloodwood - Tallowwood moist open forest of the far northern ranges of the NSW North Coast Bioregion*. This PCT is not associated with any EEC or TEC.

(c) In relation to the habitat of a threatened species or ecological community:

> ***(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***

The proposed development will not block koala movement across the subject land and habitat trees will be retained on site, with only limited clearing.

The proposal will result in the clearing of two regrowth trees, i.e. T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH), and 122 regrowth koala food tree saplings within an area of approximately 112m^2. The DBH of saplings range from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH.

Remaining scattered regrowth koala food trees (i.e. T1, T2, T3, T4 and T6) will be retained; given legal protection status via a legal covenant on property title, e.g. Section 88B/E; and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 1**.

Removal of dense exotic weed cover in the southwest portion of the site to be cleared for bushfire protection will permit improved koala access to tall mature koala food trees on the adjoining lot to the southwest.

The feed tree species to be cleared as a result of the proposal will be offset as per the KPoM, with replanting to occur in a local Council reserve that is within the land used by the local population.

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

As described in Sections 3 and 4 above, the project has been designed to be permeable to koalas and so the proposal will not significantly increase habitat fragmentation, isolate areas of koala habitat or restrict movement of koalas through or around the site or throughout the broader landscape.
Most of the larger regrowth of koala food trees to be retained will be given legal protection status via a legal covenant on property title, e.g. Section 88B/E, and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 1**. Proposed koala habitat plantings in the northern portion of the site will increase available habitat.

Free and safe movement of koalas will be facilitated across the west and north of the site and between adjoining areas of koala habitat via a Koala Corridor which will effectively incorporate retained scattered regrowth koala food trees; and link with proposed strategic plantings within the street verge and public reserve in the northern portion of the site in the vicinity of proposed lots 8 to 15. Lot boundary fences to the west and north and between lots 8 and 9 are to be a koala permeable fence that does not impede koala movement as outlined in the CKPoM, e.g. post and wire fence with bottom strand being plain wire placed a minimum of 300 mm above the ground. This will be achieved via a legal covenant on property title, e.g. Section 88B/E.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Due to modifications of the proposal, the impacts on important habitat will be limited and will not have a significant impact on the local occurrence of koalas.

The subject land, though now largely cleared, forms part of a movement corridor for the local population. It facilitates periodic movement of koalas between patches of nearby primary habitat, such as occurs to the immediate north and west of the subject land.

There will be two trees greater than 10 cm DBH removed, and a patch of smaller seedlings/saplings. All such trees will be offset as required under the KPoM.

The importance of the movement corridor, and the regenerating feed trees on site have been acknowledged and the proposed development redesigned as explained in Sections 3 and 4 above.

The regenerating feed trees proposed to be removed and the limited additional fragmentation of habitat will not prevent koalas moving across the site. There will also be additional trees planted on site that will offset the loss of the regenerating specimens to be removed.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

Declared Areas of Outstanding Biodiversity Value (AOBV) represent the most valuable sites for biodiversity conservation in NSW (OEH 2018).

No Areas of Outstanding Biodiversity Value (AOBV) listed under the *Biodiversity Conservation Regulation 2017* occur on or in close proximity to the subject site and the proposal will not impact any declared area of outstanding biodiversity value.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposal will entail limited clearing of regenerating native vegetation, which is a key threatening process, as explained below. However, this will be restricted to two saplings above 10 cm DBH and a patch of smaller seedlings, with all cleared vegetation to be offset following the requirements of the CKPoM.

A threatening process is defined under the *Biodiversity Conservation Act 2016* as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities.

In addition to deciding whether the action/activity constitutes a key threatening process (KTP), consideration must also be given to whether the proposal is likely to exacerbate a KTP. Species listed in the determination as being ‘at risk’ warrant particular consideration if these species are known or likely to occur within the study area of the development or activity.

The current list of key threatening processes listed under the BC Act and an assessment of whether parts of the proposal constitutes or exacerbates a KTP is shown below in **Table 1.**

Table 1. Key Threatening Process (KTP) assessment

Listed Key Threatening Processes (as described in the final determination of the Scientific Committee to list key threatening processes)	Likelihood of the parts of the proposal to be classed as a KTP		
	Likely	Possible	Unlikely
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, *Manorina melanocephala* (Latham, 1802)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process)			✓
Anthropogenic climate change			✓
Bushrock removal (as described in the final determination of the Scientific Committee to list the threatening process)			✓
Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process)	✓		
Competition and grazing by the feral European Rabbit, *Oryctolagus cuniculus* (L.)			✓
Competition and habitat degradation by Feral Goats, *Capra hircus* Linnaeus 1758			✓
Competition from feral honey bees, *Apis mellifera* L.			✓
Death or injury to marine species following capture in shark control programs on ocean beaches (as described in the final determination of the Scientific Committee to list the key threatening process)			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments (as described in the final determination of the Scientific Committee to list the key threatening process)			✓
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners			✓
Habitat degradation and loss by Feral Horses (brumbies, wild horses), Equus caballus Linnaeus 1758			✓
Herbivory and environmental degradation caused by feral deer			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Importation of Red Imported Fire Ants *Solenopsis invicta* Buren 1972			✓
Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family			✓

Listed Key Threatening Processes (as described in the final determination of the Scientific Committee to list key threatening processes)	Likelihood of the parts of the proposal to be classed as a KTP		
	Likely	Possible	Unlikely
Myrtaceae			
Introduction of the large earth bumblebee, *Bombus terrestris* (L.)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. lat)			✓
Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.			✓
Invasion of native plant communities by *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses			✓
Invasion of the Yellow Crazy Ant, *Anoplolepis gracilipes* (Fr. Smith) into NSW			✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees			✓
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)			✓
Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)			✓
Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish) (as described in the final determination of the Scientific Committee to list the threatening process)			✓
Predation by the Ship Rat *Rattus rattus* on Lord Howe Island			✓
Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa* Linnaeus 1758			✓
Removal of dead wood and dead trees			✓

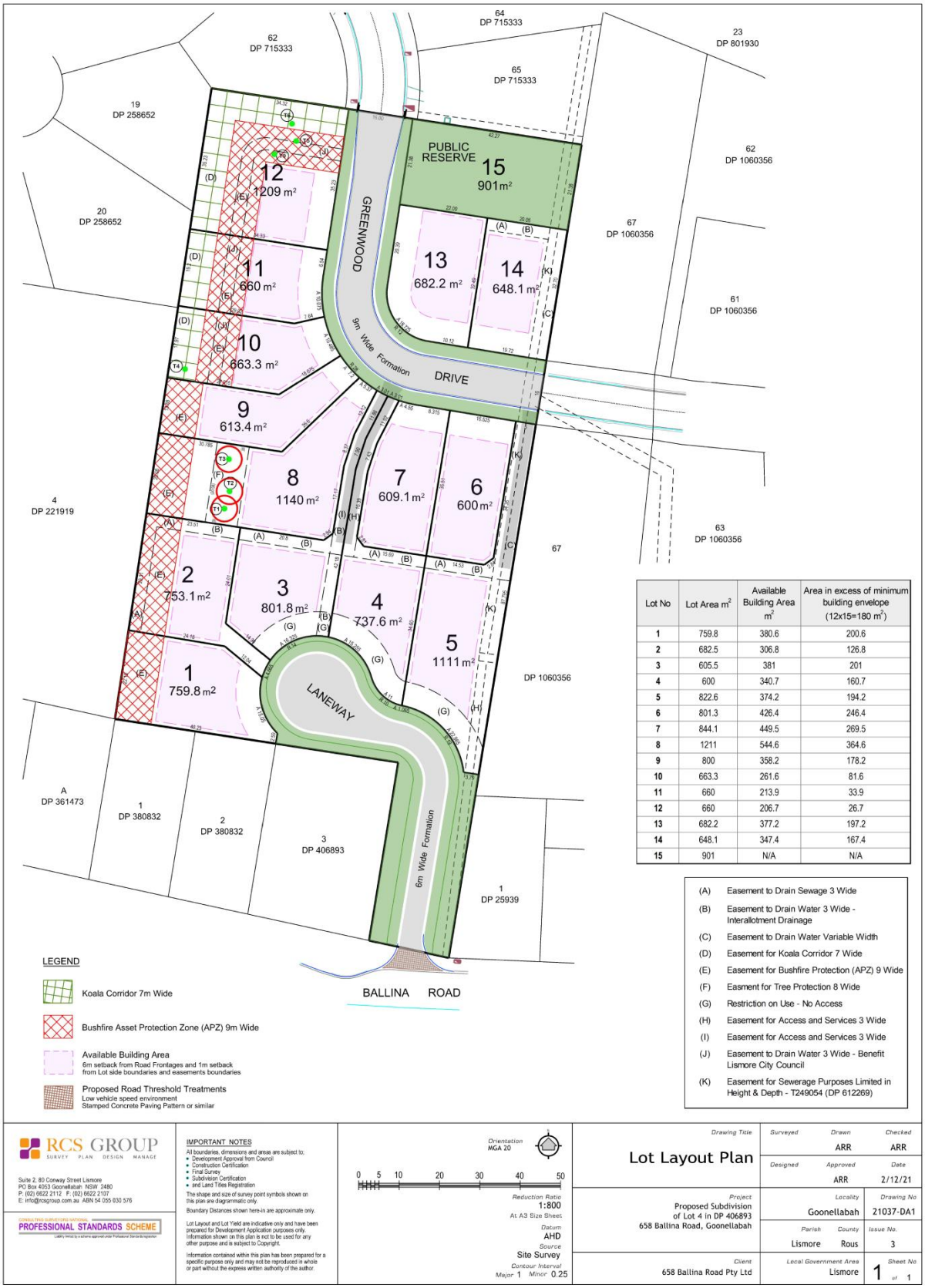
The proposal will contribute incrementally and cumulatively to the Key Threatening Process *Clearing of native vegetation*. The extent to which the proposed tree clearing contributes to this threatening process is, however, considered to be negligible considering the scale of proposed clearing, i.e. a single Tallowwood (17cm DBH), Forest Red Gum (10cm DBH) and an approximate 112m^2 area of juvenile sapling trees.

5.1. Test of Significance Conclusion

The proposal will impose some negative ecological effects associated with land subdivision; construction of dwellings and infrastructure; intensified human occupation; and clearing of koala habitat consisting of a single Tallowwood and Forest Red Gum and an approximate 112m^2 area of juvenile sapling trees. The vegetation is, however, considered to not be critical to the survival or recovery of the local Koala population.

The proposal is considered unlikely to significantly contribute to key threatening processes or significantly reduce habitat values for the Koala or other forest species, including foraging, movement, roosting, nesting, reproduction or sheltering values in the locality and beyond. The long-term koala survival and persistence in the local area is unlikely to be significantly affected by the proposal.

The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/ compensation measures outlined in **Sections 3 and 4**. Thus preparation of a biodiversity development assessment report by an accredited assessor is not necessary in relation to s.7.3 of the *NSW Biodiversity Conservation Act 2016*.



Lot No	Lot Area m²	Available Building Area m²	Area in excess of minimum building envelope (12x15=180 m²)
1	759.8	380.6	200.6
2	682.5	306.8	126.8
3	605.5	381	201
4	600	340.7	160.7
5	822.6	374.2	194.2
6	801.3	426.4	246.4
7	844.1	449.5	269.5
8	1211	544.6	364.6
9	800	358.2	178.2
10	663.3	261.6	81.6
11	660	213.9	33.9
12	660	206.7	26.7
13	682.2	377.2	197.2
14	648.1	347.4	167.4
15	901	N/A	N/A

Figure 1. Lot Layout Plan, source RCS Group.

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Bushfire Management Plan

Version 2.1

Proposed Development: Bushfire Management Plan Relating to Lots 1 – 14 relating to the Subdivision Masterplan of 658 Ballina Road

Location: Lots 1 - 14
658 Ballina Road
Goonellabah NSW 2480

Client: Craig Adams

Our Ref: 2105L&E

Date of Issue: 18 March 2022

Report prepared by **Melanie Jackson**

Grad Dip (Bushfire Protection); B.A.Sc. (EnvResMgt)
BPAD-Level 3 Accredited Practitioner & Member of the FPA Australia

‘Prepare—Act—Survive’

In the Event of an Emergency Call:

‘000’

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ABBREVIATIONS

Abbreviation	Description
APZ	Asset protection zone
AS3959	Australian Standard – Construction of Buildings in Bushfire Prone Areas
BAL	Bush fire attack level
BCA	Building Code of Australia
BLE	Building location envelope
BPM	Bush fire protection measure
DA	Development application
IPA	Inner protection area
NSW RFS	NSW Rural Fire Service
OPA	Outer Protection Area
PBP	Planning for Bushfire Protection

1 INTRODUCTION

The purpose of the BMP is to document the bushfire protection measures in combination agreed to between the bushfire experts for compliance as a result of the approved conditions of consent for this development.

A copy of this BMP is to be provided at enquiry of purchase and shall form part of the contract of sale.

1.1 The Development

Bushfire Management Plan Relating to Lots 1 – 14 relating to the Subdivision Masterplan of 658 Ballina Road. The development includes the sub-division of one (1) lot into fourteen (13) residential lots and one (1) reserve lot. The land in question shall be referred to as the 'Subject Site' and future dwellings to be sited within the Building Location Envelope identified within each lot, these shall be referred to as a 'BLE' throughout this document.

1.2 Subject Site

Site address: Lots 1 - 14 (formerly Lot 4 DP406893) of 658 Ballina Road Goonellabah NSW 2480. Greenwood Drive shall provide access to ten (13) lots with lots 2, 3 and 4 accessed via a short 'Right of Carriageway' shared driveway; The remaining Lot 1, shall be accessible from Ballina Road (Ref. Appendix A).

1.3 Bushfire Protection Measures

The Bushfire Protection Measures (BPM) are a set of measures to be satisfied which aim to reduce risk from bushfires and enhance occupant survival, property protection, occupant survival and community resilience to bushfire attack, commensurate with the level of risk for the subject site.

BPM may include the following:

- APZ (comprising of an IPA & OPA)
- Landscaping
- Access
- Building construction
- Siting and design
- Services
- Emergency and evacuation planning

2 LANDSCAPING, VEGETATION & ASSET PROTECTION ZONE MANAGEMENT

All lots within the development masterplan are sited within 100m of bushfire prone land. As a result all lots are situated in an area prone to bushfire attack in the event of a bushfire from the adjacent lots. Specific attention therefore is placed on asset protection through landscaping management and design principles in order to protect your home from both direct and indirect ignition sources, such as ember attack, radiant heat and direct flame contact.

By undertaking ongoing maintenance to protect your home, it is critical to maintain your surroundings, including gardens and storage solutions for flammable materials as these play a critical role in prevention of indirect ignition sources from burning debris around the house and garden and via connected vegetated areas such as burning gardens and wildlife corridors which lead to increased radiant heat and direct flame contact with buildings.

Vegetation should not be planted in rows along lot boundaries by lot owners which may create connectivity between bushfire hazard and buildings etc. as this may compromise the combined bushfire protection measures, design features and effectiveness of measures which relate to bushfire events that have been considered during the design phase and DA approval conditions imposed on the overall sub-division masterplan.

The purchasers of all lots shall be issued a copy of this report to understand their responsibilities to undertake specific Landscaping requirements and ongoing APZ management as set out below shall be undertaken generally pursuant to the requirements set out in Appendix 4 (PBP) (Ref. Appendix B herein) and the RFS document '*Standards for Asset Protection Zones*' (RFS 2005).

2.1 Asset Protection Zones

Minimum Asset Protection Zones (APZ) (Building Exclusion Zone) and the Koala Corridor (and OPA) are identified in Figure A 1. All lots are to be managed as per the RFS Guideline '*Standards for Asset Protection Zones*' (RFS 2005) in perpetuity.

A s.88b instrument shall be provided to ensure vegetation management is undertaken in a low fuel manner in perpetuity and placed on title. The following landscaping principles shall be applied both on and offsite:

2.1.1 Trees

- Tree canopies should be separated by 2 to 5m; and preference should be given to smooth barked trees;
- Eucalyptus spp. noted as Trees 1, 2 & 3 on Lot 8, Tree 4 on Lot 9, and Tree 6 on Lot 11 shall be retained (Figure A 1).
- Tree canopy cover should be less than 15% of the size of the lot at maturity;
- Trees or canopy should not come within 2m of a building;
- Lower limbs should be removed up to a height of 2m above the ground;

2.1.2 Retained Koala Food Trees

- Trees 1, 2 & 3 being retained within Lot 8 are exempt from requiring individual canopy separation (i.e. 2 to 5m spacing between individual canopies) and may be considered an equivalent to one tree canopy as they mature.
- Tree 4 on Lot 9 and Tree 6 on Lot 11, being retained in the Koala corridor are exempt from requiring individual canopy separation from any neighbouring trees where applicable as they mature.
- All retained trees 1, 2, 3, 4 & 6 shall be pruned so as not to overhang the building, however, it is acknowledged upon maturity minor overhang by branch tips is deemed acceptable.

2.1.3 Grass and Ground Fuel

- Grass should be kept mown (i.e. no more than 100mm in height); and
- Leaves and vegetation debris should be removed.

2.2 Koala Corridor (Private land)

- The Koala Corridor is to be managed as an OPA in perpetuity with exception of retained Tree 4 & 6 which are exempt from the canopy separation requirements.

2.3 Reserve Lot 14 and Road Reserves (Council managed land)

- The offsite detention basin (Reserve Lot 14) shall be managed as an IPA in perpetuity.
- Reserve Lot 14 shall be managed as per the principles set out above with exception shrubs shall not be planted within the road reserve.
- Trees in the road reserves shall be planted in positions set out on the masterplan (Ref. Figure A 1).
- No additional trees outside those identified in the masterplan attached are to be planted in the road reserve.

2.4 Landscaping

- Minimal ground fuel shall be maintained i.e. regularly pick up sticks and rake up leaves to avoid ground fuel building up, i.e. fine fuel to remain below 1cm in thickness.
- Non-combustible mulch shall be used e.g. gravel, scoria etc. in garden beds around or next to buildings and in a manner which does not create a wicking path between clumps of vegetation and buildings.
- Plants shall include rainforest species, species with high moisture and/or salt content, and avoid species with high oil content e.g. Eucalyptus spp.
- Endemic species are preferable over exotic species.
- Vegetation should not be planted in rows along lot boundaries to avoid vegetation connectivity between bushfire hazard and buildings.
- Shrubs should not be located under trees.
- Shrubs should not form more than 10% ground cover.
- All shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation at maturity.

2.5 Other Hazards – Storage and Management in the APZ.

- Store flammable materials such as fuel, firewood, chemicals etc. in a sealed, non-combustible, tightly sealed shed away from the structure and other hazards i.e. vegetation (6m or more).
- Maintain a min. 1.5m pedestrian access (or to the boundary whichever is closer) around the entire dwelling at all times.
- Ensure pathways around the dwelling, are free from obstacles, flammable materials etc. to ensure access by firefighters and occupants.
- Best practice is to maintain short mown grass and/or non-combustible pavers or like around the curtilage of buildings i.e. utilise pavers and footpaths near windows and doors etc.
- Unprotected flammable materials shall not be stored under structures.

2.6 APZ Maintenance Responsibility

2.6.1 Lots 1 – 13 (Privately held lots)

Individual lot owners are responsible for ongoing management and maintenance of the APZ and landscaping in perpetuity on privately held lots.

2.6.2 Lot 14 (Reserve Lot) & Road Reserves

Council are responsible for the ongoing maintenance and management of reserve lots i.e. Lot 14 and road reserves etc.

2.7 APZ Maintenance Compliance

There is no statutory legislation in relation to governance of the APZ and there is potential for house to house fires especially in relation to bushfire therefore maintenance is critical prior to the bushfire danger period. Ongoing maintenance of both the buildings and APZ is the responsibility of the lot owner under a s.88b covenant attached to the title of each lot.

Potential hazards and/or failure to meet the guidelines set out herein, should be discussed with the owner of the lot to rectify the issue in the first instance. For significant breaches and/or compliance failures, notices may be issued under the '*Rural Fires Act*' 1997 to remove hazard/s if appliable and concerns may be raised with the following agencies:

- Lismore City Council.
- NSW RFS.

3 ACCESS

Figure A 1: Bushfire Management Plan – Masterplan Layout, shows the access to the subject site via Greenwood Drive. In summary, Greenwood Drive provides access to Lots 2 – 13 with Lots 2 – 4 are accessible via the 'Right of Carriageway' and Lot 1 is accessed via Ballina Road.

- Greenwood Drive shall:
  - Be constructed with a 9m wide carriageway.
  - Parking shall be provided outside of the carriageway.
  - Hydrants shall be located clear of parking areas.
- The 'Right of Carriageway' shall:
  - Be constructed with a 6m wide carriageway.
  - Have a trafficable turning head including 12m outer and 6m inner curves adequate for turning fire fighting vehicles.
  - Be a no parking area.
  - No Parking signage shall be erected.
- All Trafficable surfaces shall be sufficient to carry up to 23 tonnes.
  - Curves of roads have a minimum inner radius of 6m.
  - The road crossfall does not exceed 3 degrees.
  - A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.
  - A short driveway shall suffice to all proposed lots.

4 CONSTRUCTION REQUIREMENTS

4.1 Dwellings and Associated Buildings

The recommended BAL rating/s for the proposed development is as follows:

- Comply with the acceptable solutions and the NSW variations to AS3959 as follows:
- The following recommended BAL ratings shall be met:
  - The Existing dwelling on Lot 3 shall be upgraded to meet BAL-19 construction requirements as set out in s.3 - construction general and s.6 - Construction requirements for BAL-19 of AS3959-2018;
  - Lots 4, 8, 9, 10, 11, 12 & 13 shall be constructed to BAL-29 as set out in s.3 - construction general and s.7 - Construction requirements for BAL-29 of AS3959-2018.
  - Lot 7, should be constructed to BAL-19 as set out in s.3 - construction general and s.6 - Construction requirements for BAL-19 of AS3959-2018 and NSW Variations to be applied as per s.7.5.2 PBP 2019.
  - Lots 1, 2, 5 & 6 shall be constructed to BAL-12.5 as set out in s.3 - construction general and s.5 - Construction requirements for BAL-12.5 of AS3959-2018; and
  - NSW Variations shall be applied (Ref. s.7.5.2 PBP 2019).
- The following NSW variations for construction must be applied:
  - Clause 3.10 of AS3959 is deleted and any sarking used for BAL-12.5, BAL-19, BAL-29 or BAL-40 shall:
  - Be non-combustible; or
  - Comply with AS/NZS 4200.1, be installed on the outside of the frame, and have a flammability index of not more than 5 as determined by AS1530.2; and
  - Clause 5.2 ad 6.2 of AS3959 is replaced by Clause 7.2 of AS3959, except that any wall enclosing the subfloor space need only comply with the wall requirements for the respective BAL; and
  - Clause 5.7 and 6.7 of AS3959 is replaced by clause 7.7 of AS3959, except that any wall enclosing the subfloor space need only comply with the wall requirements for the respective BAL.
- For the purposes of s.7.5.2 of PBP 2019, all sarking shall be non-combustible.

4.2 Gutters

- Roofs shall be gutterless or have leafless guttering and valleys to prevent the build-up of flammable material; and
- Any materials or devices used to stop leaves collecting in the gutters shall have a flammability index of not greater than 5 when tested in accordance with AS1530.2.

4.3 Fences & Gates

- Where installed, all fences and gates shall be non-combustible.

5 SERVICES – WATER, ELECTRICITY & GAS

5.1 Water Supplies for Fire Fighting Purposes

- Reticulated water supplies shall service the lots and be located no further than 60m from the nearest part of a building.
- Do not obstruct hydrants.
- Hydrant locations presented in Figure A 1 are clear of parking areas.
- Fire hydrant, spacing, design and sizing complies with the relevant clauses of Australian Standard AS 2419.1:2005.
- Hydrants are not located within any road carriageway; and
- Reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads.
- All above-ground water service pipes are metal, including and up to any taps

5.2 Electricity Supply

- Electrical transmission lines shall be placed underground.

5.3 Gas Services

- Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 - The storage and handling of LP Gas, the requirements of relevant authorities, and metal piping is used.
- All fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side.
- Connections to and from gas cylinders are metal.
- Polymer-sheathed flexible gas supply lines are not used; and
- Above-ground gas service pipes are metal, including and up to any outlets.

6 BUSHFIRE EMERGENCY MANAGEMENT & EVACUATION PLAN

It is recommended occupants of the site prepare a bushfire survival plan and practice it annually. A guide to preparing a 'Bushfire Survival Plan' is available for download on the NSW RFS website: www.rfs.nsw.gov.au (RFS 2019).

7 CONCLUSION

The subject site is located on Bushfire Prone Land. As a result of a detailed Bushfire Risk Assessment and Land and Environment Court proceedings for the fourteen (14) lot sub-division (Ref. Appendix A) required the preparation of a BMP. This BMP is to be issued to the developer and subsequent property owners along with s.88b instruments/easements to be presented on title.

It is crucial property owners understand their responsibilities and effectively implement appropriate, planning, design and vegetation maintenance in perpetuity to enhance bushfire protection not only for individual lots/occupants but for neighbours and the community as a whole.

The requirements detailed herein shall be undertaken by property owners and used for the establishment and undertaking ongoing bushfire protection measures in perpetuity. Failure to comply could result in detrimental consequences to life, property, and the environment.

In conclusion, the works required by this BMP shall be carried out by the developer in the first instance and prior to occupation, then by subsequent property owners to protect from negative effects of bushfire.

A copy of this BMP is to be provided at enquiry of purchase and shall form part of the contract of sale.

8 REFERENCES

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APPENDIX A – FIGURES

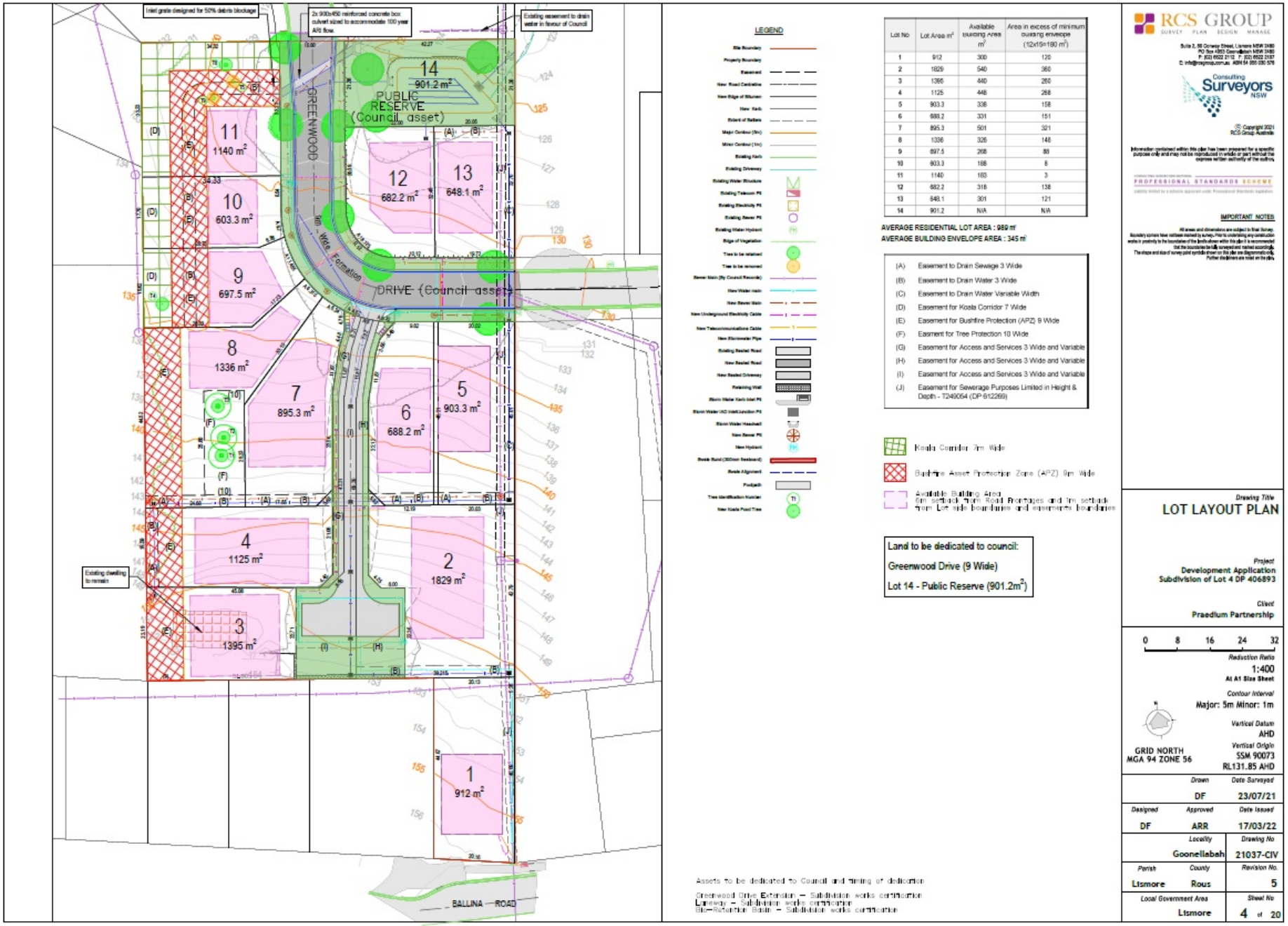

Figure A 1: Bushfire Management Plan – Masterplan Layout

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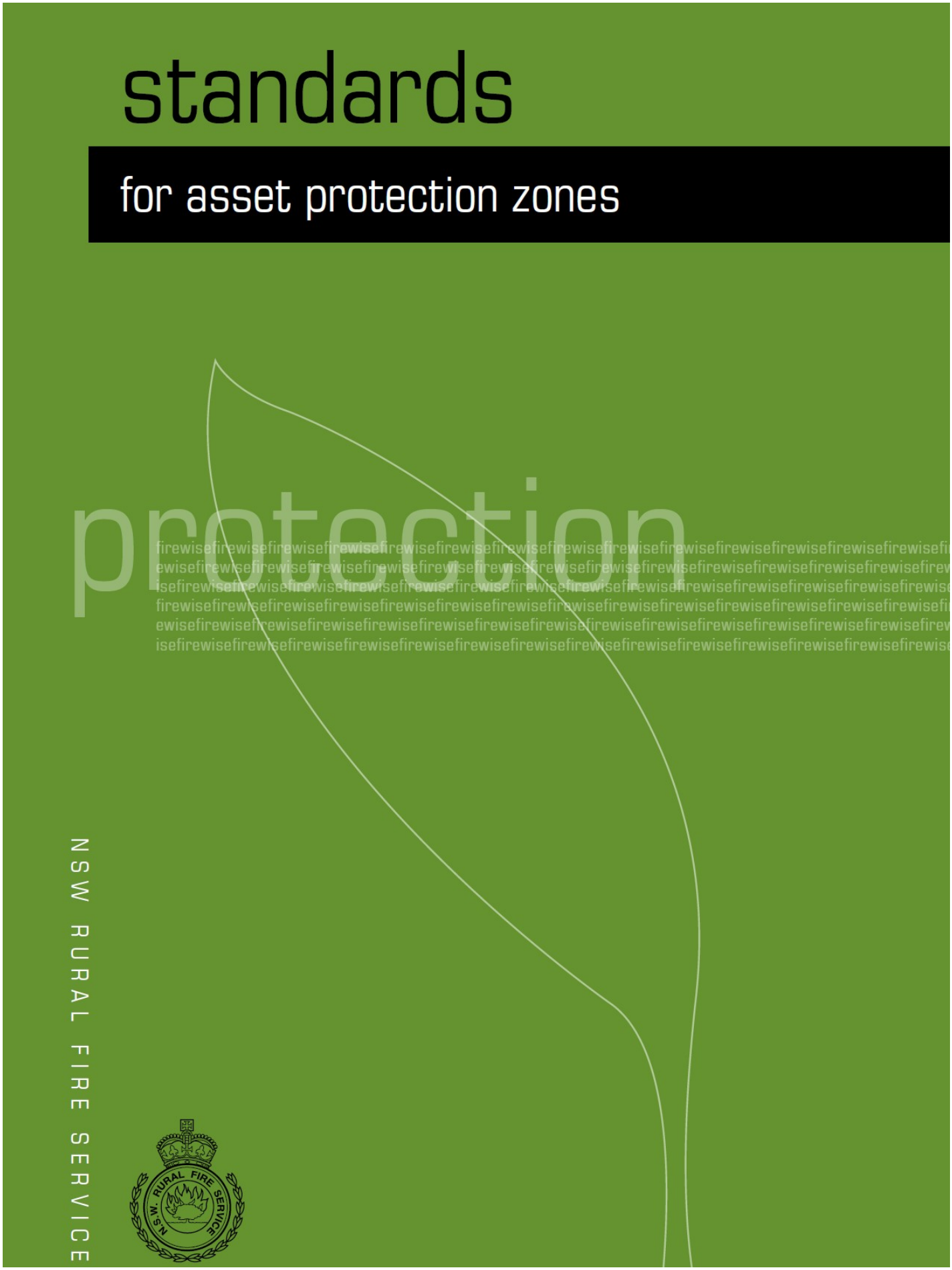
APPENDIX B – ASSET PROTECTION ZONE REQUIREMENTS



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INTRODUCTION

For thousands of years bush fires have been a natural part of the Australian landscape. They are inevitable and essential, as many Australian plants and animals have adapted to fire as part of their life cycle.

In recent years developments in bushland areas have increased the risk of bush fires harming people and their homes and property. But landowners can significantly reduce the impact of bush fires on their property by identifying and minimising bush fire hazards. There are a number of ways to reduce the level of hazard to your property, but one of the most important is the creation and maintenance of an Asset Protection Zone (APZ).

A well located and maintained APZ should be used in conjunction with other preparations such as good property maintenance, appropriate building materials and developing a family action plan.

WHAT IS AN ASSET PROTECTION ZONE?

An Asset Protection Zone (APZ) is a fuel reduced area surrounding a built asset or structure. This can include any residential building or major building such as farm and machinery sheds, or industrial, commercial or heritage buildings.

An APZ provides:

- a buffer zone between a bush fire hazard and an asset;
- an area of reduced bush fire fuel that allows suppression of fire;
- an area from which backburning may be conducted; and
- an area which allows emergency services access and provides a relatively safe area for firefighters and home owners to defend their property.

Potential bush fire fuels should be minimised within an APZ. This is so that the vegetation within the planned zone does not provide a path for the transfer of fire to the asset either from the ground level or through the tree canopy.

WHAT WILL THE APZ DO?

An APZ, if designed correctly and maintained regularly, will reduce the risk of:

- direct flame contact on the asset;
- damage to the built asset from intense radiant heat; and
- ember attack on the asset.

WHERE SHOULD I PUT AN APZ?

An APZ is located between an asset and a bush fire hazard.

The APZ should be located wholly within your land. You cannot undertake any clearing of vegetation on a neighbour's property, including National Park estate, Crown land or land under the management of your local council, unless you have written approval.

If you believe that the land adjacent to your property is a bush fire hazard and should be part of an APZ, you can have the matter investigated by contacting the NSW Rural Fire Service (RFS).

There are six steps to creating and maintaining an APZ. These are:

1. Determine if an APZ is required;
2. Determine what approvals are required for constructing your APZ;
3. Determine the APZ width required;
4. Determine what hazard reduction method is required to reduce bush fire fuel in your APZ;
5. Take measures to prevent soil erosion in your APZ; and
6. Landscape and regularly monitor in your APZ for fuel regrowth.

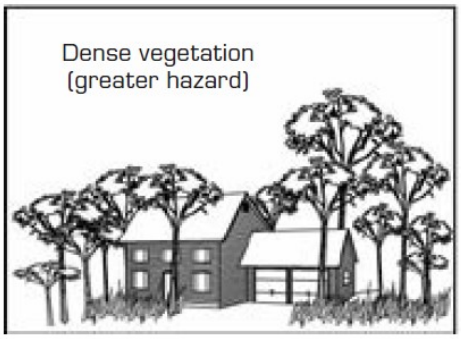
STEP 1. DETERMINE IF AN APZ IS REQUIRED

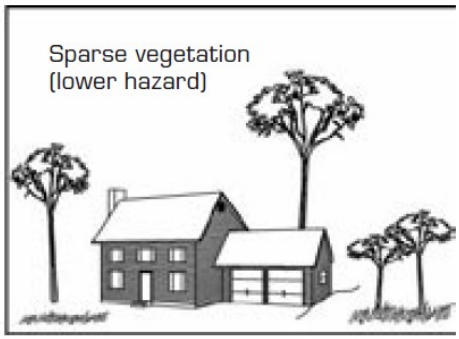
Recognising that a bush fire hazard exists is the first step in developing an APZ for your property.

If you have vegetation close to your asset and you live in a bush fire prone or high risk area, you should consider creating and maintaining an APZ.

Generally, the more flammable and dense the vegetation, the greater the hazard will be. However, the hazard potential is also influenced by factors such as slope.

- A large area of continuous vegetation on sloping land may increase the potential bush fire hazard.
- The amount of vegetation around a house will influence the intensity and severity of a bush fire.
- The higher the available fuel the more intense a fire will be.





Isolated areas of vegetation are generally not a bush fire hazard, as they are not large enough to produce fire of an intensity that will threaten dwellings.

This includes:

- bushland areas of less than one hectare that are isolated from large bushland areas; and
- narrow strips of vegetation along road and river corridors.

If you are not sure if there is a bush fire hazard in or around your property, contact your local NSW Rural Fire Service Fire Control Centre or your local council for advice.

STEP 2. DETERMINE WHAT APPROVALS ARE REQUIRED FOR CONSTRUCTING YOUR APZ

If you intend to undertake bush fire hazard reduction works to create or maintain an APZ you must gain the written consent of the landowner.

Subdivided land or construction of a new dwelling
If you are constructing an APZ for a new dwelling you will need to comply with the requirements in *Planning for Bushfire Protection*. Any approvals required will have to be obtained as part of the Development Application process.

Existing asset
If you wish to create or maintain an APZ for an existing structure you may need to obtain an environmental approval. The RFS offers a free environmental assessment and certificate issuing service for essential hazard reduction works. For more information see the RFS document *Application Instructions for a Bush Fire Hazard Reduction Certificate* or contact your local RFS Fire Control Centre to determine if you can use this approval process.

Bear in mind that all work undertaken must be consistent with any existing land management agreements (e.g. a conservation agreement, or property vegetation plan) entered into by the property owner.

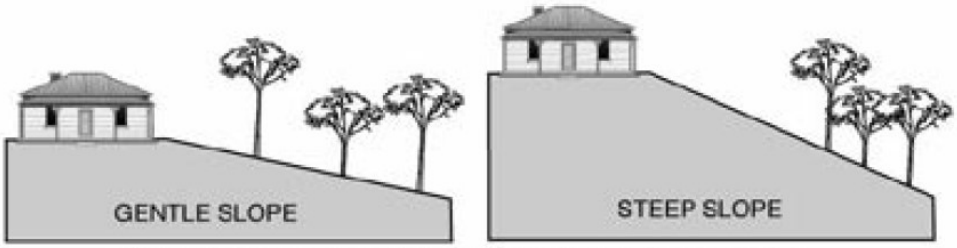
If your current development consent provides for an APZ, you do not need further approvals for works that are consistent with this consent.

If you intend to burn off to reduce fuel levels on your property you may also need to obtain a Fire Permit through the RFS or NSW Fire Brigades. See the RFS document *Before You Light That Fire* for an explanation of when a permit is required.

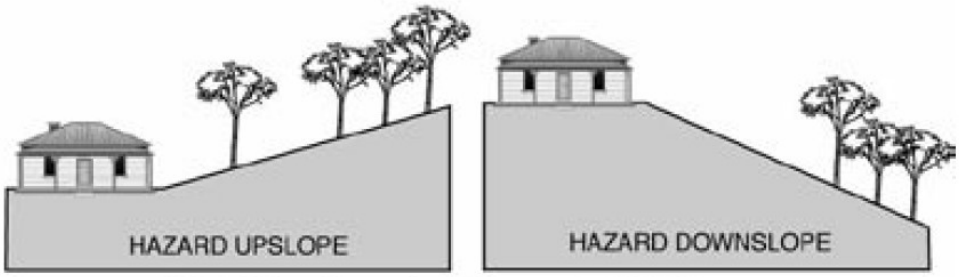
STEP 3. DETERMINE THE APZ WIDTH

The size of the APZ required around your asset depends on the nature of the asset, the slope of the area, the type and structure of nearby vegetation and whether the vegetation is managed.

Fires burn faster uphill than downhill, so the APZ will need to be larger if the hazard is downslope of the asset.



Gentle slopes require a smaller APZ distance than steep slopes



A hazard downslope will require a greater APZ distance then a hazard upslope of the asset

Different types of vegetation (for example, forests, rainforests, woodlands, grasslands) behave differently during a bush fire. For example, a forest with shrubby understorey is likely to result in a higher intensity fire than a woodland with a grassy understorey and would therefore require a greater APZ width.

A key benefit of an APZ is that it reduces radiant heat and the potential for direct flame contact on homes and other buildings. Residential dwellings require a wider APZ than sheds or stockyards because the dwelling is more likely to be used as a refuge during bush fire.

Subdivided land or construction of a new dwelling
If you are constructing a new asset, the principles of *Planning for Bushfire Protection* should be applied. Your Development Application approval will detail the exact APZ distance required.

Existing asset
If you wish to create an APZ around an existing asset and you require environmental approval, the Bush Fire Environmental Assessment Code provides a streamlined assessment process. Your Bush Fire Hazard Reduction Certificate (or alternate environmental approval) will specify the maximum APZ width allowed.

For further information on APZ widths see *Planning for Bushfire Protection* or the *Bush Fire Environmental Assessment Code* (available on the RFS website), or contact your local RFS Fire Control Centre.

STEP 4. DETERMINE WHAT HAZARD REDUCTION METHOD IS REQUIRED TO REDUCE BUSH FIRE FUEL IN YOUR APZ

The intensity of bush fires can be greatly reduced where there is little to no available fuel for burning. In order to control bush fire fuels you can reduce, remove or change the state of the fuel through several means.

Reduction of fuel does not require removal of all vegetation, which would cause environmental damage. Also, trees and plants can provide you with some bush fire protection from strong winds, intense heat and flying embers (by filtering embers) and changing wind patterns. Some ground cover is also needed to prevent soil erosion.

Fuels can be controlled by:

1. raking or manual removal of fine fuels
Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire.

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Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

2. mowing or grazing of grass
Grass needs to be kept short and, where possible, green.

3. removal or pruning of trees, shrubs and understorey
The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation.

Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by two to five metres. A canopy should not overhang within two to five metres of a dwelling.

Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.

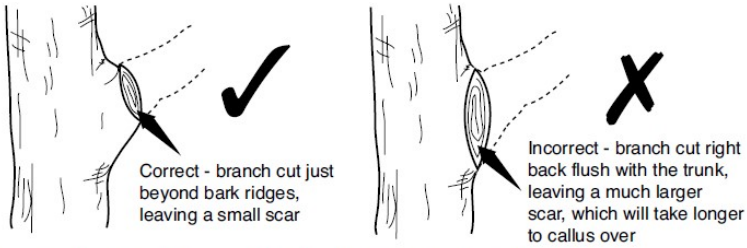
When choosing plants for removal, the following basic rules should be followed:

1. Remove noxious and environmental weeds first. Your local council can provide you with a list of environmental weeds or 'undesirable species'. Alternatively, a list of noxious weeds can be obtained at **www.agric.nsw.gov.au/noxweed/**;
2. Remove more flammable species such as those with rough, flaky or stringy bark; and
3 Remove or thin understorey plants, trees and shrubs less than three metres in height

The removal of significant native species should be avoided.

Prune in acordance with the following standards:

- Use sharp tools. These will enable clean cuts and will minimise damage to the tree.
- Decide which branches are to be removed before commencing work. Ensure that you maintain a balanced, natural distribution of foliage and branches.
- Remove only what is necessary.
- Cut branches just beyond bark ridges, leaving a small scar.
- Remove smaller branches and deadwood first.



There are three primary methods of pruning trees in APZs:

1. Crown lifting (skirting)
Remove the lowest branches (up to two metres from the ground). Crown lifting may inhibit the transfer of fire between the ground fuel and the tree canopy.

2. Thinning
Remove smaller secondary branches whilst retaining the main structural branches of the tree. Thinning may minimise the intensity of a fire.

3. Selective pruning
Remove branches that are specifically identified as creating a bush fire hazard (such as those overhanging assets or those which create a continuous tree canopy). Selective pruning can be used to prevent direct flame contact between trees and assets.

Your Bush Fire Hazard Reduction Certificate or local council may restrict the amount or method of pruning allowed in your APZ.

See the *Australian Standard 4373 (Pruning of Amenity Trees)* for more information on tree pruning.

4. Slashing and trittering
Slashing and trittering are economical methods of fuel reduction for large APZs that have good access. However, these methods may leave large amounts of slashed fuels (grass clippings etc) which, when dry, may become a fire hazard. For slashing or trittering to be effective, the cut material must be removed or allowed to decompose well before summer starts.

If clippings are removed, dispose of them in a green waste bin if available or compost on site (dumping clippings in the bush is illegal and it increases the bush fire hazard on your or your neighbour's property).

Although slashing and trittering are effective in inhibiting the growth of weeds, it is preferable that weeds are completely removed.

Care must be taken not to leave sharp stakes and stumps that may be a safety hazard.

5. Ploughing and grading
Ploughing and grading can produce effective firebreaks. However, in areas where this method is applied, frequent maintenance may be required to minimise the potential for erosion. Loose soil from ploughed or graded ground may erode in steep areas, particularly where there is high rainfall and strong winds.

6. Burning (hazard reduction burning)
Hazard reduction burning is a method of removing ground litter and fine fuels by fire. Hazard reduction burning of vegetation is often used by land management agencies for broad area bush fire control, or to provide a fuel reduced buffer around urban areas.

Any hazard reduction burning, including pile burns, must be planned carefully and carried out with extreme caution under correct weather conditions. Otherwise there is a real danger that the fire will become out of control. More bush fires result from escaped burning off work than from any other single cause.

It is YOUR responsibility to contain any fire lit on your property. If the fire escapes your property boundaries you may be liable for the damage it causes.

Hazard reduction burns must therefore be carefully planned to ensure that they are safe, controlled, effective and environmentally sound. There are many factors that need to be considered in a burn plan. These include smoke control, scorch height, frequency of burning and cut off points (or control lines) for the fire. For further information see the RFS document *Standards for Low Intensity Bush Fire Hazard Reduction Burning,* or contact your local RFS for advice.

7. Burning (pile burning)
In some cases, where fuel removal is impractical due to the terrain, or where material cannot be disposed of by the normal garbage collection or composted on site, you may use pile burning to dispose of material that has been removed in creating or maintaining an APZ.

For further information on pile burning, see the RFS document *Standards for Pile Burning.*

In areas where smoke regulations control burning in the open, you will need to obtain a Bush Fire Hazard Reduction Certificate or written approval from Council for burning. During the bush fire danger period a Fire Permit will also be required. See the RFS document *Before You Light that Fire* for further details.

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STEP 5. TAKE MEASURES TO PREVENT SOIL EROSION

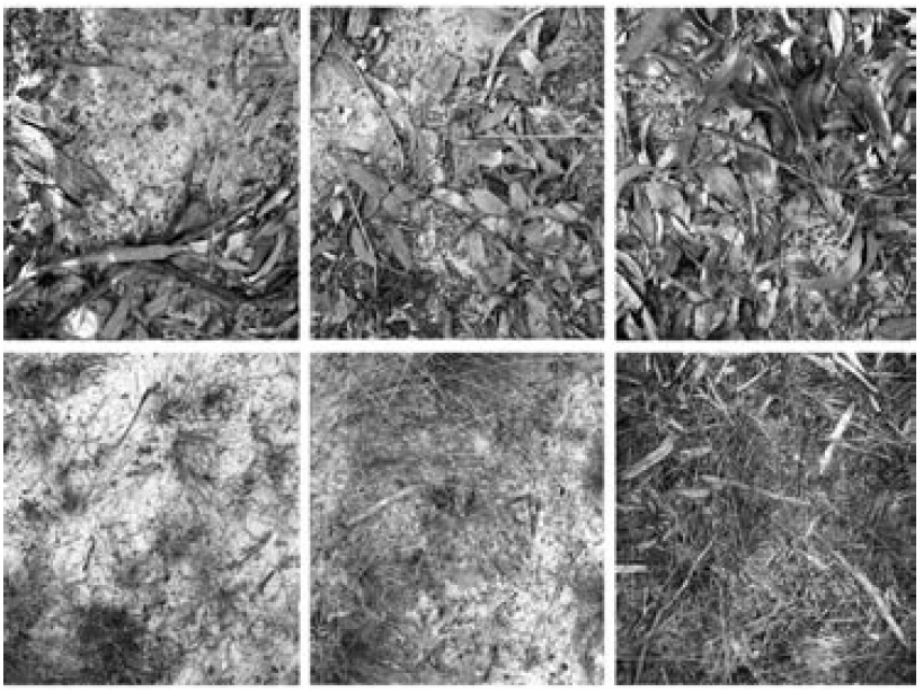
While the removal of fuel is necessary to reduce a bush fire hazard, you also need to consider soil stability, particularly on sloping areas.

Soil erosion can greatly reduce the quality of your land through:

- loss of top soil, nutrients, vegetation and seeds
- reduced soil structure, stability and quality
- blocking and polluting water courses and drainage lines

A small amount of ground cover can greatly improve soil stability and does not constitute a significant bush fire hazard. Ground cover includes any material which directly covers the soil surface such as vegetation, twigs, leaf litter, clippings or rocks. A permanent ground cover should be established (for example, short grass). This will provide an area that is easy to maintain and prevent soil erosion.

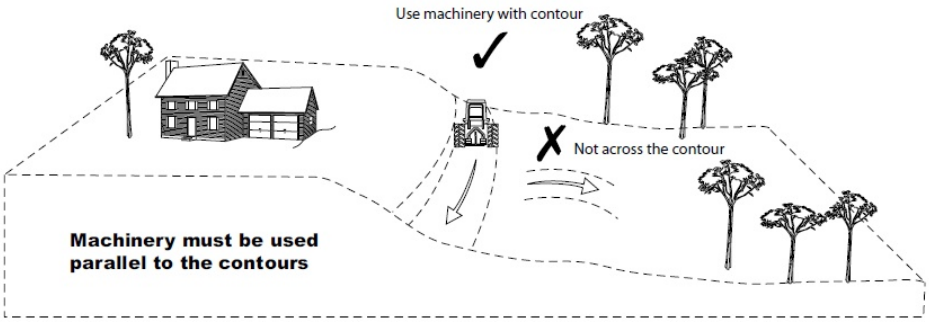
When using mechanical hazard reduction methods, you should retain a ground cover of at least 75% to prevent soil erosion. However, if your area is particularly susceptible to soil erosion, your Hazard Reduction Certificate may require that 90% ground cover be retained.



50% **75%** **100%**

Ground Cover

To reduce the incidence of soil erosion caused by the use of heavy machinery such as ploughs, dozers and graders, machinery must be used parallel to the contours. Vegetation should be allowed to regenerate, but be managed to maintain a low fuel load.



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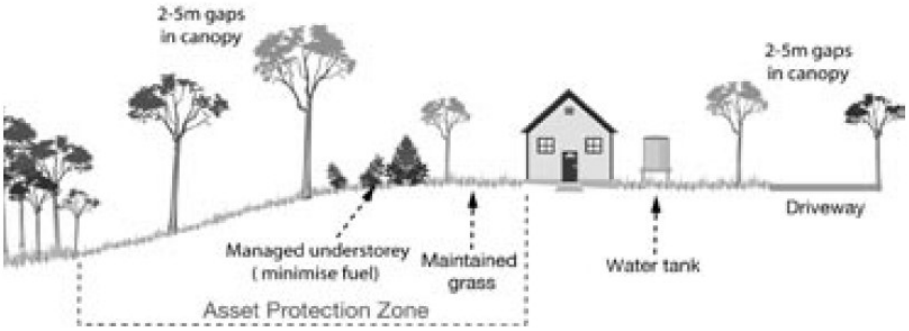
STEP 6. ONGOING MANAGEMENT AND LANDSCAPING

Your home and garden can blend with the natural environment and be landscaped to minimise the impact of fire at the same time. To provide an effective APZ, you need to plan the layout of your garden to include features such as fire resistant plants, radiant heat barriers and windbreaks.

Layout of gardens in an APZ
When creating and maintaining a garden that is part of an APZ you should:

- ensure that vegetation does not provide a continuous path to the house;
- remove all noxious and environmental weeds;
- plant or clear vegetation into clumps rather than continuous rows;
- prune low branches two metres from the ground to prevent a ground fire from spreading into trees;
- locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission;
- plant and maintain short green grass around the house as this will slow the fire and reduce fire intensity. Alternatively, provide non-flammable pathways directly around the dwelling;
- ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non flammable ground cover such as pebbles and crush tile; and
- avoid erecting brush type fencing and planting "pencil pine" type trees next to buildings, as these are highly flammable.



Removal of other materials
Woodpiles, wooden sheds, combustible material, storage areas, large quantities of garden mulch, stacked flammable building materials etc. should be located away from the house. These items should preferably be located in a designated cleared location with no direct contact with bush fire hazard vegetation.

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Other protective features
You can also take advantage of existing or proposed protective features such as fire trails, gravel paths, rows of trees, dams, creeks, swimming pools, tennis courts and vegetable gardens as part of the property's APZ.

PLANTS FOR BUSH FIRE PRONE GARDENS

When designing your garden it is important to consider the type of plant species and their flammability as well as their placement and arrangement.

Given the right conditions, all plants will burn. However, some plants are less flammable than others.

Trees with loose, fibrous or stringy bark should be avoided. These trees can easily ignite and encourage the ground fire to spread up to, and then through, the crown of the trees.

Plants that are less flammable, have the following features:

- high moisture content
- high levels of salt
- low volatile oil content of leaves
- smooth barks without "ribbons" hanging from branches or trunks; and
- dense crown and elevated branches.

When choosing less flammable plants, be sure not to introduce noxious or environmental weed species into your garden that can cause greater long-term environmental damage.

For further information on appropriate plant species for your locality, contact your local council, plant nurseries or plant society.

If you require information on how to care for fire damaged trees, refer to the Firewise brochure *Trees and Fire Resistance; Regeneration and care of fire damaged trees.*

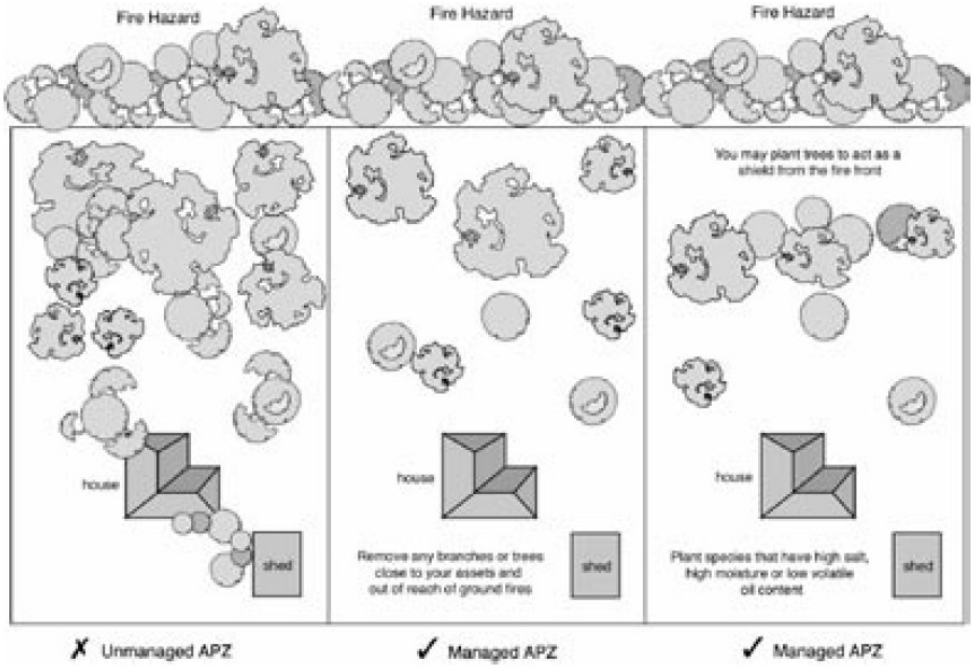
WIND BREAKS

Rows of trees can provide a wind break to trap embers and flying debris that could otherwise reach the house or asset.

You need to be aware of local wind conditions associated with bush fires and position the wind break accordingly. Your local RFS Fire Control Centre can provide you with further advice.

When choosing trees and shrubs, make sure you seek advice as to their maximum height. Their height may vary depending on location of planting and local conditions. As a general rule, plant trees at the same distance away from the asset as their maximum height.

When creating a wind break, remember that the object is to slow the wind and to catch embers rather than trying to block the wind. In trying to block the wind, turbulence is created on both sides of the wind break making fire behaviour erratic.



HOW CAN I FIND OUT MORE?

The following documents are available from your local Fire Control Centre and from the NSW RFS website at **www.rfs.nsw.gov.au.**

- Before You Light That Fire
- Standards for Low Intensity Bush Fire Hazard Reduction Burning
- Standards for Pile Burning
- Application Instructions for a Bush Fire Hazard Reduction Certificate

If you require any further information please contact:

- your local NSW Rural Fire Service Fire Control Centre. Location details are available on the RFS website or
- call the NSW RFS Enquiry Line 1800 679 737 (Monday to Friday, 9am to 5pm), or
- the NSW RFS website at **www.rfs.nsw.gov.au.**

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Bushfire Risk Assessment

Version 3 – Bushfire Report

Graham Peter Meineke trading as GM Project Development and Management v Lismore City Council (2021/00044443)

Proposed Development: Sub-division of one (1) lot into thirteen (13) residential lots and one (1) reserve lot.

Location: Lot 4 DP 406893
658 Ballina Road
Goonellabah NSW 2480

Client: Craig Adams

Our Ref: 2105L&E

Date of Issue: 18 March 2022

Report prepared by **Melanie Jackson**
Grad Dip (Bushfire Protection); B.App.Sc (EnvResMgt)
BPAD-Level 3 Accredited Practitioner & Member of the FPA Australia

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

'Prepare—Act—Survive'

In the Event of an Emergency Call:

'000'

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Version 3.0	18/03/2022	MJ	-	The client

EXPIRY

The bushfire risk assessment and resulting BAL rating contained in this report should not be relied upon for a period extending 6 months from date of issue. If this report was issued more than 6 months ago, it is recommended that the validity of the determination be confirmed with the Accredited Practitioner and where required an updated report should be issued.

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Despite best efforts, there is no guarantee that desirable outcomes are achievable during extreme bushfire weather episodes, which may occasion unpredictable bushfire behaviour and detrimental consequences to life, property and the environment. Any representation, statement, opinion or advice expressed or implied in this report is made in good faith on the basis that Bushfire Risk or its employees are not liable (whether by reason of negligence, lack of care or otherwise) to any person for damage or loss whatsoever that may occur in relation to that person taking or not taking (as the case may be) action in respect of any representation, statement or advice referred to below.

EXECUTIVE SUMMARY

This Bushfire Risk Assessment relates to a proposed development located at:	Lot 4 DP 406893 658 Ballina Road; Goonellabah NSW 2480
Client/s:	Craig Adams
Site inspection date:	31 May 2018 and 8 July 2021
Proposed development:	Sub-division of one (1) lot into thirteen (13) residential lots and one (1) reserve lot.
Land & Environment Court No.	2021/00044443
Site Plans by:	Issue no. 5; RCS Group; Date: 17/03/22. A full set of plans shall be provided by the applicant to accompany the DA, which should be read in conjunction with this report. The design and site plans demonstrate compliance with the building setbacks, roads, APZ, hydrants etc. for the development as proposed which relate to the recommendations contained herein.
Is there a suitable building location envelope within each proposed lot below critical radiant heat flux limits of ≤29kW/m²?	YES – all proposed new lot/s incorporate an indicative building location envelope/s (BLE) with setbacks which remain below the critical radiant heat flux limit of 29kW/m². The existing dwelling on lot 3 shall be upgraded to achieve BAL-19 construction level, pursuant to AS3959-2018 (incl. NSW Variations).
Does this development satisfy the Aims and Objectives of PBP?	YES – with performance solutions for access
Are performance solutions presented herein?	YES – a performance solution has been presented herein demonstrating compliance against the performance criteria whereby a perimeter road is not proposed.
Does this development require referral to the NSW Rural Fire Service as per s.100B Rural Fires Act 1997?	A BFSA was granted in relation to previous plans however these are no longer applicable. Approval shall be sought via the Land and Environment Court process and/or a new Bushfire Safety Authority shall be required; This bushfire report and associated plans replaces all previous versions.
This assessment has been prepared and certified by Melanie Jackson BPAD-Level 3 Certified Practitioner; FPAA Cert. No: 21977	

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ABBREVIATIONS & DEFINITIONS

Abbreviation/Definition	Description
APZ	Asset protection zone
AS3959	Australian Standard – Construction of Buildings in Bushfire Prone Areas
BAL	Bush fire attack level
BCA	Building Code of Australia
BFDB	Bush fire design brief
BFPL	Bush fire prone land
BFPL Map	Bush fire prone land map
BFSA	Bush fire safety authority
BLE	Building location envelope
BPM	Bush fire protection measure
BRA	Bush fire risk assessment
DA	Development application
DCP	Development control plan
EP&A Act	*Environmental Planning & Assessment Act 1979*
FFDI	Forest fire danger index
GFDI	Grass fire danger index
IPA	Inner protection area
kW/m^2	Kilowatts per metre squared
LEP	Local environmental protection plan
NSW RFS	NSW Rural Fire Service
OPA	Outer protection area
PBP	Planning for Bushfire Protection
RF Act	*Rural Fires Act 1997*
RF Reg	*Rural Fire Regulation 2013*
SEPP	*State Environmental Planning Policy*
SFPP	Special fire protection purpose
SFR	Short fire run
Defendable space	An area adjoining a building that is managed to reduce combustible elements free from constructed impediments. It is a safe working environment in which efforts can be undertaken to defend the structure, before and after the passage of a bushfire.
Performance based solution	A method of complying with the performance criteria other than by an acceptable solution.

1 INTRODUCTION

Bushfire Risk Pty Ltd was engaged by the client/s to conduct a Bushfire Risk Assessment in support of a Development Application (DA) Reference: 5.2019.438.1 was rejected by Council. Therefore the client is pursuing the DA under the Land & Environment Court process, reference case number: 2021/00044443.

The client, and consultants associated with the proposal have been consulting with the various parties and expert witnesses without prejudice to date and as a result the client is proposing a new site layout plan be issued in order to address any outstanding objections.

It was therefore deemed necessary to undertake a new bushfire risk assessment specifically to address the with the new/proposed sub-division layout under current legislative requirements, including PBP 2019, whereby the purpose of this assessment is to determine category of bushfire attack and critical radiant heat flux limits in relation to the proposed development, whilst ensuring bushfire protection measures in combination are provided for and suitable for the subject site and associated level of risk.

The development shall be carried out on the lot/s referred to as the 'Subject Site' (Figure 1) and where applicable, existing or future dwellings shall be sited within a Building Location Envelope which shall be referred to as a 'BLE' throughout this document.

1.1 Subject Site

Address: Lot 4 DP 406893 of 658 Ballina Road Goonellabah NSW 2480.

1.2 Proposed Development

Sub-division of one (1) lot into thirteen (13) residential lots and one (1) reserve lot.

It is noted suitable BLEs have been nominated within each lot where radiant heat flux limits are unlikely to exceed 29kW/m² and direct flame contact negated. The existing lot size is: 15,370 m² whereby the proposed lots and sizes are tabulated below (Table 1).

Table 1: Proposed lots and size

Lot number	Proposed lot size (m²)	Lot number	Proposed lot size (m²)
Lot 1	912	Lot 8	1336
Lot 2	1829	Lot 9	697.5
Lot 3 (existing dwelling)	1395	Lot 10	603.3
Lot 4	1125	Lot 11	1140
Lot 5	903.3	Lot 12	682.2
Lot 6	688.2	Lot 13	648.1
Lot 7	895.3	Lot 14	901.2

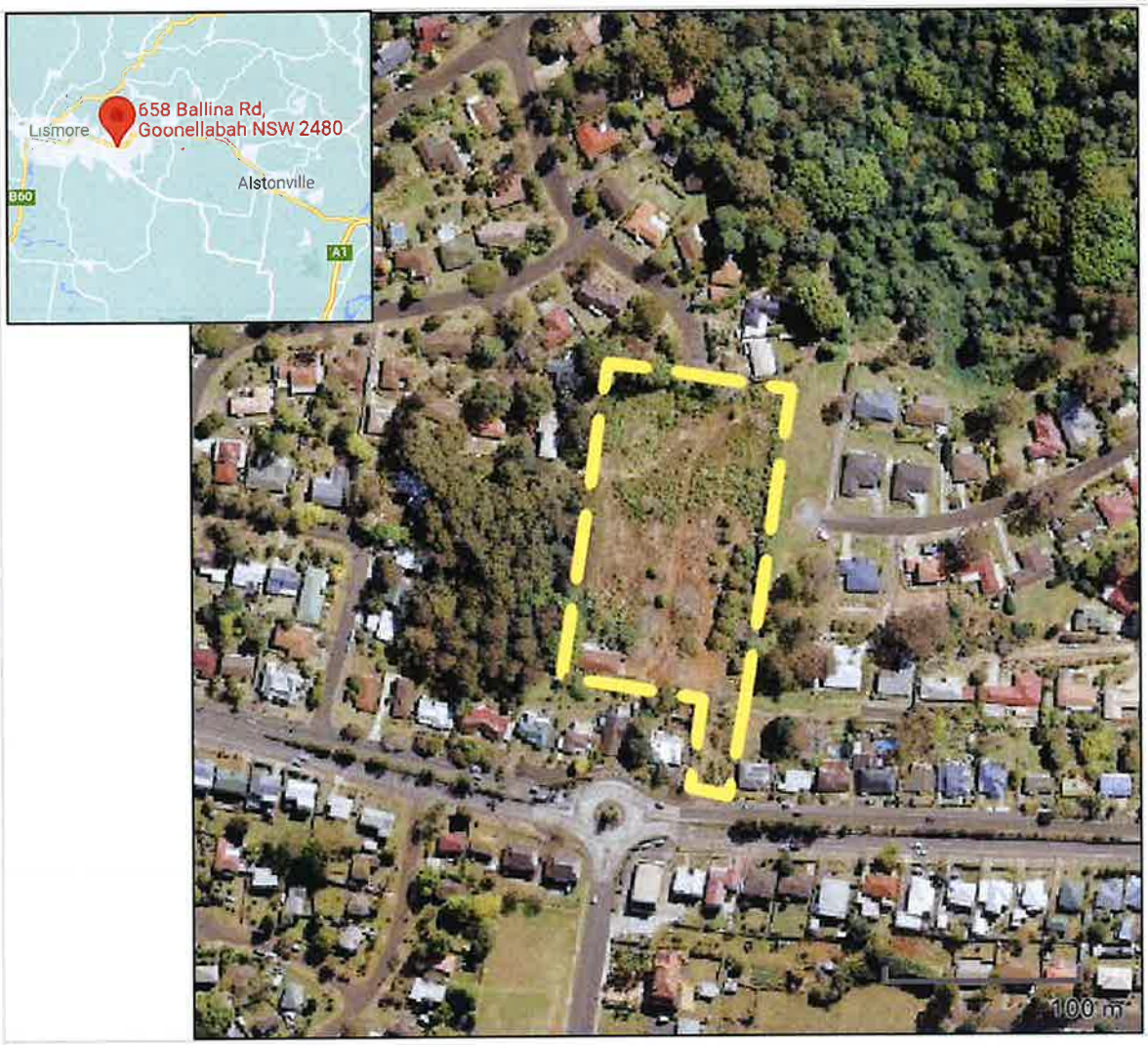


Figure 1: Aerial image of the subject site and surrounds (Source: NSW Government; Google Maps 2021)

1.3 Legislation

1.3.1 Building on Bushfire Prone Land

The National Construction Code (NCC) contains Performance Requirements and Deemed-to-Satisfy provisions relating building on Bushfire Prone Land (BFPL). Construction on BFPL must comply with AS3959-2018 – Construction of buildings in bushfire prone areas (AS3959) or the National Association of Steel Framed Housing (2014) Steel Framed Construction in Bush Fire Areas (NASH Standard) as varied in NSW. These requirements are considered Deemed-to-Satisfy solutions, however, do not extend to BAL-FZ or where modified by specific conditions of the relevant development consent.

1.3.2 Bushfire Prone Land

The subject site is mapped as 'Bush Fire Prone Land' (BFPL) under s.10.3 Environmental Planning and Assessment Act 1979 (EPA Act), triggering the legislative requirements for building on bushfire prone land is applicable (Figure 2).

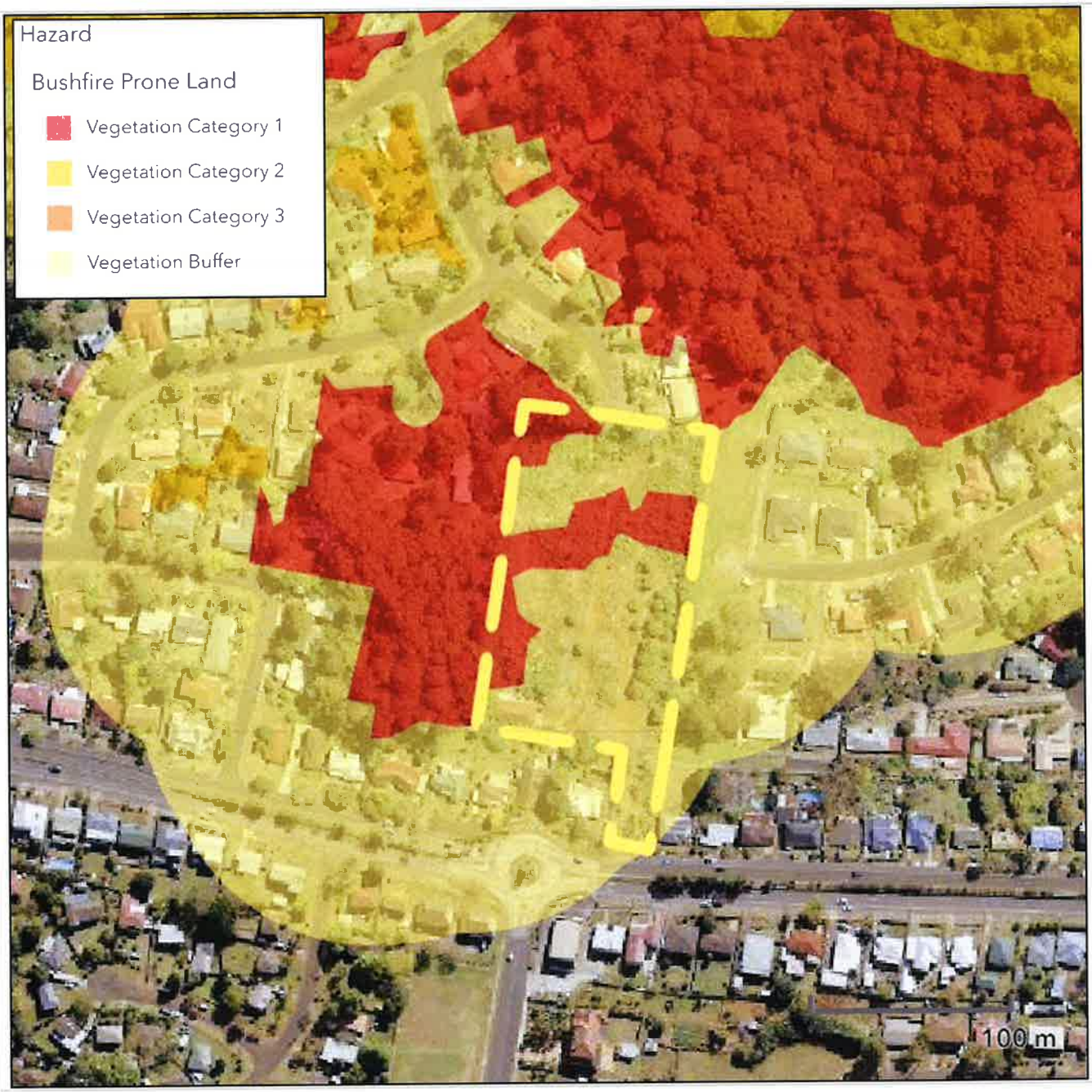


Figure 2: BFPL Map (Source: NSW Government 2021)

1.3.3 Development requiring a Bushfire Safety Authority (BFSA)

Proposed sub-divisions and special fire protection purpose (SFPP) developments as defined in PBP require approval from the NSW RFS in the form of a bushfire safety authority (BFSA) under s.100B *Rural Fires Act 1997*. Such developments are considered 'Integrated development' under s.4.46 of the *EP&A Act 1979*.

1.3.4 Residential and Rural Residential Sub-Division

The following bushfire risk assessment was undertaken pursuant to section 5 – Residential and Rural Residential Subdivisions (PBP).

1.3.5 Existing Dwelling – Proposed Lot 3

While all new dwellings within a subdivision must comply with PBP, the existing dwelling/s located on the land is likely to benefit from BPMs. Therefore, the recommendations herein include upgrading the existing structure for ember protection or higher in order to provide a better bushfire outcome.

1.3.6 Environmental, Ecological and Aboriginal Features

The scope of this bushfire report does not include and environmental, ecological or aboriginal assessment. As a result, this report should be read in conjunction with the Statement of Environmental Effects (SEE) and any supporting assessments and reports submitted in support of the DA, which shall address the environmental, ecological or Aboriginal features known to the applicant/client for consideration during the Development Application (DA) process.

It is the responsibility of the applicant/client to disclose the details of any threatened species, population or ecological community identified under the Threatened Species Conservation Act 1995 that is known to the applicant to exist on the property and details and location of any Aboriginal object (within the meaning of the National Parks and Wildlife Act 1974) or Aboriginal place (within the meaning of that Act) that is known to the applicant to be situated on the property.

Identification of any significant environmental features may include the following:

- Riparian corridors
- SEPP 14 – Costal Wetlands
- SEPP 26 Littoral Rainforest
- SEPP 44 – Koala Habitat
- Areas of geological interest
- Environmental protection zone or steep lands (>18°)
- Land slip or flood prone areas
- National parks estate or various other reserves

Details of threatened species, populations, endangered ecological communities and critical habitat known to the applicant may include the following:

- Details of some threatened species can be found online (www.environment.nsw.gov.au)
- Past studies or surveys for the area (e.g. local environment studies)
- Documentation supplied to council in relation to flora and fauna

Details of Aboriginal heritage know to the applicant

- Past surveys and information held by the DEC (application fees may apply).

1.4 Aim & Objectives

1.4.1 Aim and Objectives of PBP 2019

All development on BFPL must satisfy the aim and objectives of Planning for Bush Fire Protection (PBP 2019). This report demonstrates how the requirements can be met by ensuring suitable Bushfire Protection Measures (BPM) are put in place commensurate with the level of risk and characteristics of the occupants.

The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.

The objectives are to:

- Afford buildings and their occupants protection from exposure to a bush fire.
- Provide for a defendable space to be located around buildings.
- Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings.
- Ensure that appropriate operational access and egress for emergency service personnel and occupants is available.
- Provide for ongoing management and maintenance of BPMs; and
- Ensure that utility services are adequate to meet the needs of firefighters.

1.4.2 Specific Objectives – Subdivisions (s.5 PBP)

- Minimise perimeters of the subdivision exposed to the bushfire hazard (hourglass shapes, which maximise perimeters and create bottlenecks should be avoided).
- Minimise vegetation corridors that permit the passage of bushfire towards buildings.
- Provide for the siting of future dwellings away from ridge-tops and steep slopes, within saddles and narrow ridge crests.
- Ensure that APZs between a bushfire hazard and future dwellings are effectively designed to address the relevant bushfire attack mechanisms.
- Ensure the ongoing maintenance of APZs.
- Provide adequate access from all properties to the wider road network for residents and emergency services.
- Provide access to hazard vegetation to facilitate bushfire mitigation works and fire suppression.
- Ensure the provision of an adequate supply of water and other services to facilitate effective firefighting.

2 BUSHFIRE RISK ASSESSMENT

This Bushfire Risk Assessment includes an analysis of the hazard, threat and subsequent risk to the development as proposed and provides recommendations that the proposal satisfies the aim and objectives of PBP 2019 by complying with the acceptable solutions or performance criteria by applying an appropriate suite of bushfire protection measures (BPM) for the development as proposed, commensurate with the level of risk and characteristics of the occupants.

The bushfire risk assessment shall incorporate provisions to ensure appropriate separation distance between building/s and the hazard can be afforded relevant to the BAL rating. The specific objectives for the proposed development shall be met by demonstrating compliance against the acceptable solutions set out in PBP. Alternatively, deviations from the acceptable solutions will be addressed by providing performance solutions to demonstrate compliance.

2.1 Methodology

2.1.1 PBP 2019

The bushfire risk assessment was undertaken pursuant to the requirements set out in s.5 – *Residential and Rural Residential Subdivisions* (PBP 2019).

2.1.2 Site Analysis

A desktop and onsite assessment were carried out pursuant to the methodology described in PBP 2019 commensurate with the proposed development type and level of risk. The following methodology was used:

- As per the acceptable solutions, the minimum distance for APZs was determined pursuant to Table A1.12.3 Appendix 1 PBP.
- The acceptable solution as per the methodology described in Appendix 1 – Site Assessment Methodology using table A1.12.6 – Determination of BAL, FFDI 80 – residential development (PBP 2019) was used to determine the BAL rating and appropriate APZ/setbacks for the proposed development.

2.1.3 Vegetation & Significant Environmental Features

The assessment and classification of the predominant vegetation types on and surrounding the subject site (out to a minimum distance of 140m from the boundaries of the property) was undertaken, using Keith (2006) vegetation classification system as described in PBP (2019) (Ref. Table 2).

2.1.4 Exotic Vegetation

Pursuant to s.A1.9 (PBP) it is recognised specific exotic vegetation types are common in the northern rivers region which require conversion to the vegetation formations in AS3959 as there is no direct comparison for this vegetation type in PBP.

Therefore a large expanse of exotic vegetation dominated by Camphor laurels with a canopy cover exceeding 70% occurs to the northeast of the subject site. However erring on the side of caution the canopy cover shall be considered as less than 70% therefore a higher level or protection shall be afforded. Therefore pursuant to Table A1.9 (PBP) the Camphor dominated site converts to the

vegetation formation in AS3959 as 'Woodland' which was used in the assessment methodology process and results table/s presented herein.

2.1.5 Remnant Vegetation

Pursuant to s.A1.11 the area west of the subject site has been assessed as remnant bushland, using the simplified approach whereby the vegetated area presents as a size no greater than 1ha in area which presents as a low hazard. Therefore the APZ setbacks and construction standards were assessed the same as for Rainforests using the approach under s.A1.11.1 (PBP).

2.1.6 Slope & Aspect

An assessment of the aspect and effective slope, being the land under the classified vegetation most likely to have the greatest effect on bushfire behaviour within 100m of the site was undertaken.

Slope analysis was undertaken using assessment methodology:

- A desktop assessment of 2m contours available via the Fire Protection Association (FPAA) *FireMaps NSW* platform (FPAA 2021).
- On-site ground truthing was undertaken on-site, the slope was determined using a Leopold Laser Range Finder and a comparison made to determine the effective slope of the hazard. The results presented in the assessment tables herein (Table 3).

2.1.7 Bushfire Protection Measures (BPM)

The BPMs are a set of measures to be satisfied which aim to reduce risk from bushfires and enhance occupant survival, property protection and community resilience to bushfire attack. Analysis of the BPMs shall be undertaken commensurate to the level of risk to occupants and the subject site. Recommendations provided are based on the results. BPMs to be satisfied include the following:

- APZ
- Access
- Construction
- Siting and design
- Landscaping
- Services
- Emergency and evacuation planning

3 ANALYSIS & RESULTS

The following sections describe in detail, the vegetation type, slope, access, availability of water supplies and environmental considerations for the subject site and surrounds.

3.1 Site Inspection Details

An assessment of the subject site was undertaken by Melanie Jackson (BPAD-Level 3 Accredited Practitioner No. 21977) on 31 May 2018 (Ref. Figure 3; Table 2).

Table 2: Vegetation Analysis

Vegetation Formation, Direction/Plot & Description	Photos
Managed Land – North, East & South The subject site is situated adjacent to residential lots, classified as 'Managed Land'. It is noted that number 29 Greenwood Drive is also being prepared for sub-division. There are a number of fruit and nut trees near the north and eastern portion of the lot which are likely to be removed as part of the development. The land in these areas in general presents as a low bushfire threat to the subject site and BLE.	 Photo 1: Managed residential land (east) Photo 2: Managed residential duplex lot between to the subject site and hazard (northeast)

Vegetation Formation, Direction/Plot & Description	Photos
Woodland formation (Camphor laurel dominated exotic vegetation) – Northeast The area north-east of the subject site consists of managed lots up to the rear boundaries of lots along Greenwood Drive (north and east of the subject site). The remaining large tract of land is mapped in Lismore Council Vegetation Mapping as forest vegetation. However ground truthing of the area reveals limited eucalypts in the area and exotic vegetation predominantly Camphor laurels dominating the landscape. Despite the areas canopy cover exceeding 70%, a more conservative approach was adopted, pursuant to the exotic vegetation conversion Table A1.9 (PBP), the vegetation formation of 'Woodland' for vegetation with a canopy cover of less than 70%.	 Photo 3: Camphor dominated hazard northeast
Rainforest formation (Remnant) – West The land to the west consists of a stand of Eucalypt spp. with a predominantly cleared understorey, managed in a low fuel state upslope from the subject site. The vegetated area being less than 1ha in size. Pursuant to s.A1.11.1 of PBP *'The simplified approach provides an acceptable method for assessing remnant vegetation. Remnant vegetation is a parcel of vegetation with a size of less than 1 Ha or a shape that provides a potential fire run that could threaten buildings not exceeding 50m. These remnants are considered a low hazard and APZ setbacks and building construction standards for these may be the same as for rainforests.'*	 Photo 4: Remnant 'Rainforest formation' west
Rainforest formation (remnant) – Northwest A 7m wide Koala movement corridor and V-drainage area for overland flow/diversion runoff is proposed. This area shall be planted with small rainforest shrubs suitable to assist Koala movement between the main hazard land, i.e. northeast to west. The corridor is classified as a Rainforest (remnant).	

Figure 3: Survey area, hazard analysis (Source: FireMaps 2021; Nearmaps 2021)

3.2 Bushfire Protection Measures (BPM)

The BPMs, namely APZ, access, construction, siting and design, landscaping, services and emergency and evacuation planning, are the relevant set of specifications and requirements to be satisfied to improve life safety, property protection and community resilience to bushfire attack.

3.2.1 APZ & Landscaping

APZs shall comply with the acceptable solutions whereby siting of future buildings for each lot shall be able to accommodate minimum APZ distances ensuring radiant heat exposure limits are unlikely to exceed 29kW/m^2 and potential flame contact is negated pursuant to the acceptable solutions, namely assessed against Table A1.12.3 (PBP).

Adequate APZs and landscaping shall be imposed on the development with covenants put in place to ensure ongoing management as an APZ to be maintained in perpetuity within the bounds of each proposed lot (excluding the existing dwelling on Lot 3) pursuant to '*Appendix 4 – Asset Protection Zone Requirements*' (PBP; Ref. Appendix B) in addition to the requirements set out in the NSW RFS document '*Standards for Asset Protection Zone Standards*' (RFS 2005; herein).

In relation to Lot 1, as the dwelling is an infill site, the APZ shall be managed however the setback cannot be increased from the hazard to the west. Therefore the existing structure shall be upgraded to comply with BAL-19 to enhance and improve the existing scenario in relation to bushfire by reducing the potential for embers to enter the dwelling.

A number of trees have been identified for retention within Lot 8, 9 and 11, with additional trees to be planted along the public reserve including the road reserve (Ref. Figure 4: Hydrant (yellow triangle) and tree (tree retention and offset planting) layout plan).

3.2.2 Likely Environmental Impacts

The scope of this report does not include an environmental assessment of the mature and regrowth vegetation required to be removed for bushfire management purposes and therefore this report should be read in conjunction with the Statement of Environmental Effects (SEE) and the supporting ecological assessment report/s being submitted in support of the subdivision application.

3.2.3 Existing Dwelling – Better Bushfire Outcome

The existing dwelling on proposed Lot 3 was constructed prior to 2002 and does not appear to have BPMs incorporated into the design. It is recommended to upgrade the existing structure to achieve BAL-19, the additional provision for BPMs such as new road, hydrants in addition to the upgrades shall provide a better bushfire outcome for the property than currently exists (Ref. Recommendations herein).

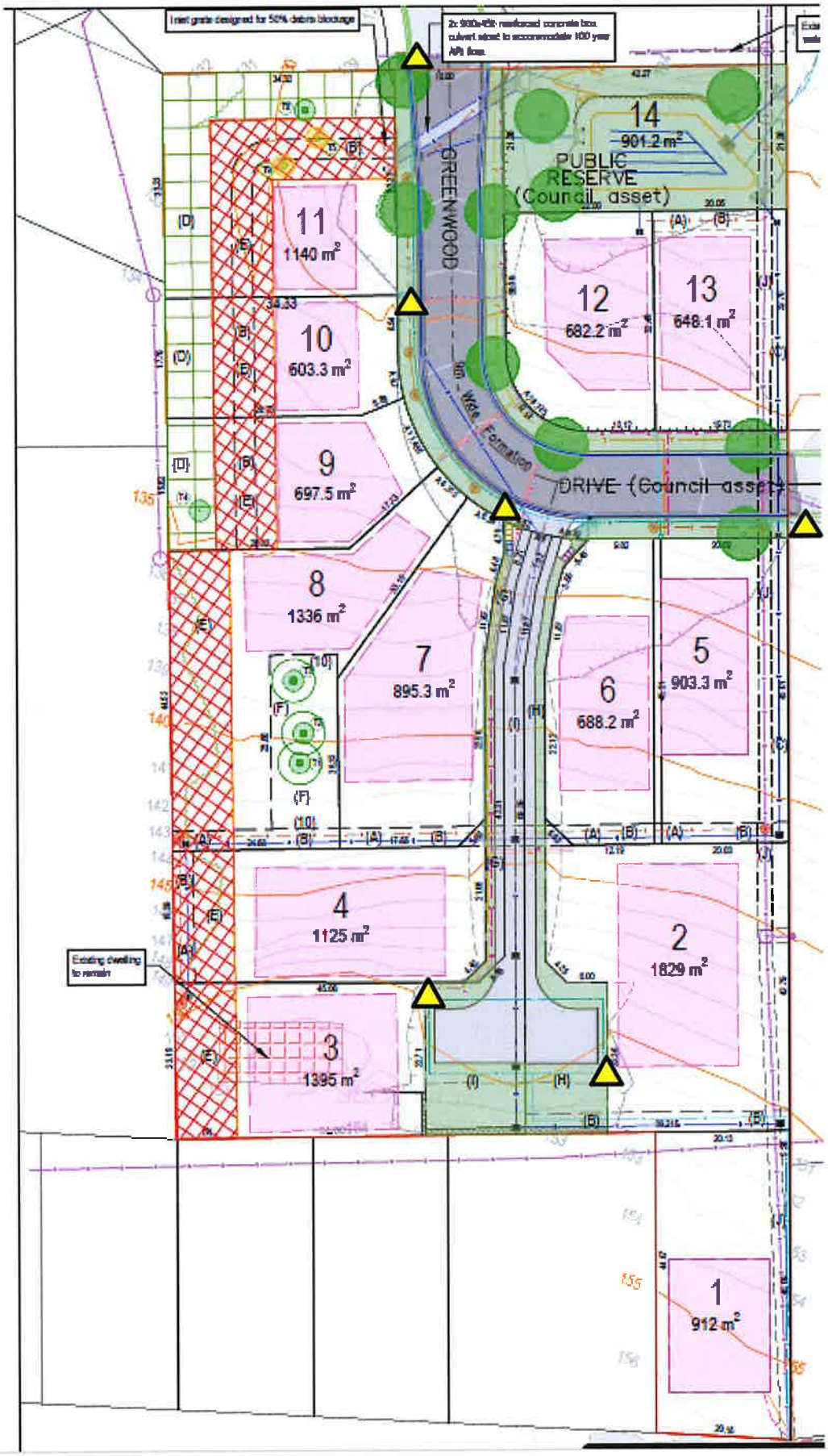


Figure 4: Hydrant (yellow triangle) and tree (tree retention and offset planting) layout plan

3.2.4 Water Supplies for Fire Fighting Purposes

The subject site is situated in a reticulated water supply area and an extension to the existing water supply system including hydrant location and spacing shall be upgrade pursuant to the acceptable solutions presented herein. It is noted hydrants are to be located no greater than 60m from each BLE.

3.2.5 Electricity & Gas Services

Mains gas (natural gas) is not available in this locality. An existing electricity supply services the area, thus requiring an extension as part of the development approval process, whereby underground power shall be installed pursuant to the acceptable solutions presented in Figure 4: Hydrant (yellow triangle) and tree (tree retention and offset planting)Table 5 herein.

3.2.6 Construction Requirements

The BAL rating/s shall comply with the acceptable solutions as per Table A.1.12.3 (PBP) for BAL-29 or lower meeting the acceptable solutions with exception of lot there whereby the current dwelling requires upgrading to meet BAL-19 (or higher; Ref. recommendations herein).

3.2.7 Access – Performance Solution

Suitable access shall be provided pursuant to the solution meeting the following performance criteria:

> *'Firefighting vehicles are provided with safe, all-weather access to structures'*; &
>
> *'Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating'*.

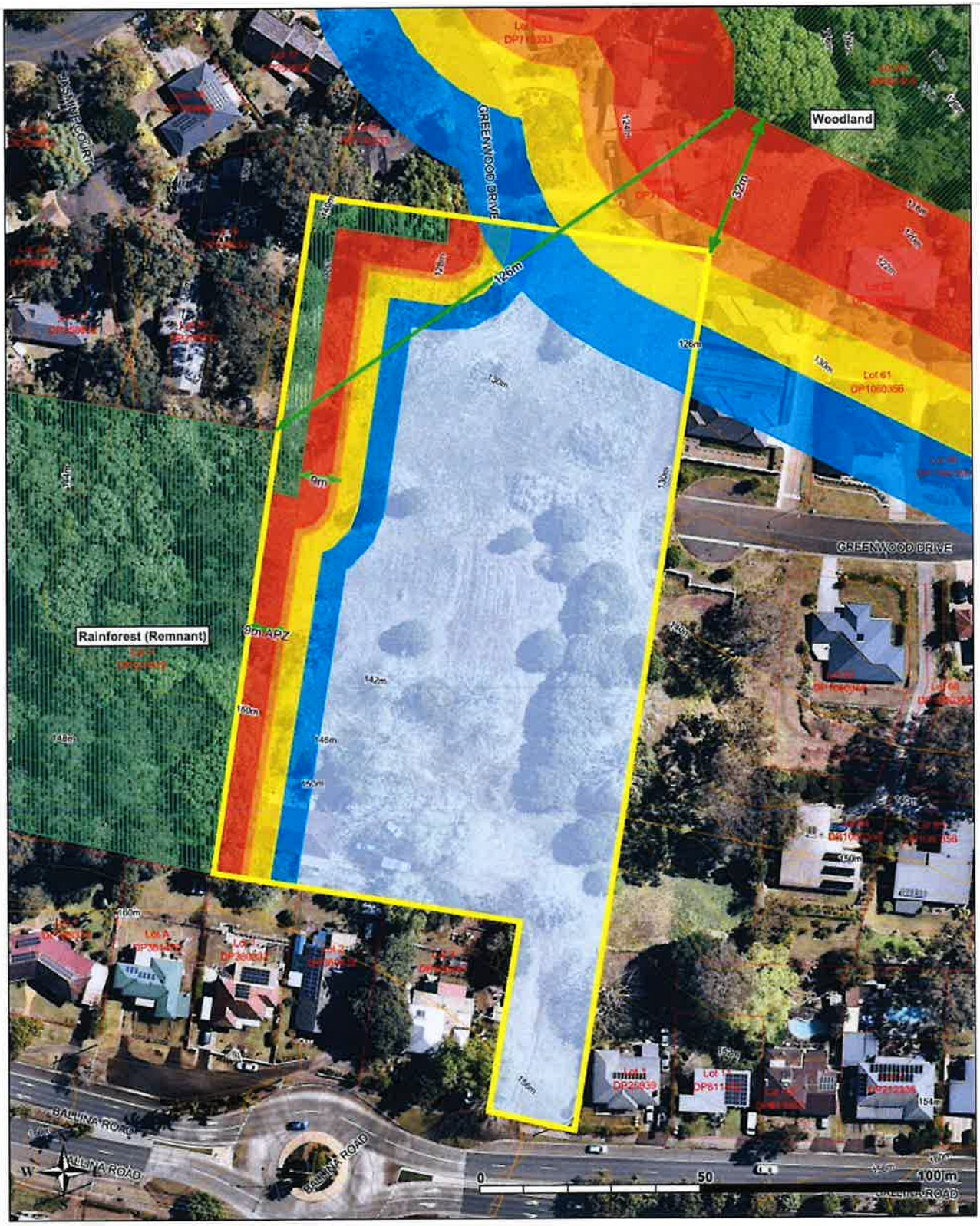
A performance solution is presented in relation to access requirements because the proposed property access presented deviates from the acceptable solutions. Therefore the performance solution is summarised in the Bushfire Design Brief (BFDB) presented herein (Ref. s.4) which demonstrating how the performance criteria (therefore compliance) shall be met.

3.3 Summary of Results – APZ & BAL Rating

A summary of the findings of the on-site bushfire risk assessment is presented in the following table/s of results (Ref. Table 3; Figure 3 & Table 3).

Table 3: Table of Results – APZ & BAL Rating

Vegetation/Hazard Analysis				Analysis – min. APZ (m)		BAL Results
Direction/Plot	**Veg Formation/Class**	**Hazard Slope (°)**	**Distance (m)**	**Table A1.12.3 (PBP)**	**Table 2.5 (AS3959)**	**Highest BAL**
Northeast	Woodland (exotic veg)	15-20 down	≥32	-	35	BAL-29
West	Rainforest (Remnant)	0 level/upslope	≥9	9	-	BAL-29
North, South & East	Managed land	-	-	-	-	-
Northwest	Rainforest (Remnant)	0 level/upslope	≥9	9	-	BAL-29



Legend

Dimensions BAL map
Distance

Property boundary
Lot Boundary

140m survey
140m survey area

Veg
Rainforest

BAL3
B, Woodland

BAL Analysis - Woodland (AS3959)
BAL-19
BAL-29
BAL-40
BAL-FZ

BAL Analysis - Remnant (PBP)
BAL-12.5
BAL-19
BAL-29
BAL-40
BAL-FZ

Lot Boundary

Roads

Large Scale Contours (2m)

Medium Scale Contours (10m)

Map Printed from FireMaps on Mon Oct 11 17:36:30 AEDT 2021

Figure 5: APZ & BAL analysis (Source: FireMaps 2021; Nearmap 2021)

4 BUSHFIRE DESIGN BRIEF – PROPERTY ACCESS

4.1 Non-perimeter Road

The existing road network is via Greenwood Drive which is a public access road which is currently dissected via the subject site whereby the road network does not currently traverse through the subject site. The performance solution is required because a perimeter road shall not be applied to this development due to existing site constraints.

It is noted the subject site is situated within an NSW Rural Fire Brigade area whereby Lismore Brigade is in possession of a Scania Heavy Type 3 Pumper Vehicle being larger than Category 1 fire fighting tankers. The full width of the Scania being 3m wide mirror to mirror. It is therefore deemed prudent to ensure suitable trafficable width for both NSW Fire Brigade and RFS vehicle clearances.

The proposed development therefore presents the performance approach, by connecting two (currently separated) sections of Greenwood Drive, ensuring a 9m wide trafficable road, connecting the east and north sections of Greenwood Drive. The 9m road width proposed exceeds the 8m wide carriageway width as an acceptable solution in Table 5.3b (PBP) for Perimeter Roads by 1m. carriageway. Curves, parking, cross fall and clearances shall comply with the requirements set out in Table 5.3b (PBP) for perimeter roads.

4.1.1 Lots 5 – 13 – Access

Koala/traffic calming measures shall be engineered so as not to impede movement of emergency service vehicles and residents evacuation in opposite directions specifically in relation to Lots 5 to 13, whereby short driveways shall be constructed directly onto the linked Greenwood Drive Road.

4.1.2 Lots 2, 3 & 4 – Access

Access from Greenwood Drive to lots 2, 3 and 4, consists of an 8m wide, sealed '*Right of Carriageway*', designed with a turning head pursuant to the acceptable solution as per Table 5.3b '*Property Access*' (PBP) which states:

> *'A development comprising **more than three** dwellings has access by dedication of a road and not by right of way'.*

It is noted Lots 2, 3 and 4, comply with the acceptable solution, whereby these three (3) dwellings not exceeding three lots. Each lot shall have a short standard driveway within each lot egressing to the shared roadway as per the engineering plans provided herein (Ref. Appendix A).

The '*Right of Carriageway*' formation shall consist of the following:

- Fire hydrants are less than 90m from a dwelling, kept clear of parking areas.
- No parking signage shall be installed.
- Min. 6m wide sealed carriageway.
- A 'Type B' turning head as per s.A3.3 PBP, shall be installed.
- Where applicable, mountable kerbs suitable for vehicular use shall be provided incorporating min. 6m inner and 12m outer radius on curves.

- The combined road and footpath is to be engineered to carry firefighting vehicles (both RFS and NSW Fire) up to 23 tonnes.

4.1.3 Lot 1 – Access

Finally Lot 1 shall be made accessible via a single driveway traversing directly off Ballina Road, which shall be situated within close proximity (less than 70m) of a fire hydrant.

4.2 Compliance

As a result, the proposed sealed, two-way, two-wheel drive access roads (public and private) with formed turning head and curves, crossfall etc. shall be equal to or exceed the acceptable solutions for non-perimeter roads as set out in Table 5.3.b PBP therefore the solution ensures adequate capacity for fully loaded fire vehicles (RFS and NSW Fire). No parking signs shall be erected along the Right of Carriageway.

Both new roads, namely, Greenwood Drive shall be dedicated to Council for ongoing maintenance upon completion provide an appropriate solution complying with the criteria as presented in Table 4 below. A full set of engineering plans has been provided in support of the DA and shall be read in conjunction with this report (Ref. Appendix A).

In conclusion the performance criterion specifically '*Firefighting vehicles are provided with safe, all-weather access to structures*' shall be met whereby adequate hardstand shall be provided within the roads allowing adequate width for traffic to pass and '*Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating*' thus the deviations from the acceptable solutions.

Table 4: Performance solutions

BPM	Performance Criteria	Acceptable Solution that Cannot be Met	Response Summary
Access (General Requirements)	Firefighting vehicles are provided with safe, all-weather access to structures.	• Perimeter roads are provided for residential subdivisions of three or more allotments. • Subdivisions of three or more allotments have more than one access in and out of the development. • All roads are through roads. • Dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a	• Perimeter roads are not proposed as they are not practical, however the following solution/s comply with the performance criteria. • The proposed extension of Greenwood Drive shall provide a connected road providing a through road and two access/egress options for occupants evacuating the site and for NSW RFS and Fire Brigade firefighting vehicles to access the structures. • Access designed and engineered to accommodate both rural fire and town fire brigade vehicles including a Scania type 3 heavy pumper located at Lismore NSW Fire Brigade (none at Goonellabah). • Lots 2 – 13 have two way access/egress via Greenwood Drive (north or east) with a proposed 9m wide carriageway width. • Lots 2, 3 & 4 have a min. sealed, 6m wide 'Right of Carriageway' traversing to Greenwood Drive. • A turning head shall be provided suitable for all Fire Fighting Vehicles to safely manoeuvre and access the structures. Accommodating suitable

		minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end. • Traffic management devices are constructed to not prohibit access by emergency services vehicles.	turning radii as per the acceptable solutions i.e. min. 12 outer and 6m inner curves. • The road provides access and egress in two directions on Greenwood Drive. • Clear signage shall be provided for the private road to lots 2 – 4 i.e. as a private dead end road and parking shall not be allowed along the road or within the turning area. • No parking signage shall be erected on the private road. • Greenwood Drive has traffic calming measures proposed for Koalas protection however the proposal includes painted signage on the road surface and signage thus negating pinch points and/or hinder traffic movement for emergency vehicles and occupants are evacuation in opposite directions. • Greenwood drive meets the acceptable solution for road widths as stated for perimeter roads. • Parking signage and hydrant locations shall not be compromised as a result of the proposal. • Hydrant locations depicted on the engineering plans provided in support of the DA. • Lot 1 shall be accessible to evacuate the site via a short driveway onto Ballina Road.
Non-perimeter Roads	Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	• Minimum 5.5m carriageway width kerb to kerb.	• The proposed modification to Greenwood Drive proposes a trafficable width of 9m and the private road (Right of Carriageway) shall be sealed and min. 6m wide. The design ensures provision for ensuring access/egress which exceeds the minimum requirements for non-perimeter road which states min. a 5.5m wide carriageway is satisfactory. However as the road consists of a dead end road, he design incorporates additional road width as an additional level of redundancy. • A legally binding easement over the 'Right of Carriageway' shall be provided i.e. s.88b instrument. • Access and egress is suitable for both Category 1 fire fighting vehicles and heavy type 3 pumpers with a width of up to 3m for large vehicles to pass in opposite directions, allowing occupants to evacuate during emergency events.

4.3 Discussion

It is understood that the suite of BPMs in combination which include, provision for water supplies, electricity and gas services, APZ and construction level (BAL-29 or lower) in accordance with the acceptable solutions. The combination of acceptable and performance solution/s (access) are acceptable for the level of risk and egress opportunities into the surrounding residential locality.

The extension and connection of both sections of Greenwood Drive provides the perfect opportunity to improve access and egress for the neighbouring properties therefore this sub-division as proposed provides a significant improvement to the existing situation for neighbouring lots by opening up alternate access/egress opportunities during adverse bushfire episodes.

4.4 Conclusion

Provided the recommendations herein are applied, including construction of the road as per the supporting engineered designs and site plan, including ongoing management of the roads proposed to be handed over to Council upon completion, it is in my professional opinion the proposed performance solution for property access presented herein, satisfies the objectives, performance criteria and the intent of measures as per s.5.3.2 (PBP).

5 RECOMMENDATIONS & COMPLIANCE

The following table/s indicate the extent to which the proposed development conforms with or deviates from the standards, specific objectives, performance criteria and acceptable solutions set out in *s.5 – Residential and Rural Residential Subdivisions* (PBP).

The results and recommendations herein are commensurate with the level of bushfire risk and characteristics of the occupants for the proposed development, by applying the suite of BPM in combination, being the site specific requirements that must be satisfied in order to comply. The table below specifies the method used to demonstrate compliance i.e. acceptable solution or performance based solution, against the BPMs and provides recommendations to ensure the intent of each BPM shall be met (Ref. Table 5).

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
The intent may be achieved where:			
s.5.3.1 APZ – Intent of measures: To provide sufficient space and maintain reduced fuel loads to ensure radiant heat levels at the buildings are below critical limits and prevent direct flame contact.			

APZ	• Potential building footprints must not be exposed to radiant heat levels exceeding 29kW/m² on each proposed lot.	• APZs are provided in accordance with Tables A1.12.2 or A1.12.3 based on the FFDI.	Complies with the acceptable solution.
			• The proposed lots are able to accommodate APZs onsite pursuant to the min. distances set out in table A1.12.3 (PBP) commensurate with BAL-29 construction level (or lower) (with exception of the existing dwelling on lot 3 which as an infill dwelling shall be provided with additional construction requirements to improve the existing structure for ember protection).
			• A defendable space will be provided for all proposed lots consisting of the following:
			  • A min. 1m wide pedestrian access shall travers the perimeter of the building location envelope (within the APZ);
			  • The area shall remain free of fuel and obstacles to ensure a cleared pedestrian access around the entire perimeter of the dwelling is maintained at all times.
			Existing dwelling (proposed lot 3):
			• The existing dwelling on Lot 3 shall be upgraded for ember protection to BAL-19 as the APZ adjacent to the existing dwelling cannot be extended beyond the boundary to the west.
			• Upgrades shall be undertaken pursuant to BAL-19 construction level as set out in s.3 - construction general

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
			and s.6 - Construction requirements for BAL-19 of AS3959-2018 in addition to the NSW Variations which shall be applied (Ref. Recommendations for construction below). Notes: 1. The public reserve (Lot 14) is a proposed stormwater detention basin constructed from concrete and rocks, this area should only be planted (where required) with minimal vegetation, i.e. reeds and rushes, maintained as a low fuel zone in perpetuity. 2. An offsite APZ/easement nominating the low fuel landscaping requirements and management regime over Lot 14 (a reserve lot) is required under a s.88b instrument and a Bushfire Management Plan shall be created to ensure suitable management of the reserves is undertaken in perpetuity. 3. A Bushfire Management Plan shall be prepared for the entire site to address the issues in relation to fuel management requirements for public reserves, roads, Koala corridors, APZ, landscaping, fencing requirements and BAL rating etc. as a restriction on title for the lots/site.
APZ	• APZs are managed and maintained to prevent the spread of a fire towards a building.	• APZs are managed in accordance with the requirements of Appendix 4 (PBP).	Comply with the acceptable solutions with exception of three Eucalypt species identified tree no. 1, 2 & 3 in the engineering plans (Ref. Appendix A) sited in Lot 8 (Tree 1, 2 & 3) and Lot 9 (tree 4 in Koala Corridor) and Lot 11 (tree 6 in Koala Corridor). Being retained as they are recognised as Koala food trees. These trees shall be exempt from requiring individual canopy separation (i.e. 2 to 5m spacing between individual canopies)

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
			but shall be considered equivalent to one tree canopy as they mature. In addition, trees 1, 2, 3, 4 and 6 shall be pruned so as not to overhang the building, however, it is acknowledged upon maturity minor overhang by branch tips is deemed acceptable.
APZ	• The APZ is provided in perpetuity.	• APZs are wholly within the boundaries of the development site.	Complies with the acceptable solution with exception of the following: • The existing dwelling on lot 3 shall be upgraded for ember protection and the APZ cannot be met within the existing boundary; and The following provisions shall be provided therefore to ensure compliance against the performance criteria in relation to Lot 14: • The offsite detention basin shall be managed in a low fuel state in perpetuity. • A s.88b instrument shall be provided to ensure vegetation management is undertaken in a low fuel manner in perpetuity and placed on title. • A Bushfire Management Plan (BPM) shall be prepared for the entire subject site. • The BPM shall address issues in relation to fuel management requirements including private lots and public reserves, Koala corridors, APZ, landscaping requirements, fences and BAL rating etc. placed as a restriction on title for those lots affected.

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
APZ	• APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	• APZ are located on lands with a slope less than 18 degrees.	Complies with the acceptable solutions.
Landscaping	• Landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions.	• Landscaping is in accordance with Appendix 4 (PBP); & • Fencing is constructed in accordance with section 7.6.	Comply with the acceptable solutions and the following: • Landscaping is to be managed in accordance with Appendix 4 (PBP) and where required fences shall be constructed as follows: • Where installed fences shall be non-combustible.
Construction Standards	• The proposed building can withstand bush fire attack in the form of embers, radiant heat, and flame contact.	• BAL is determined in accordance with Tables A1.12.5 to A1.12.7; and • Construction provided in accordance with the NCC and as modified by section 7.5 (please see advice on construction in the flame zone).	Comply with the acceptable solutions and the NSW variations to AS3959 as follows: The following recommended BAL ratings shall be met: The Existing dwelling on Lot 3 shall be upgraded to meet BAL-19 construction requirements as set out in s.3 - construction general and s.6 - Construction requirements for BAL-19 of AS3959-2018; Lots 4, 8, 9, 10, 11, 12 & 13 shall be constructed to BAL-29 as set out in s.3 - construction general and s.7 - Construction requirements for BAL-29 of AS3959-2018. Lot 7, should be constructed to BAL-19 as set out in s.3 - construction general and s.6 - Construction requirements for BAL-19 of AS3959-2018 and NSW Variations to be applied as per s.7.5.2 PBP 2019. Lots 1, 2, 5 & 6 shall be constructed to BAL-12.5 as set out

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**

			in s.3 - construction general and s.5 - Construction requirements for BAL-12.5 of AS3959-2018; and
			
			NSW Variations shall be applied (Ref. s.7.5.2 PBP 2019).
			
			The following NSW variations for construction must be applied:
			• Clause 3.10 of AS3959 is deleted and any sarking used for BAL-12.5, BAL-19, BAL-29 or BAL-40 shall:
			  • Be non-combustible; or
			  • Comply with AS/NZS 4200.1, be installed on the outside of the frame, and have a flammability index of not more than 5 as determined by AS1530.2; and
			• Clause 5.2 ad 6.2 of AS3959 is replaced by Clause 7.2 of AS3959, except that any wall enclosing the subfloor space need only comply with the wall requirements for the respective BAL; and
			• Clause 5.7 and 6.7 of AS3959 is replaced by clause 7.7 of AS3959, except that any wall enclosing the subfloor space need only comply with the wall requirements for the respective BAL.
			
			Gutters:
			• Roofs shall be gutterless or have leafless guttering and valleys to prevent the build-up of flammable material; and
			• Any materials or devices used to stop leaves collecting in the gutters shall have a flammability index of not greater than 5 when tested in accordance with AS1530.2.

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
Water Supplies	• Adequate water supplies are provided for firefighting purposes.	• Reticulated water is to be provided to the development where available. • A static water and hydrant supply are provided for non-reticulated developments or where reticulated water supply cannot be guaranteed. & • Static water supplies shall comply with Table 5.3d.	Comply with the acceptable solution for reticulated water provisions. • Hydrant locations as presented on the site plans herein are positioned no greater than 60m from each BLE (Appendix A). • Noting there are two hydrants located on opposite sides of the turning head at the end of the 'Right of Carriageway'.
s.5.3.2 Access – Intent of measures: To provide safe operational access to structures and water supply for emergency services, while residents are seeking to evacuate from an area.			
Access (General Requirements)	• Firefighting vehicles are provided with safe, all-weather access to structures.	• Property access roads are two-wheel drive, all- weather roads. • Perimeter roads are provided for residential subdivisions of three or more allotments. • Subdivisions of three or more allotments have more than one access in and out of the development. • Traffic management devices are constructed to not prohibit access by emergency services vehicles.	• The existing public access roads are adequate. • Compliance is achieved by meeting the acceptable solutions and performance criteria as discussed in the BFDB presented herein (Ref. s.4). • Roads shall be constructed pursuant to the site plans provided in the engineering plans provided in support of the DA.

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
		• Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient. • All roads are through roads. • Dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end. • Where access/egress can only be achieved through forest, woodland and heath vegetation, secondary access shall be provided to an alternate point on the existing public road system; and • One way only public access roads are no less than 3.5metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.	

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
Access (General Requirements)	• The capacity of access roads is adequate for firefighting vehicles.	• The capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges and causeways are to clearly indicate load rating.	Comply with the acceptable solutions.
Access (General Requirements)	• There is appropriate access to water supply.	• Hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression. • Hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005 – *Fire hydrant installations System design, installation and commissioning*; and • There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.	Comply with the acceptable solutions.
Non-perimeter Roads	• Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	• Minimum 5.5m carriageway width kerb to kerb. • Parking is provided outside of the carriageway width.	Complies with the performance criteria whereby the performance solution presented in the BFDB (s.4 herein) provide a satisfactory solution. Compliance shall be met pursuant to the site plans and supporting engineering plans provided in support of the DA. • Greenwood Drive shall:

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
		• Hydrants are located clear of parking areas. • Roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m. • Curves of roads have a minimum inner radius of 6m. • The road crossfall does not exceed 3 degrees. & • A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	• Be constructed with a 9m wide carriageway; • Parking shall be provided outside of the carriageway; • Hydrants shall be located clear of parking areas; • The 'Right of Carriageway' shall: • Be constructed with a min. 6m wide carriageway; • Have a turning head installed consistent with the multipoint options in Appendix 3 (PBP); • Exclude parking; • No Parking signage shall be erected. • All Trafficable surfaces shall be sufficient to carry up to 23 tonnes. • Curves shall consist of a minimum 12m outer and 6m inner radius. • The road crossfall does not exceed 3 degrees; and • A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.
Property Access	• Firefighting vehicles can access the dwelling and exit the property safely.	• There are no specific access requirements in an urban area where an unobstructed path (no greater than 70m) is provided between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that	Complies with the acceptable solution. • A short driveway shall suffice to all proposed lots.

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
		supports the operational use of emergency firefighting vehicles. In circumstances where this cannot occur, the following requirements apply: • Minimum 4m carriageway width. • In forest, woodland and heath situations, rural property roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m, at the passing bay. • A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches. • Provide a suitable turning area in accordance with Appendix 3. • Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress. • The minimum distance between inner and outer curves is 6m. • The crossfall is not more than 10 degrees. • Maximum grades for sealed roads do not exceed 15 degrees and not	

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
		more than 10 degrees for unsealed roads; and • A development comprising more than three dwellings has formalised access by dedication of a road and not by right of way. Note: Some short constrictions in the access may be accepted where they are not less than 3.5m wide, extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. The gradients applicable to public roads also apply to community style development property access roads in addition to the above.	
s.5.3.3 Services – Water, Electricity and Gas – Intent of Measures: To provide adequate services of water for the protection of buildings during and after the passage of a bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.			
Water Supplies	• Adequate water supplies are provided for firefighting purposes.	• Reticulated water is to be provided to the development where available. • A static water and hydrant supply are provided for non-reticulated developments or where reticulated water supply cannot be guaranteed. & • Static water supplies shall comply with Table 5.3d.	Comply with the acceptable solution for reticulated water provisions. • Hydrants shall be installed as per Australian Standard AS 2419.1:2005, ensuring coverage to all lots.

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
Water Supplies	• Water supplies are located at regular intervals; and • The water supply is accessible and reliable for firefighting operations.	• Fire hydrant, spacing, design and sizing complies with the relevant clauses of Australian Standard AS 2419.1:2005. • Hydrants are not located within any road carriageway; and • Reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads.	Comply with the acceptable solutions. • Hydrants shall be located outside any road carriageway, as depicted on the engineering plans provided in support of the DA. • Hydrants shall be positioned no greater than 60m from each BLE. • Two hydrants shall be located on opposing sides of the turning head of the 'Right of Carriageway'.
Water Supplies	• Flows and pressure are appropriate.	• Fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005.	Comply with the acceptable solution.
Water Supplies	• The integrity of the water supply is maintained.	• All above-ground water service pipes are metal, including and up to any taps. & • Above-ground water storage tanks shall be of concrete or metal.	Comply with the acceptable solution.
Electricity Services	Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.	• Where practicable, electrical transmission lines are underground; and • Where overhead, electrical transmission lines are proposed as follows: • Lines are installed with short pole spacing of 30m, unless crossing	Comply with the acceptable solution, whereby underground power supplies are proposed.

Table 5: Compliance Tables; Re: *s.5 – Residential and Rural Residential Subdivisions* (PBP)			
BPM	**Performance Criteria**	**Acceptable Solutions**	**Compliance & Recommendations**
		gullies, gorges or riparian areas; and • No part of a tree is closer to a power line than the distance set out in ISSC3 *Guideline for Managing Vegetation Near Power Lines*.	
Gas Services	Location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	• Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 - *The storage and handling of LP Gas*, the requirements of relevant authorities, and metal piping is used. • All fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side. • Connections to and from gas cylinders are metal. • Polymer-sheathed flexible gas supply lines are not used; and • Above-ground gas service pipes are metal, including and up to any outlets.	Comply with the acceptable solutions where installed.

6 CONCLUSION

The combination of BPM's and recommendations contained within this document, aim to reduce the impacts of a bushfire attack to the occupants, firefighters, building/s and environment. With the aim to reduce consequences of ember attack and direct flame contact with building/s able to be constructed within the proposed BLE. Acceptable and performance solutions (where applicable) in relation the bushfire protection measures in combination were used to demonstrate compliance against the performance criteria of PBP.

This report makes the determination through a detailed Bushfire Risk Assessment that the proposed development does not appear to negatively affect the indicative BLE, situated in an area where radiant heat levels are unlikely to exceed critical limits (29kW/m^2). The results of which are based on the proviso the recommended APZ distances and ongoing maintenance in perpetuity is undertaken.

As a qualified consultant in Bushfire Risk Assessment as recognised by the NSW Rural Fire Service, this report has considered all elements of bushfire attack and BPMs in combination. Provided the development proposal is carried out in accordance with the recommendations contained herein, the development, in my professional opinion, shall satisfy the objectives and performance criteria of PBP (2019).

The proposed development formerly received a BFSA from the NSW RFS under s.100B of the RF Act. However via the process of the Land and Environment Court, it is concluded that the proposed development complies with the requirements of PBP (2019) for integrated development and aims to provide the information to Council to demonstrate compliance in order to obtain final approval for the modified development proposal as presented herein.

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Standards Australia, 2009, AS 3959–2018 *Construction of Buildings in Bushfire Prone Areas*, Sydney, Standards Australia International Ltd.

APPENDIX A – SITE PLANS

Plans by: Issue no. 5; RCS Group; Date: 17/03/22.

All site/engineering plans shall be provided by the applicant in support of the DA. The site and engineering plans presented indicate areas of compliance as discussed herein including minimum building setbacks, building location envelopes, hydrant locations, road design, etc. in relation to this development as proposed and the recommendations contained herein.

Development Application - Engineering Design Plans

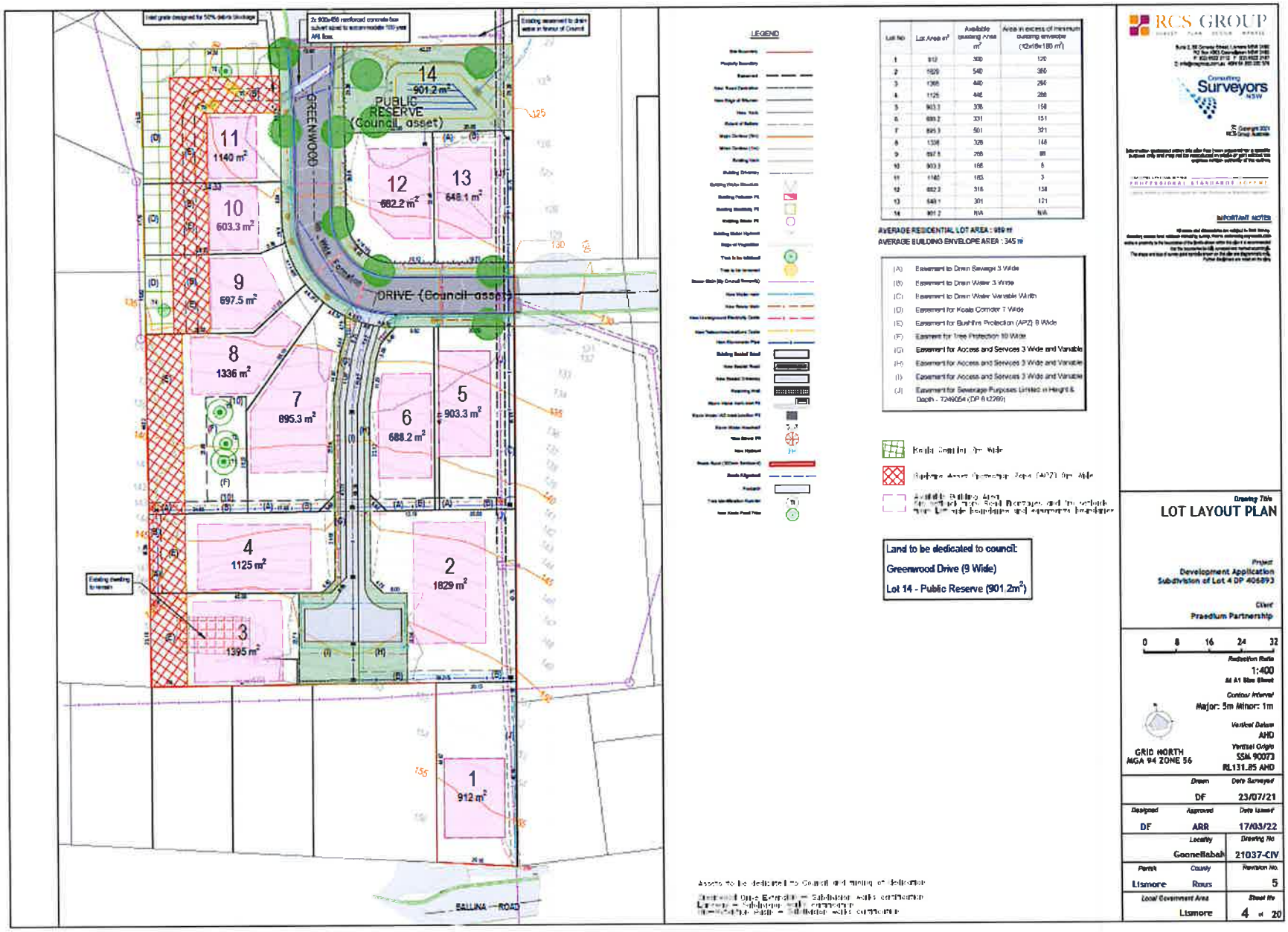
658 Ballina Road, Goonellabah , NSW
Subdivision of Lot 4 in DP406893

File Ref: 21037-26.dwg

Title	Sheet No.	Rev No.
Title Page	1	5
Site Layout Existing - Overview	2	5
Site Layout Proposed - Overview	3	5
Lot Layout	4	5
Greenwood Drive Layout	5	5
Greenwood Drive Longitudinal Section	6	5
Greenwood Drive Cross Sections	7 - 9	5
Shared Driveway Layout (Lots 2, 3 & 4)	10	5
Shared Driveway Longitudinal Section	11	5
Shared Driveway Cross Sections	12 - 13	5
Electricity and Telecom Layout Plan	14	5
Sewer and Water Reticulation Layout Plan	15	5
Stormwater Drainage Layout Plan	16	5
Stormwater Basin Layout	17	5
Stormwater Basin Sections	18	5
Asset Protection Zone Sections	19	5
Bulk Earthworks Plan	20	5

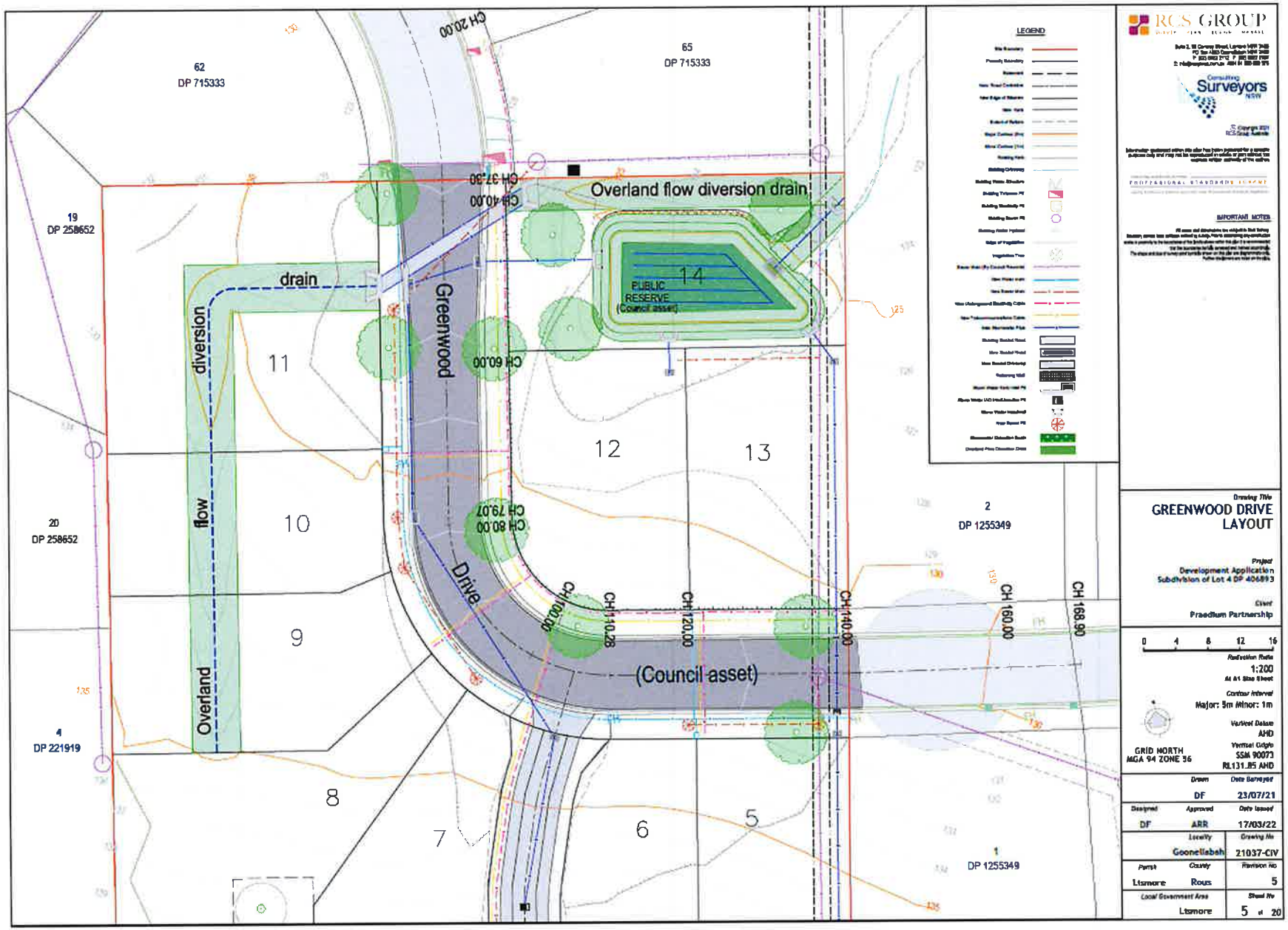
Issue #	Changes	Drawn	Approved	Date
5	Additional notation added	DF	ARR	17/03/22
4	Amended design to suit revised lot layout	DF	ARR	25/02/22
3	Further amendments to address respondents feedback	DF	ARR	5/11/21
2	Amendments to address respondents feedback	DF	ARR	28/10/21
1	Original	DF	ARR	5/10/21

RCS GROUP
SURVEY PLAN DESIGN MANAGE
Suite 2, 80 Conway Street, Lismore NSW 2480
PO Box 4053 Goonellabah NSW 2480
P: (02) 6622 2112 F: (02) 6622 2107
E: info@surveyor.com.au ABN 54 055 030 578



Lot No	Lot Area m²	Available building Area m²	Area in excess of minimum building envelope (10x18=180 m²)
1	912	300	120
2	1829	540	360
3	1395	440	260
4	1125	440	260
5	903.3	338	158
6	688.2	331	151
7	895.3	501	321
8	1336	328	148
9	697.5	265	85
10	603.3	186	6
11	1140	183	3
12	682.2	316	136
13	648.1	301	121
14	901.2	N/A	N/A

(A)	Easement to Drain Sewage 3 Wide
(B)	Easement to Drain Water 3 Wide
(C)	Easement to Drain Water Variable Width
(D)	Easement for Koala Corridor 7 Wide
(E)	Easement for Bushfire Protection (APZ) 8 Wide
(F)	Easement for Tree Protection 10 Wide
(G)	Easement for Access and Services 3 Wide and Variable
(H)	Easement for Access and Services 3 Wide and Variable
(I)	Easement for Access and Services 3 Wide and Variable
(J)	Easement for Sewerage Purposes Limited in Height & Depth - 7249054 (DP 612269)


62
DP 715333
65
DP 715333
19
DP 258652
20
DP 258652
4
DP 221919
2
DP 1255349
1
DP 1255349
Overland flow diversion drain
PUBLIC RESERVE (Council asset)
14
11
10
9
8
7
6
5
12
13
Greenwood Drive
(Council asset)
Overland flow diversion drain
CH 20.00
CH 37.30
CH 40.00
CH 60.00
CH 80.00
CH 79.07
CH 100.00
CH 110.28
CH 120.00
CH 140.00
CH 160.00
CH 169.90
LEGEND
RCS GROUP
Surveyors
GREENWOOD DRIVE LAYOUT
Development Application
Subdivision of Lot 4 DP 406893
Praedium Partnership
1:200
Major: 5m Minor: 1m
AHD
SSM 90073
RL131.85 AHD
GRID NORTH
MGA 94 ZONE 56
DF
23/07/21
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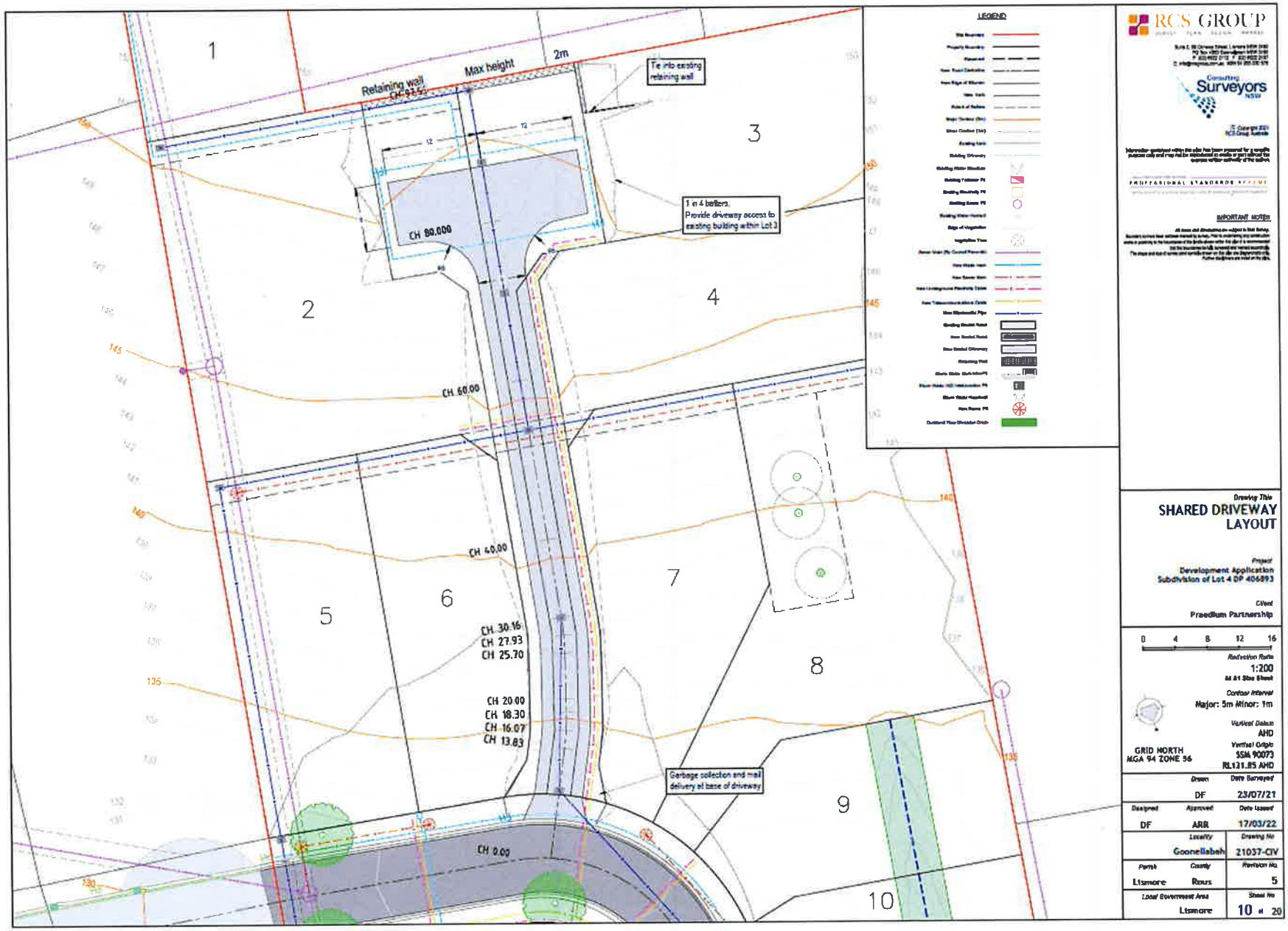
17/03/22
Goonellabah
21037-CIV
Lismore
Rous
5
Lismore
5 of 20


1
2
3
4
5
6
7
8
9
10
Retaining wall
Max height
2m
Tie into existing retaining wall
1 in 4 batters.
Provide driveway access to existing building within Lot 3
CH 80.000
CH 60.00
CH 40.00
CH 30.16
CH 27.93
CH 25.70
CH 20.00
CH 18.30
CH 16.07
CH 13.83
CH 0.00
Garbage collection and mail delivery at base of driveway
LEGEND
RCS GROUP
Consulting Surveyors NSW
SHARED DRIVEWAY LAYOUT
Development Application
Subdivision of Lot 4 DP 406893
Praedium Partnership
1:200
Major: 5m Minor: 1m
AHD
GRID NORTH
MGA 94 ZONE 56
SSM 90073
RL121.85 AHD
DF
23/07/21
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Goonellabah
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Lismore
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APPENDIX B – RFS GUIDELINES & FAST FACTS

APPENDIX 3

ACCESS

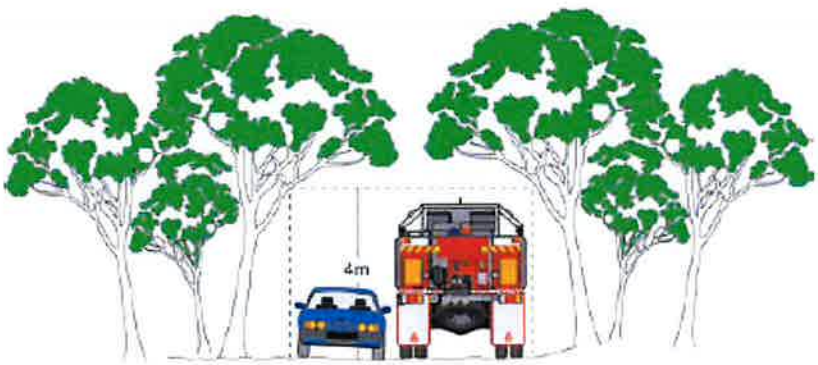
This appendix provides design principles for emergency service vehicle access.

A3.1 Vertical clearance

An unobstructed clearance height of 4 metres should be maintained above all access ways including clearance from building construction, archways, gateways and overhanging structures (e.g. ducts, pipes, sprinklers, walkways, signs and beams). This also applies to vegetation overhanging roads.

Figure A3.1

Vertical clearance.



A3.2 Vehicle turning requirements

Curved carriageways should be constructed using the minimum swept path as outlined in Table A3.2.

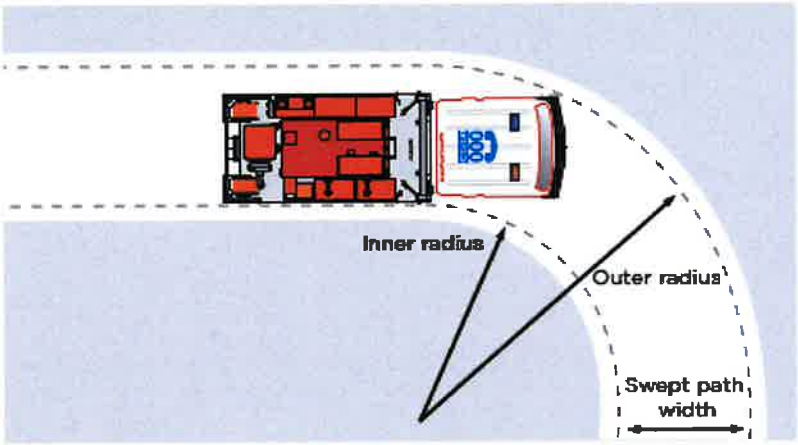
Table A3.2

Minimum curve radius for turning vehicles.

Curve radius (inside edge in metres)	Swept path (metres width)
< 40	4.0
40 - 69	3.0
70 - 100	2.7
>100	2.5

Figure A3.2a

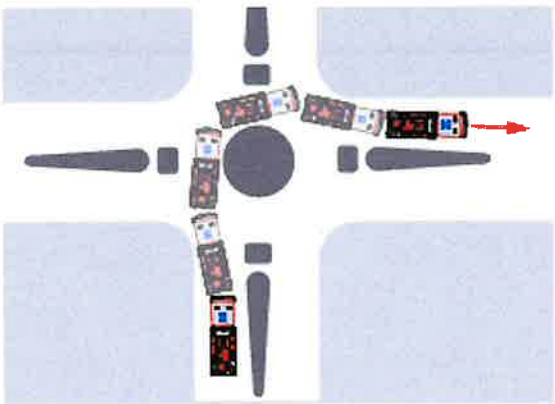
Swept path width for turning vehicles.



The radius dimensions given are for wall to wall clearance where body overhangs travel a wider arc than the wheel tracks (vehicle swept path). The swept path shall include an additional 500mm clearance either side of the vehicle.

Figure A3.2b

Roundabout swept path.



Example of a swept path as applied to a roundabout. The distance between inner and outer turning arcs allows for expected vehicle body swing of front and rear overhanging sections (the swept path).

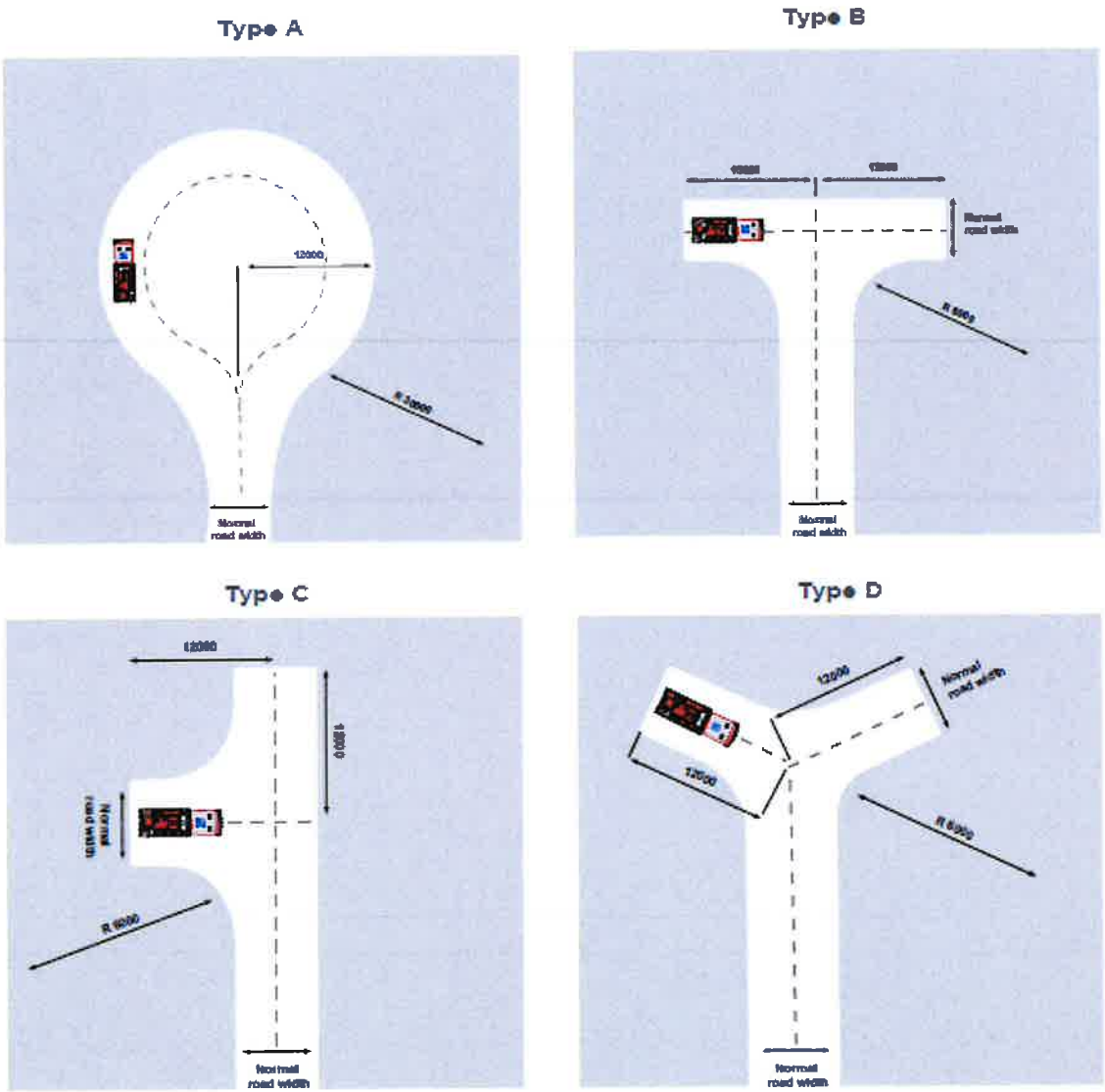
A3.3 Vehicle turning head requirements

Dead ends that are longer then 200m must be provided with a turning head area that avoids multipoint turns. "No parking" signs are to be erected within the turning head.

The minimum turning radius shall be in accordance with Table A3.2. Where multipoint turning is proposed the NSW RFS will consider the following options:

Figure A3.3

Multipoint turning options.



A3.4 Passing bays

The construction of passing bays, where required, shall be 20m in length and provide a minimum trafficable width at the passing point of 8m.

Figure A3.4

Passing bays can provide advantages when designed correctly. Poor design can and does severely impede access.

A3.5 Parking

Parking can create a pinch point in required access. The location of parking should be carefully considered to ensure fire appliance access is unimpeded. Hydrants shall be located outside of access ways and any parking areas to ensure that access is available at all times.

Figure A3.5

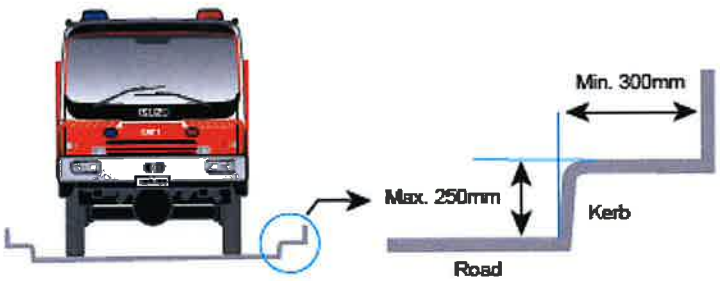
Hydrants and parking bays.

A3.6 Kerb dimensions

All kerbs constructed around access roads should be no higher than 250mm and free of vertical obstructions at least 300mm back from the kerb face to allow clearance for front and rear body overhang.

Figure A3.6

Carriageway kerb clearance dimensions.



A3.7 Services

Hydrant services should be located outside the carriageway and parking bays to permit traffic flow and access. Setup of standpipes within the carriageway may stop traffic flow. Hydrant services shall be located on the side of the road away from the bush fire threat where possible.

A3.8 Local Area Traffic Management (LATM)

The objective of LATM is to regulate traffic an acceptable level of speed and traffic volume within a local area.

Traffic engineers and planners should consider LATM devices when planning for local traffic control and their likely impact on emergency services. LATM devices by their nature are designed to restrict and impede the movement of traffic, especially large vehicles.

Where LATM devices are provided they are to be designed so that they do not impede fire vehicle access.

A3.9 Road types

A3.9.1 Perimeter Roads

Perimeter roads are to be provided with a minimum clear width of 8m. Parking and hydrants are to be provided outside of carriageways. Hydrants are to be located outside of carriageways and parking areas.

Figure A3.9a

Perimeter road widths.

A3.9.2 Non-perimeter Roads

Non-perimeter roads shall be provided with a minimum clear width of 5.5m. Parking is to be provided outside of the carriageway and hydrants are not to be located in carriageways or parking areas.

Figure A3.9b

Non-perimeter road widths.

A3.9.3 Property access

Property access roads are to be a minimum of 4m wide.

Figure A3.9c

Property access road widths.

APPENDIX 4

ASSET PROTECTION ZONE REQUIREMENTS

In combination with other BPMs, a bush fire hazard can be reduced by implementing simple steps to reduce vegetation levels. This can be done by designing and managing landscaping to implement an APZ around the property.

Careful attention should be paid to species selection, their location relative to their flammability, minimising continuity of vegetation (horizontally and vertically), and ongoing maintenance to remove flammable fuels (leaf litter, twigs and debris).

This Appendix sets the standards which need to be met within an APZ.

A4.1 Asset Protection Zones

An APZ is a fuel-reduced area surrounding a building or structure. It is located between the building or structure and the bush fire hazard.

For a complete guide to APZs and landscaping, download the NSW RFS document *Standards for Asset Protection Zones* at the NSW RFS Website www.rfs.nsw.gov.au.

An APZ provides:

- a buffer zone between a bush fire hazard and an asset;
- an area of reduced bush fire fuel that allows for suppression of fire;
- an area from which backburning or hazard reduction can be conducted; and
- an area which allows emergency services access and provides a relatively safe area for firefighters and home owners to defend their property.

Bush fire fuels should be minimised within an APZ. This is so that the vegetation within the zone does not provide a path for the spread of fire to the building, either from the ground level or through the tree canopy.

An APZ, if designed correctly and maintained regularly, will reduce the risk of:

- direct flame contact on the building;
- damage to the building asset from intense radiant heat; and
- ember attack.

The methodology for calculating the required APZ distance is contained within Appendix 1. The width of the APZ required will depend upon the development type and bush fire threat. APZs for new development are set out within Chapters 5, 6 and 7 of this document.

In forest vegetation, the APZ can be made up of an Inner Protection Area (IPA) and an Outer Protection Area (OPA).

A4.1.1 Inner Protection Areas (IPAs)

The IPA is the area closest to the building and creates a fuel-managed area which can minimise the impact of direct flame contact and radiant heat on the development and act as a defendable space. Vegetation within the IPA should be kept to a minimum level. Litter fuels within the IPA should be kept below 1cm in height and be discontinuous.

In practical terms the IPA is typically the curtilage around the building, consisting of a mown lawn and well maintained gardens.

When establishing and maintaining an IPA the following requirements apply:

Trees

- tree canopy cover should be less than 15% at maturity;
- trees at maturity should not touch or overhang the building;
- lower limbs should be removed up to a height of 2m above the ground;
- tree canopies should be separated by 2 to 5m; and
- preference should be given to smooth barked and evergreen trees.

Shrubs

- create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided;
- shrubs should not be located under trees;
- shrubs should not form more than 10% ground cover; and
- clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.

Grass

- grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and
- leaves and vegetation debris should be removed.

A4.1.2 Outer Protection Areas (OPAs)

An OPA is located between the IPA and the unmanaged vegetation. It is an area where there is maintenance of the understorey and some separation in the canopy. The reduction of fuel in this area aims to decrease the intensity of an approaching fire and restricts the potential for fire spread from crowns; reducing the level of direct flame, radiant heat and ember attack on the IPA.

Because of the nature of an OPA, they are only applicable in forest vegetation.

When establishing and maintaining an OPA the following requirements apply:

Trees

- tree canopy cover should be less than 30%; and
- canopies should be separated by 2 to 5m.

Shrubs

- shrubs should not form a continuous canopy; and
- shrubs should form no more than 20% of ground cover.

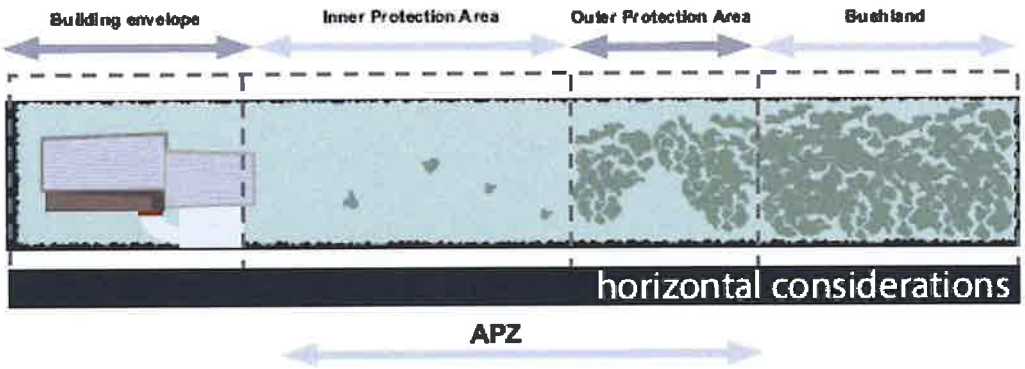
Grass

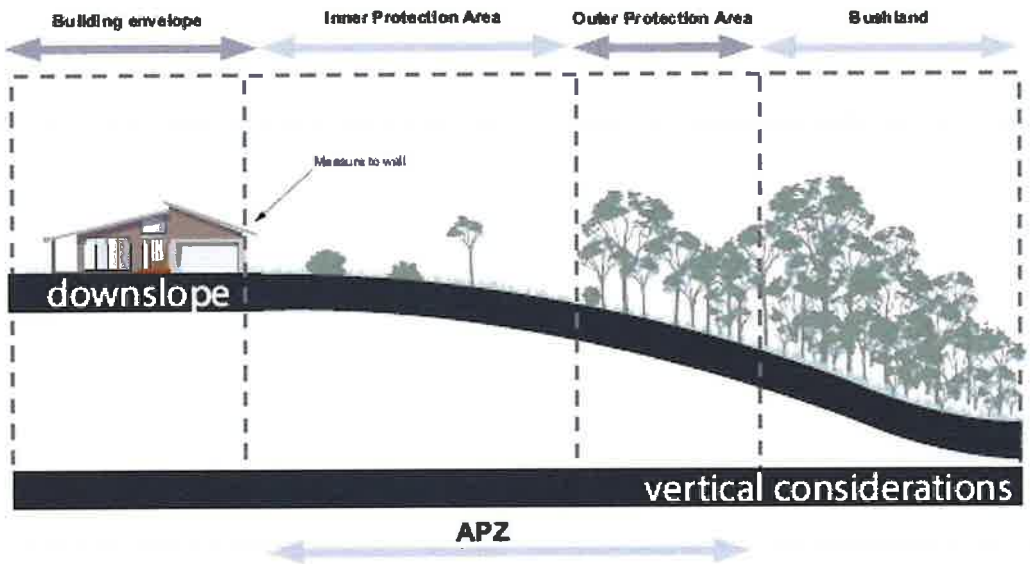
- grass should be kept mown to a height of less than 100mm; and
- leaf and other debris should be removed.

An APZ should be maintained in perpetuity to ensure ongoing protection from the impact of bush fires. Maintenance of the IPA and OPA as described above should be undertaken regularly, particularly in advance of the bush fire season.

Figure A4.1

Typical Inner and Outer Protection Areas.





PROPOSED RESIDENCE AT LOT 2 BALLINA ROAD (LANEWAY), GOONELLABAH NSW

General Notes :-

Do not scale plans, use written dimensions only.

The owner / builder subcontractor shall verify all dimensions, levels, setbacks and specifications prior to commencing works or ordering materials and shall be responsible for ensuring that all building works conform to the National Construction Code 2015 (Vol 2) (NCC), current Australian standards, building regulations and town planning requirements, report any discrepancies to the office.

All works shall comply with but not limited to the NCC and Australian standards listed below.

AS 1288 - 2006 Glass in buildings - selection and installation
AS 1562 - 1999 Design and installation of sheet roof and wall cladding
AS 1684 - 2010 Residential timber-framed construction - design criteria
AS 2049 - 2002 Roof tiles
AS 2050 - 2002 Installation of roof tiles
AS 2870 - 2011 Residential slab and footings
AS / NZS 2904 - 1995 Damp-proof courses and flashings
AS 3600 - 2009 Concrete structures
AS 3660 - 2014 Termite management
AS 3700 - 2011 Masonry structures
AS 3740 - 2010 Waterproofing of domestic wet areas
AS 3786 - 2014 Smoke alarms
AS 4055 - 2012 Wind loads for housing
AS 4100 - 1998 Steel structures

These plans shall be read in conjunction with any structural and civil engineering computations and drawings.

Soil Classification - refer to structural engineers soil test.

All buildings shall be protected against termite attack in accordance with AS 3660.1 - 2014.
and a durable notice shall be placed in the meter box indicating type of barrier and required periodical inspections.

Safety glazing to be used in the following cases :-

(1) All rooms - within 500mm vertical of the floor
(2) Bathrooms - within 1500mm vertical of the bath base
(3) Fully glazed doors
(4) Shower screens
(5) Within 300mm of a door and <1200mm above floor level
(6) Window sizes are nominal only. Actual sizes will vary with manufacturer. Flashings all round.

Stormwater to be taken to the legal point of discharge as determined by the relevant authority.

Tiled balcony's over livable areas are to be in the following order over the floor joists.
19mm compressed fibre cement sheet, with one layer of Parchem Emerproof 750, with a second layer of sand seed with a DFT of 1300 micron, installed to manufacturers specifications, and floor tiles over. All corners to have 20mm mastic sealant under the Parchem Emerproof 750. As per AS 4654

Footings not to encroach title boundaries or easements. It is recommended that where buildings are to be located in close proximity of boundaries, a check survey be conducted by a licenced surveyor.

All steelwork in masonry to be hot dip galvanized.

All wet areas to comply with NCC 3.8.1.2 and AS 3740. Splashbacks shall be impervious for 150mm above sinks, troughs and hand basins within 75mm of the wall.

Provide wall ties at 600mm spacings both vertical and horizontal and within 300mm of articulation joints. Brick ties to be Galvanised steel.

Sub-floor ventilation minimum 7500mm sq for external walls and 1500mm sq for internal walls below bearer.

Stair requirements - Minimum tread 240mm, minimum riser 115mm, maximum riser 190mm. Space between open treads maximum 125mm. Treads to be non slip surface. Balustrades to be minimum 1000mm above landings with max opening of 125mm and in accordance with NCC 3.9.2.. For stainless steel balustrading, refer to table 3.9.2.1 (Wire balustrade construction - required wire tension and maximum permissible deflection) of the NCC.

The builder shall take all steps necessary to ensure the stability of existing and new structures through-out construction.

◉ Denotes location of smoke detectors (refer electrical layout plans). These are to be hard wired & interconnected with emergency back-up and comply with AS 3786 - 2014.

Wind speed as nominated on bracing plan.
Provide lift-off hinges to w.c. or open out door, or min 1200mm clearance from door to pan.
Exhaust fans from sanitary compartments to be ducted to the outside natural air, or to a vented roof space are as per AS 1668.2 - 2012.
These notes are neither exhaustive nor a substitute for regulations, statutory requirements , building practice or contractual obligations.
All construction materials supplied must take into account proximity to coastal or industrial environments, in accordance with manufacturers specifications.
These plans are protected by copyright and are the property of the author.

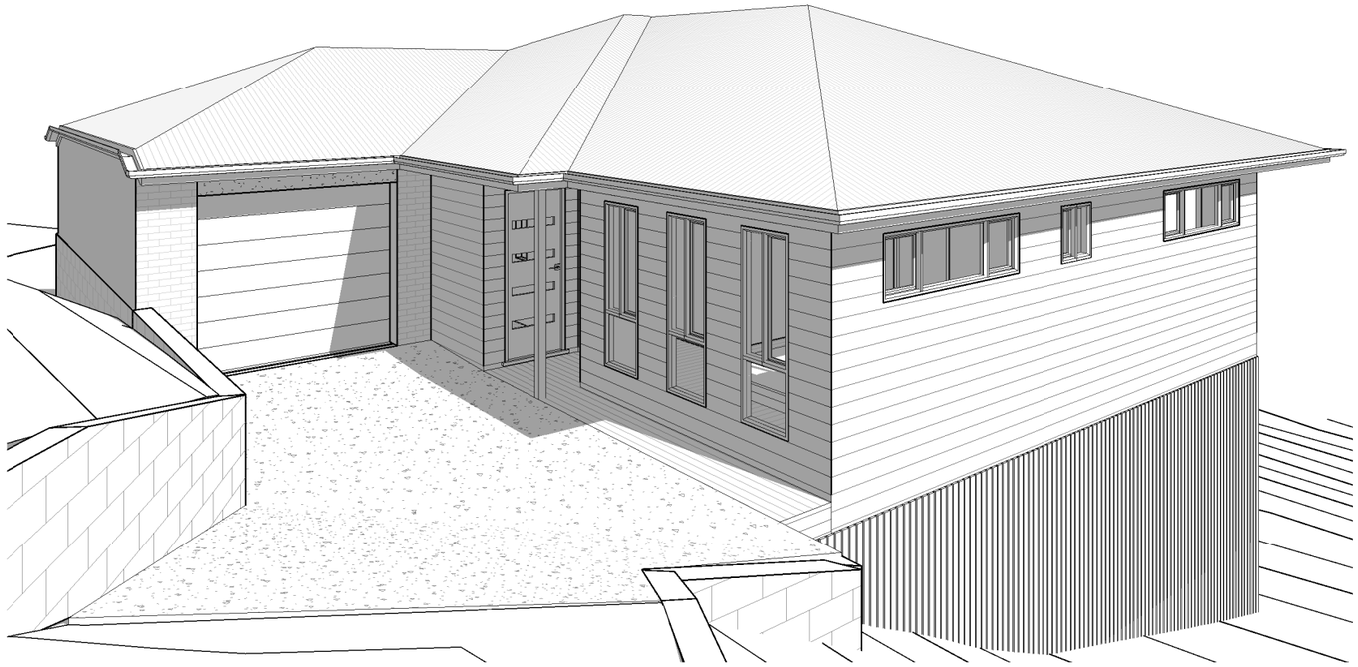
PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

Revision	Revision Description	Revision Date
A	Preliminary Issue	07/12/21

Drawing List

Sheet Number	Sheet Name	Current Revision	Current Revision Date	Current Revision Issued By
001	Title Page	A	07/12/21	PM
101	Site Plan	A	07/12/21	PM
102	Shadow Diagrams	A	07/12/21	PM
201	Ground Floor Plan	A	07/12/21	PM
202	First Floor Plan	A	07/12/21	PM
301	Elevations	A	07/12/21	PM
302	Elevations	A	07/12/21	PM
401	Sections/Details	A	07/12/21	PM



Site Notes :-

All stormwater and drainage to be in compliance with NCC parts 3.1.2 and 3.5.2 as well as AS / NZS 3500 - 2003.

Ensure 90mm diameter agricultural drains are provided to the base of all cuts and retaining walls and are connected to the stormwater system via silt pit/s to the RBS requirements.

The external finished surface surrounding the building must be drained to move surface water away from the building and grade to provide a slope not less than 50mm over the first 1000mm from the building.

The height of the overflow relief gully relative to drainage fittings and ground level must be a minimum of 150mm below the lowest sanitary fixture.

Connect downpipes to legal point of discharge via 90mm diameter UPVC stormwater pipe laid with a minimum fall of 1:80. Discharge to the satisfaction of the relevant authority.

Two downpipes max to each 90mm stormwater pipe, subsurface pipes to be 100mm diameter, any underslab piping to have an inspection opening at upper end, it is to be 100mm sewer grade piping with no joins under slab.

Legend :-

AC	Air Conditioning	MW	Microwave
AFL	Above Floor Level	NCC	National Construction Code
AW	Awning Window	NGL	Natural Ground Line
AHD	Australian Height Datum	OHC	Overhead Cupboard
AS	Australian Standards	PS	Plumbing Stack / Duct
BCA	Building Code of Australia	RL	Relative Level
CJ	Construction Joint	SL	Sidelight
CSD	Cavity Sliding Door	SP	Steel Post
DH	Double Hung Window	TRH	Toilet Roll Holder
DP	Downpipe	TP	Timber Post
DW	Dishwasher	TBC	To be confirmed
AFFL	After Finish Floor Level	TR	Towel Rail/Noggen Position
FG	Fixed Glass	UBO	Under Bench Oven
FW	Floor Waste	WO	Wall Oven
HTR	Hand Towel Ring	WM	Washing Machine
HWS	Hot Water System	WIR	Walk In Robe
LBW	Load Bearing Wall		

NOTE: 3D ARTIST IMPRESSIONS ARE INDICATIVE ONLY. FINAL PRODUCT MAY DIFFER FROM THAT ILLUSTRATED.

Title Page

PRM Design
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LOT 2 BALLINA ROAD (LANEWAY), GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	1 : 100 on A3				
DATE DRAWN:	07/12/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	001

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	07/12/21
REAL PROPERTY DESCRIPTION	TBC	

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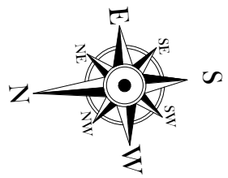
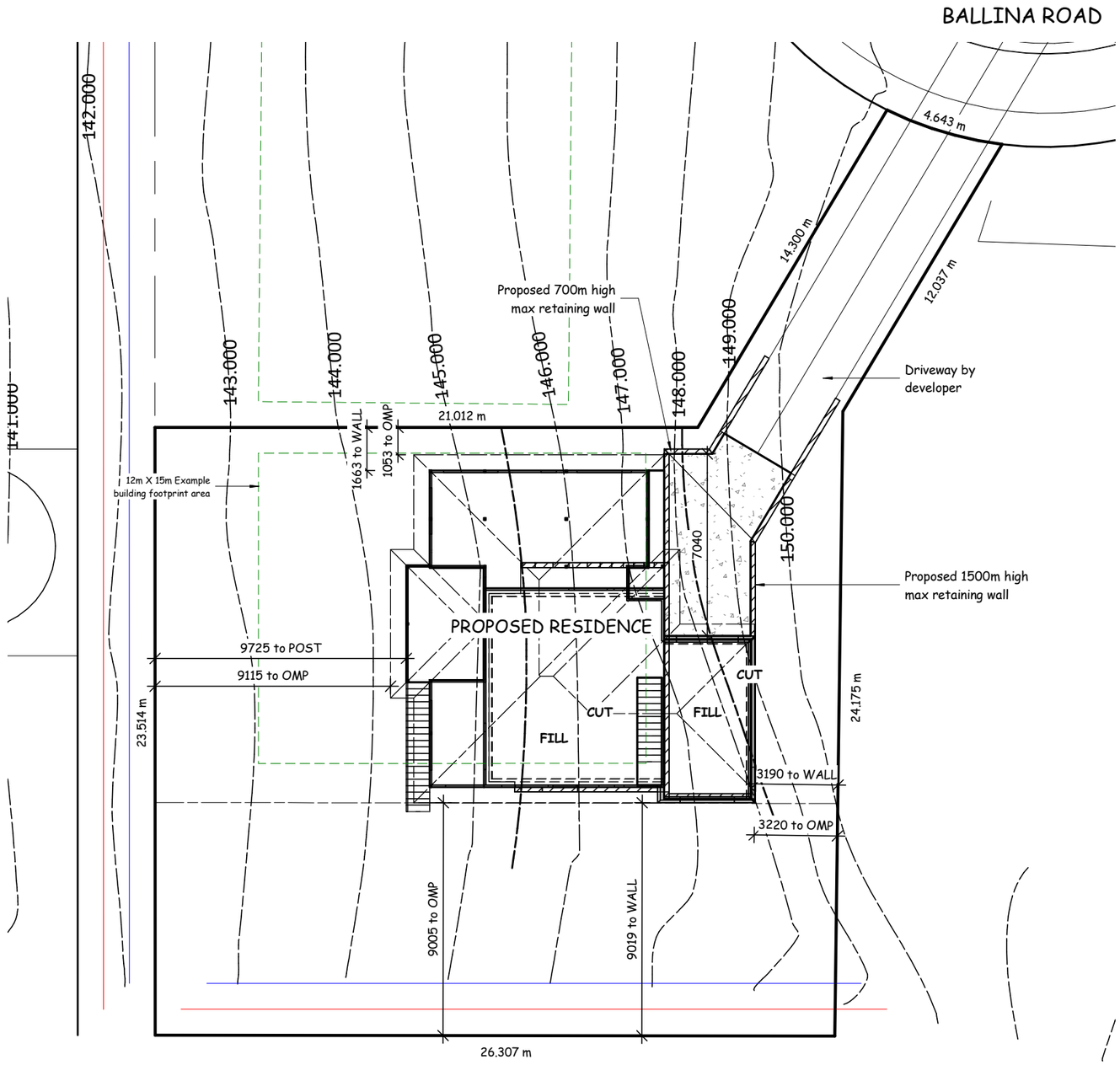
Site Coverage Schedule - Manual Calc		
Site Area	House Footprint Area	Site Coverage
683 m²	136.00	19.91%



Site Plan

1 : 200



NOTES:

- site works, including retaining walls, may be subject to change to suit final site conditions.

Concrete Schedule		
Name	Material	Area
Driveway	exposed aggregate concrete slab	27 m²

RL DETAILS		
GARAGE LEVEL		
PAD	148.200	AHD
CUT	1000mm	
FILL	1400mm	
SLAB	148.500	AHD
GROUND FLOOR LEVEL		
PAD	145.440	AHD
CUT	1800mm	
FILL	400mm	
SLAB	145.740	AHD

PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTE: STORMWATER DRAINAGE CALCULATED FOR BUILDING ROOF AREAS AND OR PAVED AREAS SHOWN ON THIS PROPOSED DEVELOPMENT ONLY, AND MAY NOT BE ADEQUATE FOR ANY SUBSEQUENT ROOF OR PAVED AREAS.
MIN 100x75 DOWNPIPES (EACH TO DRAIN MAX 40.00m SQU ROOF AREA) DISCHARING INTO 100mm S/W DRAINAGE PIPEWORK (EACH RUN CARRYING MAX CAPACITY OF 8 litres/sec) MIN GRADE TO RUBBLE PITS ON SITE TO BE 1%. ALL STORMWATER & DRAINAGE TO BE IN COMPLIANCE WITH BCA PARTS 3.1.2 & 3.5.2 AS WELL AS ASNZS3500

DISCLAIMER : AS THE SITE LEVELS HAVE BEEN SUPPLIED BY OTHERS WE CANNOT TAKE RESPONSIBILITY FOR THEIR ACCURACY. ALL SITE LEVELS TO BE CHECKED AND CONFIRMED BY BUILDER BEFORE STARTING ANY WORKS.

NOTE : FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.

Site Plan

PRM Design
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LOT 2 BALLINA ROAD (LANEWAY), GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	As indicated on A3				
DATE DRAWN:	07/12/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	101

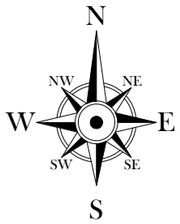
WIND CATEGORY: TBC

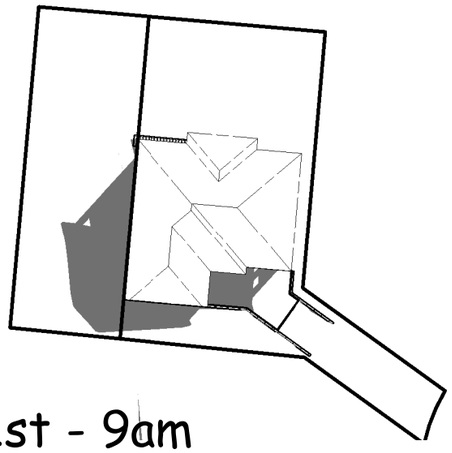
SOIL CLASS: TBC

CLIENT:

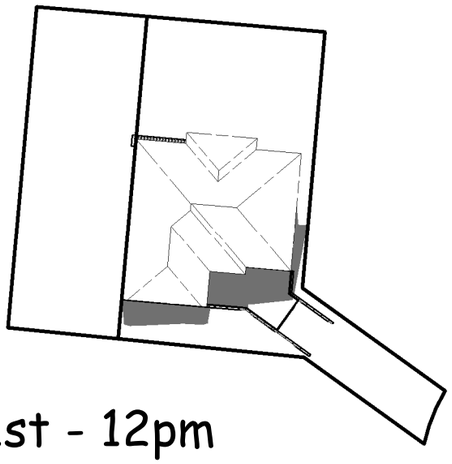
Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	07/12/21
REAL PROPERTY DESCRIPTION	TBC	

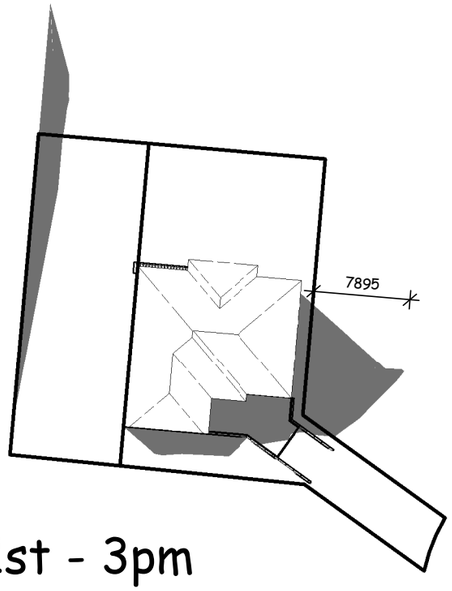




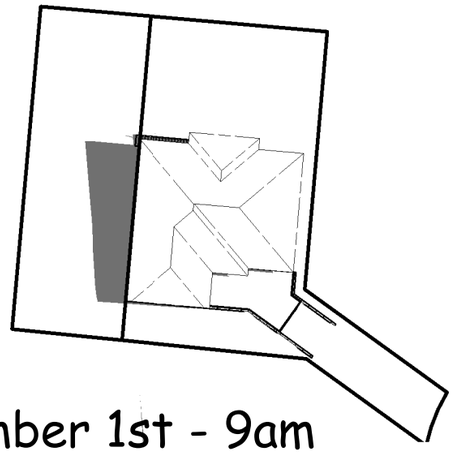
June 1st - 9am



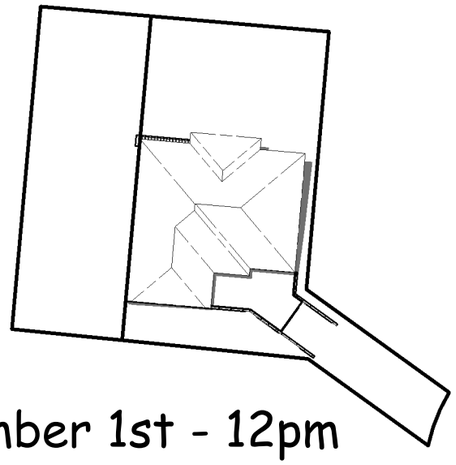
June 1st - 12pm



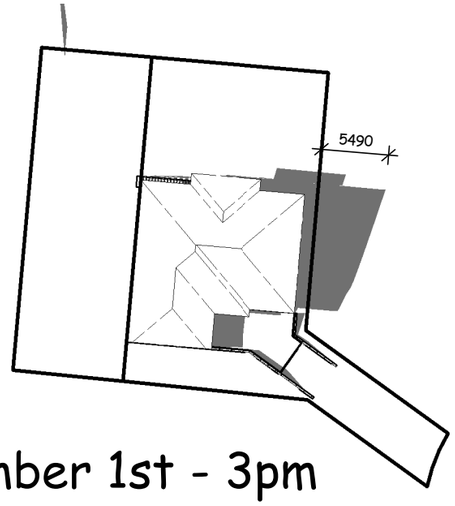
June 1st - 3pm



December 1st - 9am



December 1st - 12pm



December 1st - 3pm

Shadow Diagrams

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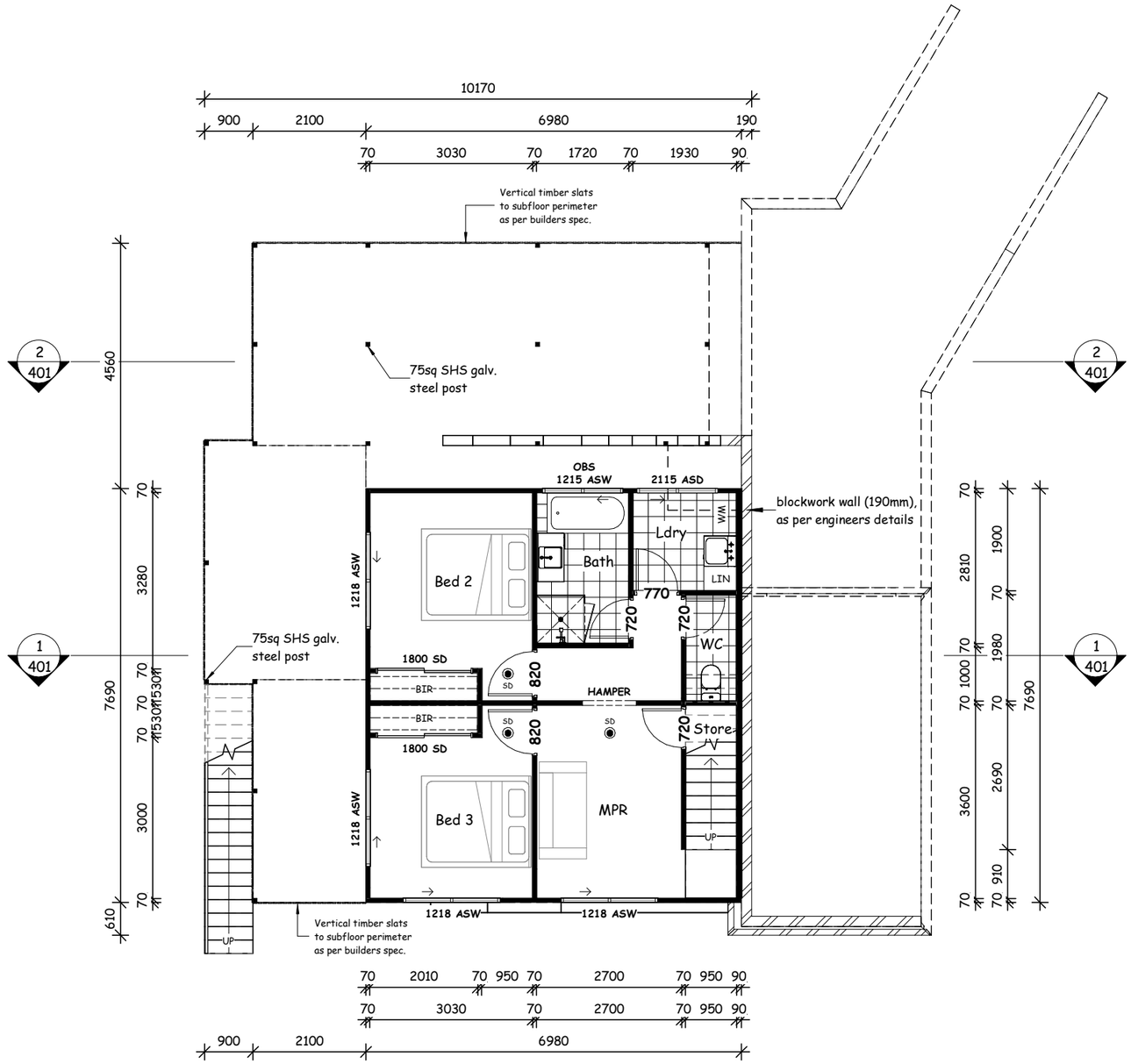
LOT 2 BALLINA ROAD (LANEWAY),
GOONELLABAH NSW

DESIGN:	CUSTOM					WIND CATEGORY:	CLIENT:
PLAN VERSION:	PRELIMINARY PLANS					TBC	
FACADE:							Client/s Signature/s:
SCALE:	1 : 500 on A3					SOIL CLASS:	CURRENT REVISION / ISSUED DATE: A 07/12/21
DATE DRAWN:	07/12/21		JOB #:			TBC	REAL PROPERTY DESCRIPTION: TBC
DRAWN:	PM	CHECKED:	PM	SHEET #	102		

NOTES :
- FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.
- LIFT OFF HINGES TO WC DOOR
- SARKING TO EXTERNAL WALLS
- INSULATION TO CEILINGS
- ALL SHOWER ROSES TO BE AAA RATED
- WATER PRESSURE LIMITED TO 500 KPA AT THE METER
- ROOMS WITH NO NATURAL VENTILATION ARE TO HAVE MECHANICAL VENTILATION INSTALLED
- PROVIDE WATER AND POWER PROVISION TO DISHWASHER SPACE
- WINDOW, SGD & INTERNAL DOOR SIZES ARE NOMINAL ONLY & TO BE CONFIRMED WITH MANUFACTURER
- ALL DIMENSIONS ON PLAN ARE FRAME SIZES UNO
- ALL ROBE/LINEN SLIDING DOORS ARE SHOWN AS FRAME OPENING WIDTH

Area Schedule		
Name	Area	Squares
Living - FF	98.20 m²	10.57
Living - GF	53.68 m²	5.78
Garage	22.96 m²	2.47
Alfresco	13.21 m²	1.42
Porch	1.70 m²	0.18
Grand total	189.74 m²	20.42

Concrete Schedule		
Name	Material	Area
Driveway	exposed aggregate concrete slab	27 m²



PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

Ground Floor Plan

PRM Design
~ building design specialists ~

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LOT 2 BALLINA ROAD (LANEWAY), GOONELLABAH NSW

DESIGN:	CUSTOM			WIND CATEGORY:	TBC
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	1 : 100 on A3			SOIL CLASS:	TBC
DATE DRAWN:	07/12/21	JOB #:			
DRAWN:	PM	CHECKED: PM	SHEET # 201		

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	07/12/21
REAL PROPERTY DESCRIPTION	TBC	

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NOTES :
- FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.
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Concrete Schedule		
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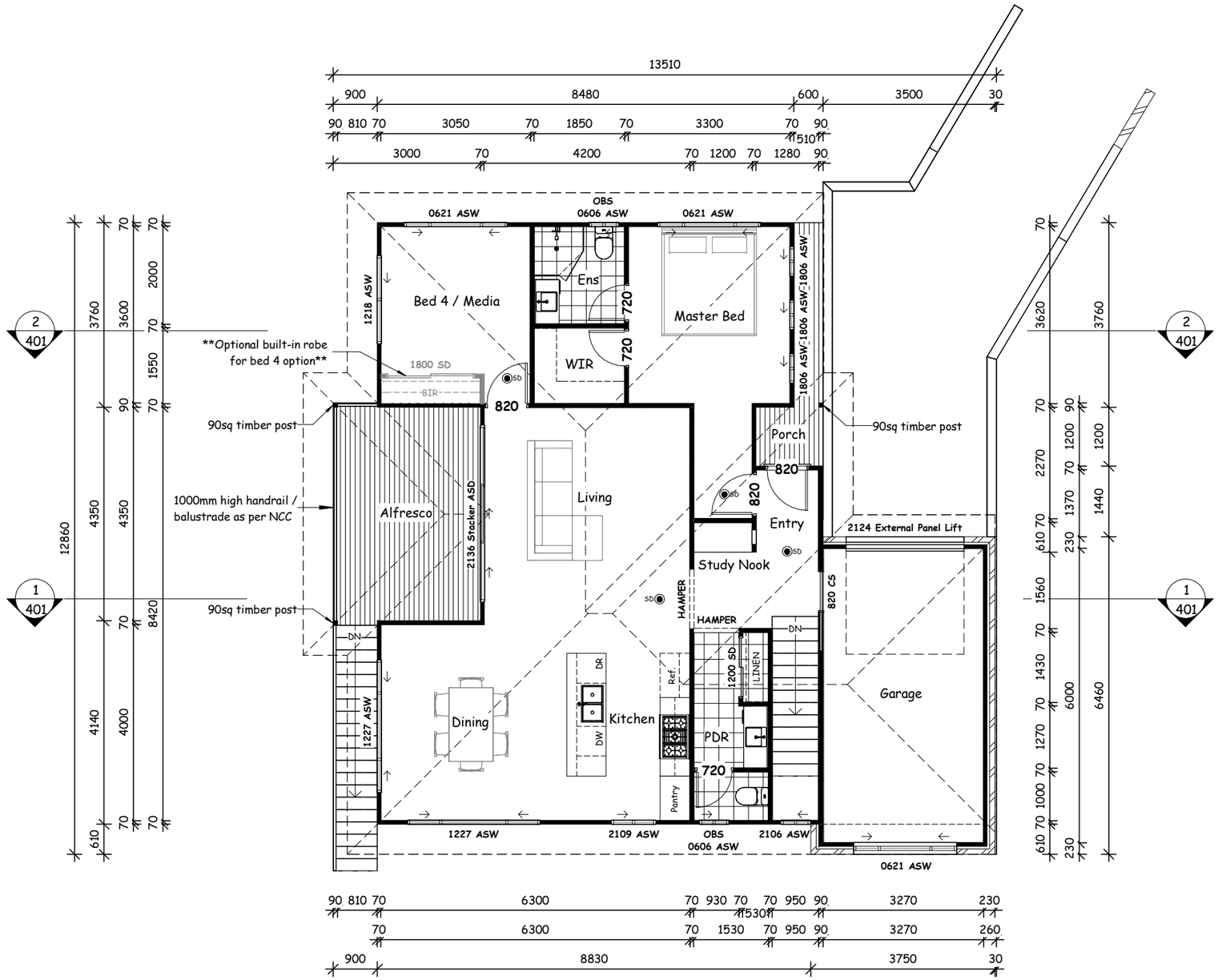

PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

First Floor Plan

PRM Design
~ building design specialists ~
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LOT 2 BALLINA ROAD (LANEWAY), GOONELLABAH NSW

DESIGN:	CUSTOM			WIND CATEGORY:	TBC
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
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DRAWN:	PM	CHECKED: PM	SHEET # 202		

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	07/12/21
REAL PROPERTY DESCRIPTION	TBC	

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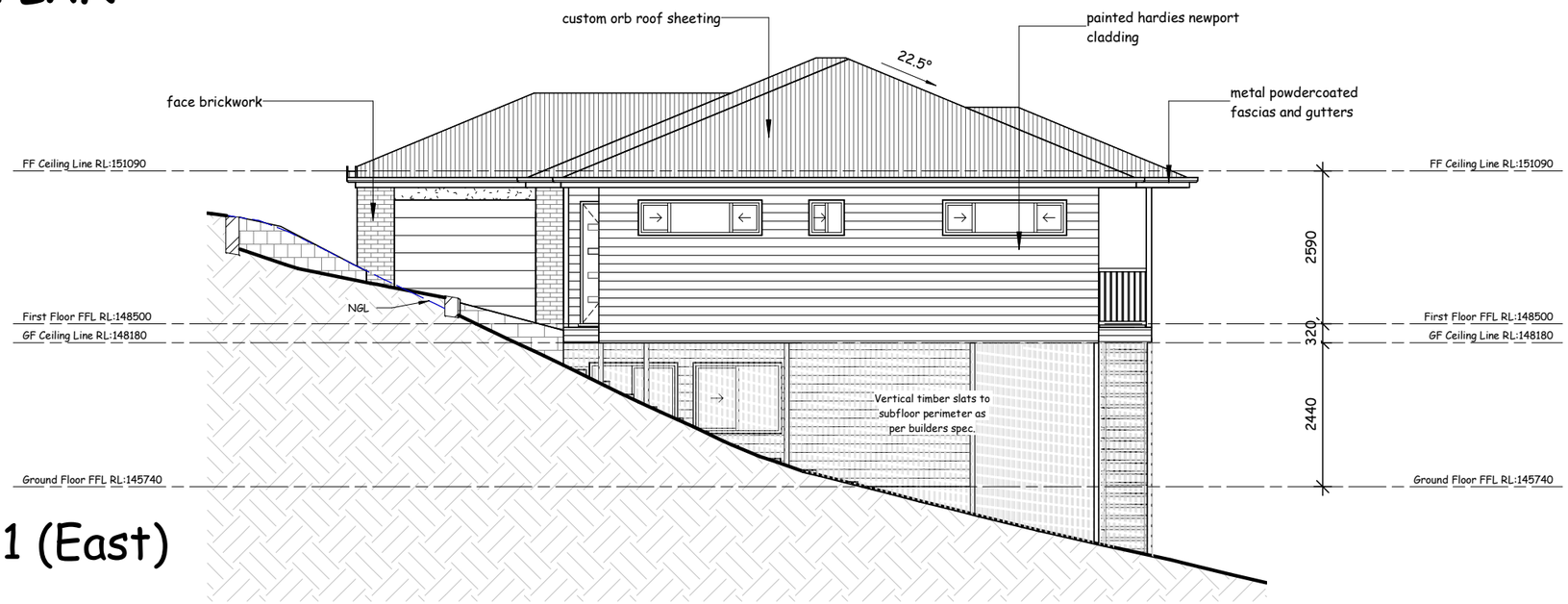
PRELIMINARY PLAN

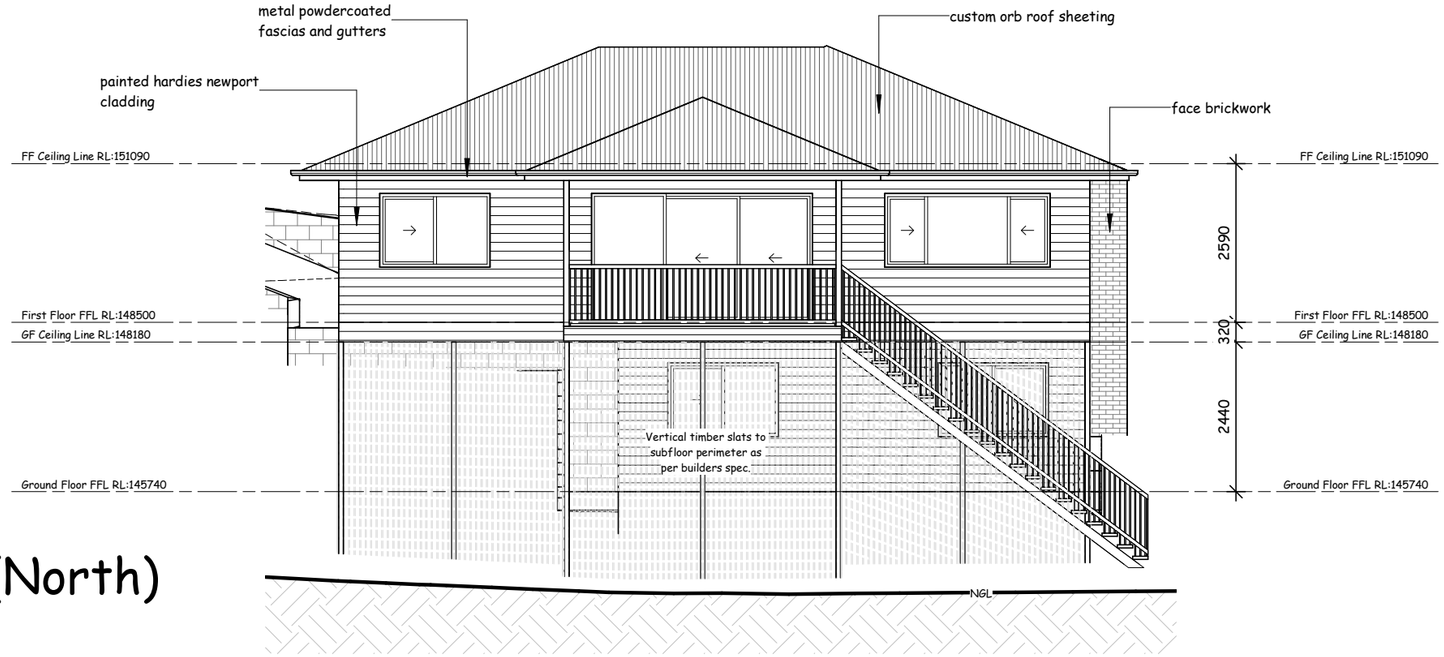
Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTES:

- Refer to colour specifications schedule for detailed internal and external colours/materials
- Articulation joints as per engineering details



Elevation 1 (East)



Elevation 2 (North)

Elevations

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QBCC Lic: 15065972

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LOT 2 BALLINA ROAD (LANEWAY), GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	1 : 100 on A3				
DATE DRAWN:	07/12/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	301

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

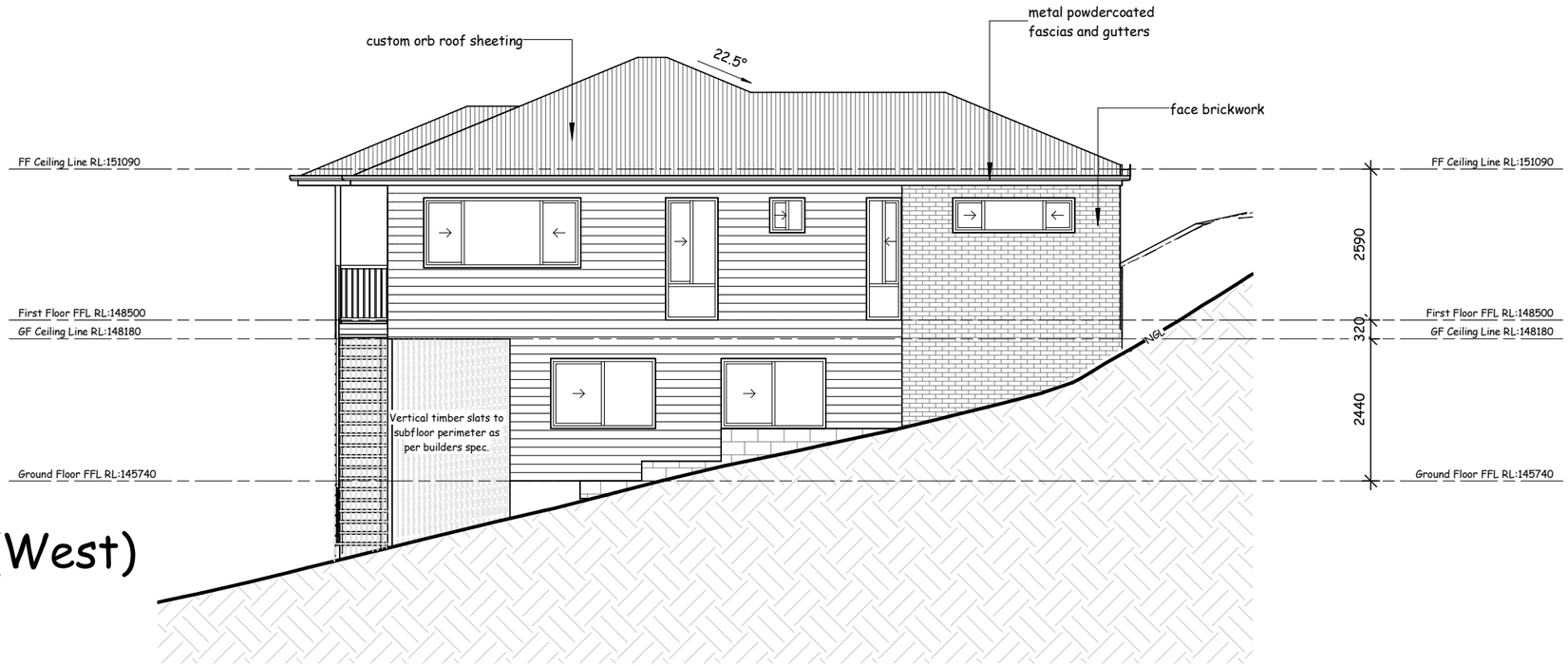
CURRENT REVISION / ISSUED DATE	A	07/12/21
REAL PROPERTY DESCRIPTION	TBC	

PRELIMINARY PLAN

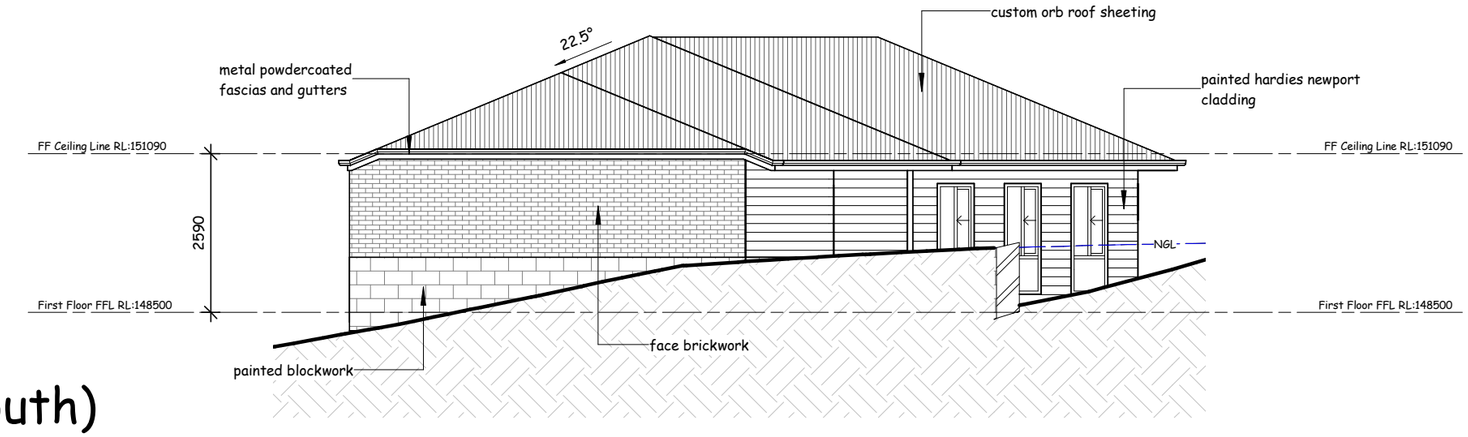
Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTES:

- Refer to colour specifications schedule for detailed internal and external colours/materials
- Articulation joints as per engineering details



Elevation 3 (West)



Elevation 4 (South)

Elevations

PRM Design
~ building design specialists ~

Contact Details:
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E: prmdesign@bigpond.com
QBCC Lic: 15065972

LOT 2 BALLINA ROAD (LANEWAY), GOONELLABAH NSW

DESIGN:	CUSTOM			WIND CATEGORY:	TBC
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:				SOIL CLASS:	TBC
SCALE:	1 : 100 on A3				
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DRAWN:	PM	CHECKED: PM	SHEET # 302		

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	07/12/21
REAL PROPERTY DESCRIPTION	TBC	

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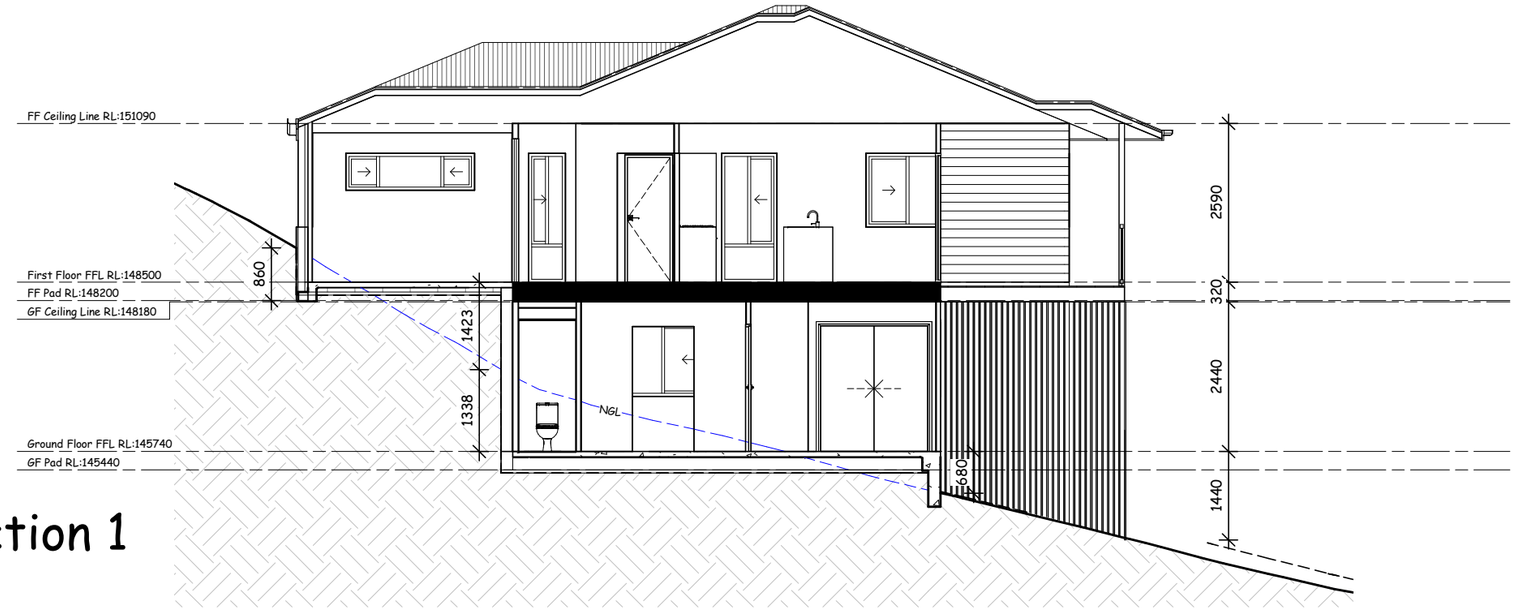
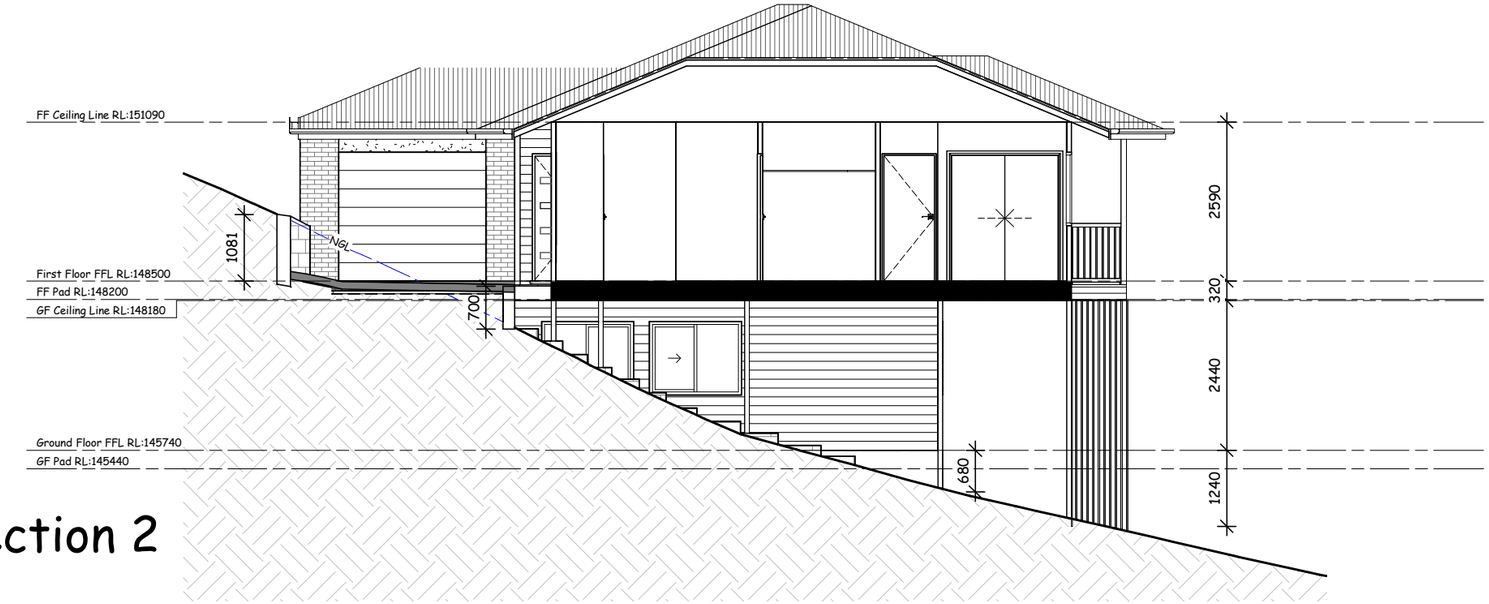
PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.



Section 1



Section 2

Sections/Details

PRM Design
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QBCC Lic: 15065972

These drawings and documents are the sole property of PRM DESIGN.

LOT 2 BALLINA ROAD (LANEWAY),
GOONELLABAH NSW

DESIGN:	CUSTOM			WIND CATEGORY:	CLIENT:
PLAN VERSION:	PRELIMINARY PLANS			TBC	
FACADE:					Client/s Signature/s:
SCALE:	1 : 100 on A3			SOIL CLASS:	CURRENT REVISION / ISSUED DATE: A 07/12/21
DATE DRAWN:	07/12/21	JOB #:		TBC	REAL PROPERTY DESCRIPTION: TBC
DRAWN:	PM	CHECKED: PM	SHEET # 401		

PROPOSED RESIDENCE AT LOT 7 GREENWOOD DRIVE, GOONELLABAH NSW

General Notes :-

Do not scale plans, use written dimensions only.

The owner / builder subcontractor shall verify all dimensions, levels, setbacks and specifications prior to commencing works or ordering materials and shall be responsible for ensuring that all building works conform to the National Construction Code 2015 (Vol 2) (NCC), current Australian standards, building regulations and town planning requirements, report any discrepancies to the office.

All works shall comply with but not limited to the NCC and Australian standards listed below.

AS 1288 - 2006 Glass in buildings - selection and installation
AS 1562 - 1999 Design and installation of sheet roof and wall cladding
AS 1684 - 2010 Residential timber-framed construction - design criteria
AS 2049 - 2002 Roof tiles
AS 2050 - 2002 Installation of roof tiles
AS 2870 - 2011 Residential slab and footings
AS / NZS 2904 - 1995 Damp-proof courses and flashings
AS 3600 - 2009 Concrete structures
AS 3660 - 2014 Termite management
AS 3700 - 2011 Masonry structures
AS 3740 - 2010 Waterproofing of domestic wet areas
AS 3786 - 2014 Smoke alarms
AS 4055 - 2012 Wind loads for housing
AS 4100 - 1998 Steel structures

These plans shall be read in conjunction with any structural and civil engineering computations and drawings.

Soil Classification - refer to structural engineers soil test.

All buildings shall be protected against termite attack in accordance with AS 3660.1 - 2014.
and a durable notice shall be placed in the meter box indicating type of barrier and required periodical inspections.

Safety glazing to be used in the following cases :-

(1) All rooms - within 500mm vertical of the floor
(2) Bathrooms - within 1500mm vertical of the bath base
(3) Fully glazed doors
(4) Shower screens
(5) Within 300mm of a door and <1200mm above floor level
(6) Window sizes are nominal only. Actual sizes will vary with manufacturer. Flashings all round.

Stormwater to be taken to the legal point of discharge as determined by the relevant authority.

Tiled balcony's over livable areas are to be in the following order over the floor joists.
19mm compressed fibre cement sheet, with one layer of Parchem Emerproof 750, with a second layer of sand seed with a DFT of 1300 micron, installed to manufacturers specifications, and floor tiles over. All corners to have 20mm mastic sealant under the Parchem Emerproof 750. As per AS 4654

Footings not to encroach title boundaries or easements. It is recommended that where buildings are to be located in close proximity of boundaries, a check survey be conducted by a licenced surveyor.

All steelwork in masonry to be hot dip galvanized.

All wet areas to comply with NCC 3.8.1.2 and AS 3740. Splashbacks shall be impervious for 150mm above sinks, troughs and hand basins within 75mm of the wall.

Provide wall ties at 600mm spacings both vertical and horizontal and within 300mm of articulation joints. Brick ties to be Galvanised steel.

Sub-floor ventilation minimum 7500mm sq for external walls and 1500mm sq for internal walls below bearer.

Stair requirements - Minimum tread 240mm, minimum riser 115mm, maximum riser 190mm. Space between open treads maximum 125mm. Treads to be non slip surface. Balustrades to be minimum 1000mm above landings with max opening of 125mm and in accordance with NCC 3.9.2.. For stainless steel balustrading, refer to table 3.9.2.1 (Wire balustrade construction - required wire tension and maximum permissible deflection) of the NCC.

The builder shall take all steps necessary to ensure the stability of existing and new structures through-out construction.

◉ Denotes location of smoke detectors (refer electrical layout plans). These are to be hard wired & interconnected with emergency back-up and comply with AS 3786 - 2014.

Wind speed as nominated on bracing plan.
Provide lift-off hinges to w.c. or open out door, or min 1200mm clearance from door to pan.
Exhaust fans from sanitary compartments to be ducted to the outside natural air, or to a vented roof space are as per AS 1668.2 - 2012.
These notes are neither exhaustive nor a substitute for regulations, statutory requirements , building practice or contractual obligations.
All construction materials supplied must take into account proximity to coastal or industrial environments, in accordance with manufacturers specifications.
These plans are protected by copyright and are the property of the author.

PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

Revision	Revision Description	Revision Date
A	Preliminary Issue	28/11/21
B	Revised Plans	01/12/21

Drawing List

Sheet Number	Sheet Name	Current Revision	Current Revision Date	Current Revision Issued By
001	Title Page	B	01/12/21	PM
101	Site Plan	B	01/12/21	PM
102	Shadow Diagrams	B	01/12/21	PM
201	Ground Floor Plan	B	01/12/21	PM
202	First Floor Plan	B	01/12/21	PM
301	Elevations	B	01/12/21	PM
302	Elevations	B	01/12/21	PM
401	Sections/Details	B	01/12/21	PM

Site Notes :-

All stormwater and drainage to be in compliance with NCC parts 3.1.2 and 3.5.2 as well as AS / NZS 3500 - 2003.

Ensure 90mm diameter agricultural drains are provided to the base of all cuts and retaining walls and are connected to the stormwater system via silt pit/s to the RBS requirements.

The external finished surface surrounding the building must be drained to move surface water away from the building and grade to provide a slope not less than 50mm over the first 1000mm from the building.

The height of the overflow relief gully relative to drainage fittings and ground level must be a minimum of 150mm below the lowest sanitary fixture.

Connect downpipes to legal point of discharge via 90mm diameter UPVC stormwater pipe laid with a minimum fall of 1:80. Discharge to the satisfaction of the relevant authority.

Two downpipes max to each 90mm stormwater pipe, subsurface pipes to be 100mm diameter, any underslab piping to have an inspection opening at upper end, it is to be 100mm sewer grade piping with no joins under slab.

Legend :-

AC	Air Conditioning	MW	Microwave
AFL	Above Floor Level	NCC	National Construction Code
AW	Awning Window	NGL	Natural Ground Line
AHD	Australian Height Datum	OHC	Overhead Cupboard
AS	Australian Standards	PS	Plumbing Stack / Duct
BCA	Building Code of Australia	RL	Relative Level
CJ	Construction Joint	SL	Sidelight
CSD	Cavity Sliding Door	SP	Steel Post
DH	Double Hung Window	TRH	Toilet Roll Holder
DP	Downpipe	TP	Timber Post
DW	Dishwasher	TBC	To be confirmed
AFFL	After Finish Floor Level	TR	Towel Rail/Noggen Position
FG	Fixed Glass	UBO	Under Bench Oven
FW	Floor Waste	WO	Wall Oven
HTR	Hand Towel Ring	WM	Washing Machine
HWS	Hot Water System	WIR	Walk In Robe
LBW	Load Bearing Wall		

NOTE: 3D ARTIST IMPRESSIONS ARE INDICATIVE ONLY. FINAL PRODUCT MAY DIFFER FROM THAT ILLUSTRATED.

Title Page

PRM Design
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LOT 7 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:	HAMPTON 1				
SCALE:	1 : 100 on A3				
DATE DRAWN:	28/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	001

WIND CATEGORY: TBC
SOIL CLASS: TBC

CLIENT:
Client/s Signature/s:

CURRENT REVISION / ISSUED DATE	B	01/12/21
REAL PROPERTY DESCRIPTION	TBC	

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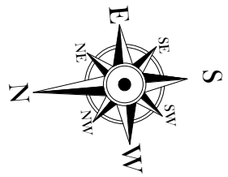
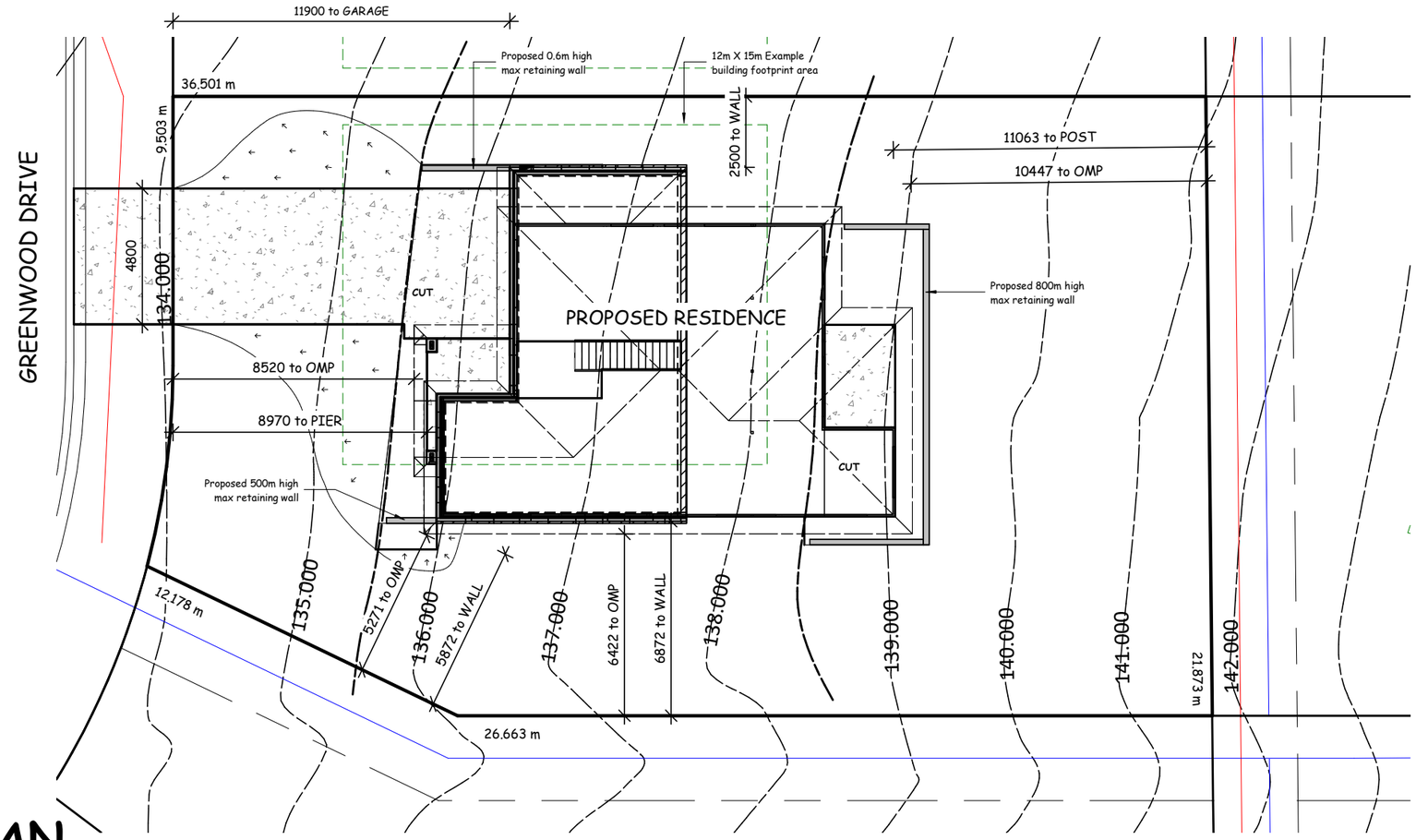
Site Coverage Schedule - Manual Calc		
Site Area	House Footprint Area	Site Coverage
779 m²	162.00	20.80%



Site Plan

1 : 200



NOTES:

- site works, including retaining walls, may be subject to change to suit final site conditions.

Concrete Schedule		
Name	Material	Area
Alfresco	exposed aggregate concrete slab	9 m²
Driveway	exposed aggregate concrete slab	77 m²
Porch	exposed aggregate concrete slab	6 m²

RL DETAILS		
GARAGE LEVEL		
PAD	135.550	AHD
CUT	2000mm	
FILL	0mm	
SLAB	135.850	AHD
FIRST FLOOR LEVEL		
PAD	138.460	AHD
CUT	800mm	
FILL	0mm	
SLAB	138.760	AHD

PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTE: STORMWATER DRAINAGE CALCULATED FOR BUILDING ROOF AREAS AND OR PAVED AREAS SHOWN ON THIS PROPOSED DEVELOPMENT ONLY, AND MAY NOT BE ADEQUATE FOR ANY SUBSEQUENT ROOF OR PAVED AREAS.
MIN 100x75 DOWNPIPES (EACH TO DRAIN MAX 40.00m SQU ROOF AREA) DISCHARING INTO 100mm S/W DRAINAGE PIPEWORK (EACH RUN CARRYING MAX CAPACITY OF 8 litres/sec) MIN GRADE TO RUBBLE PITS ON SITE TO BE 1%. ALL STORMWATER & DRAINAGE TO BE IN COMPLIANCE WITH BCA PARTS 3.1.2 & 3.5.2 AS WELL AS ASNZS3500

DISCLAIMER : AS THE SITE LEVELS HAVE BEEN SUPPLIED BY OTHERS WE CANNOT TAKE RESPONSIBILITY FOR THEIR ACCURACY. ALL SITE LEVELS TO BE CHECKED AND CONFIRMED BY BUILDER BEFORE STARTING ANY WORKS.

NOTE : FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.

Site Plan

PRM Design
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LOT 7 GREENWOOD DRIVE,
GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:	HAMPTON 1				
SCALE:	As indicated on A3				
DATE DRAWN:	28/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	101

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	B	01/12/21
REAL PROPERTY DESCRIPTION	TBC	

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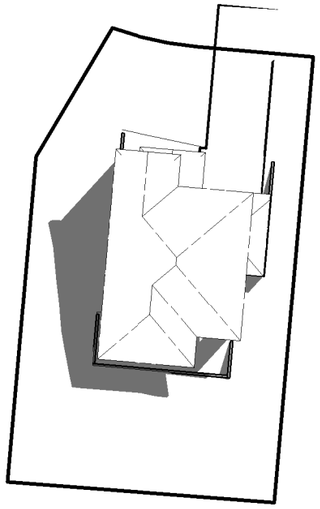
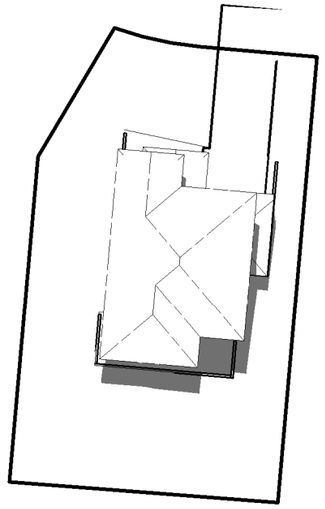
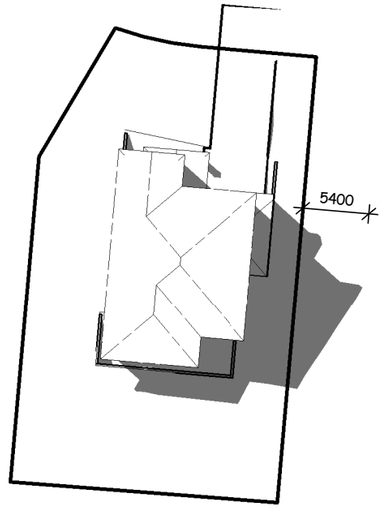


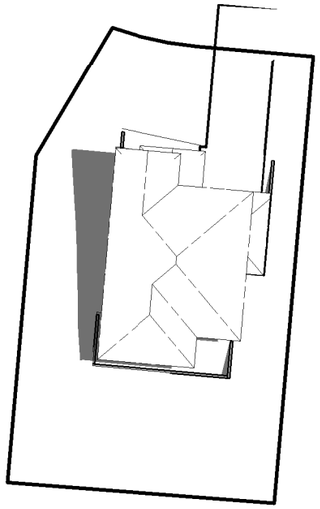
June 1st - 9am



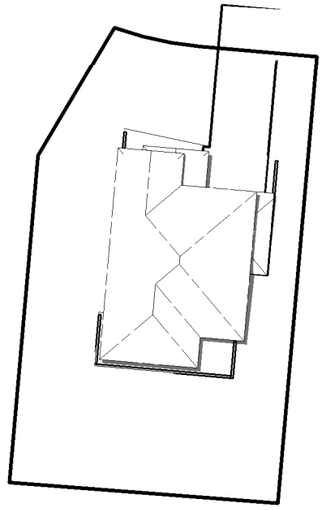
June 1st - 12pm



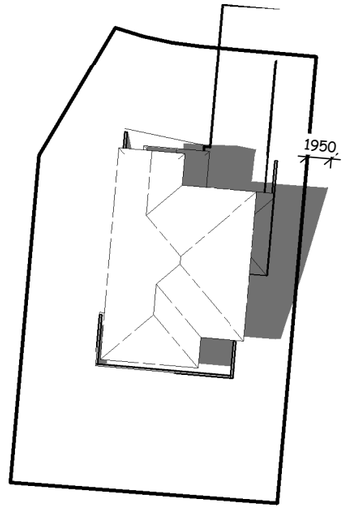
June 1st - 3pm



December 1st - 9am



December 1st - 12pm



December 1st - 3pm

Shadow Diagrams

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LOT 7 GREENWOOD DRIVE,
GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:	HAMPTON 1				
SCALE:	1 : 500 on A3				
DATE DRAWN:	28/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	102

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

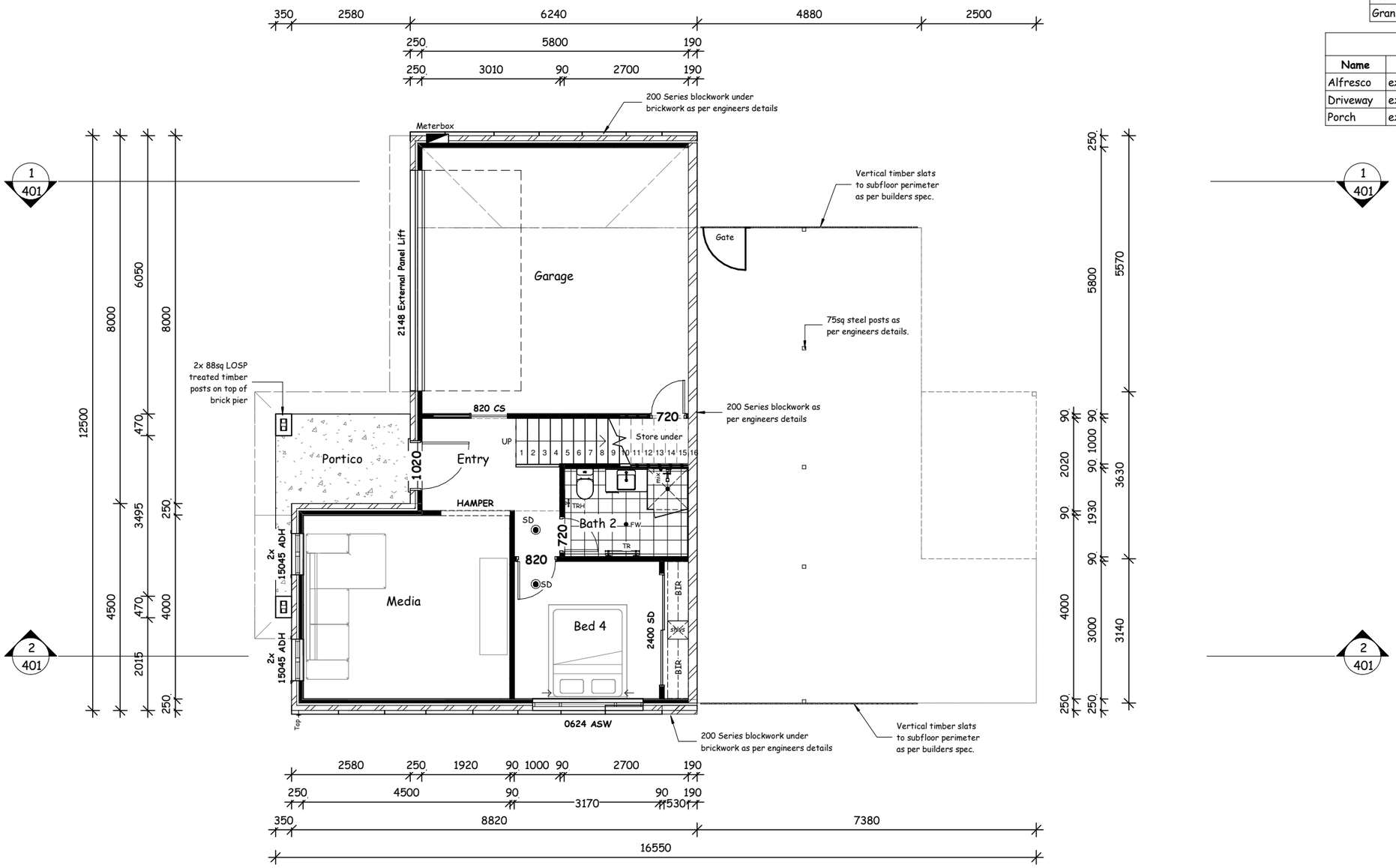
Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	B	01/12/21
REAL PROPERTY DESCRIPTION	TBC	

NOTES :
- FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.
- LIFT OFF HINGES TO WC DOOR
- SARKING TO EXTERNAL WALLS
- INSULATION TO CEILINGS
- ALL SHOWER ROSES TO BE AAA RATED
- WATER PRESSURE LIMITED TO 500 KPA AT THE METER
- ROOMS WITH NO NATURAL VENTILATION ARE TO HAVE MECHANICAL VENTILATION INSTALLED
- PROVIDE WATER AND POWER PROVISION TO DISHWASHER SPACE
- WINDOW, SGD & INTERNAL DOOR SIZES ARE NOMINAL ONLY & TO BE CONFIRMED WITH MANUFACTURER
- ALL DIMENSIONS ON PLAN ARE FRAME SIZES UNO
- ALL ROBE/LINEN SLIDING DOORS ARE SHOWN AS FRAME OPENING WIDTH

Area Schedule		
Name	Area	Squares
Living - First	134.48 m²	14.47
Living - Ground	51.86 m²	5.58
Garage	37.75 m²	4.06
Alfresco	9.08 m²	0.98
Portico	5.03 m²	0.54
Grand total	238.20 m²	25.63

Concrete Schedule		
Name	Material	Area
Alfresco	exposed aggregate concrete slab	9 m²
Driveway	exposed aggregate concrete slab	77 m²
Porch	exposed aggregate concrete slab	6 m²



PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

Ground Floor Plan

PRM Design
~ building design specialists ~

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LOT 7 GREENWOOD DRIVE,
GOONELLABAH NSW

DESIGN:	CUSTOM			WIND CATEGORY:	TBC
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:	HAMPTON 1				
SCALE:	1 : 100 on A3			SOIL CLASS:	TBC
DATE DRAWN:	28/11/21	JOB #:			
DRAWN:	PM	CHECKED: PM	SHEET # 201		

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	B	01/12/21
REAL PROPERTY DESCRIPTION	TBC	

NOTES :
- FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.
- LIFT OFF HINGES TO WC DOOR
- SARKING TO EXTERNAL WALLS
- INSULATION TO CEILINGS
- ALL SHOWER ROSES TO BE AAA RATED
- WATER PRESSURE LIMITED TO 500 KPA AT THE METER
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- ALL DIMENSIONS ON PLAN ARE FRAME SIZES UNO
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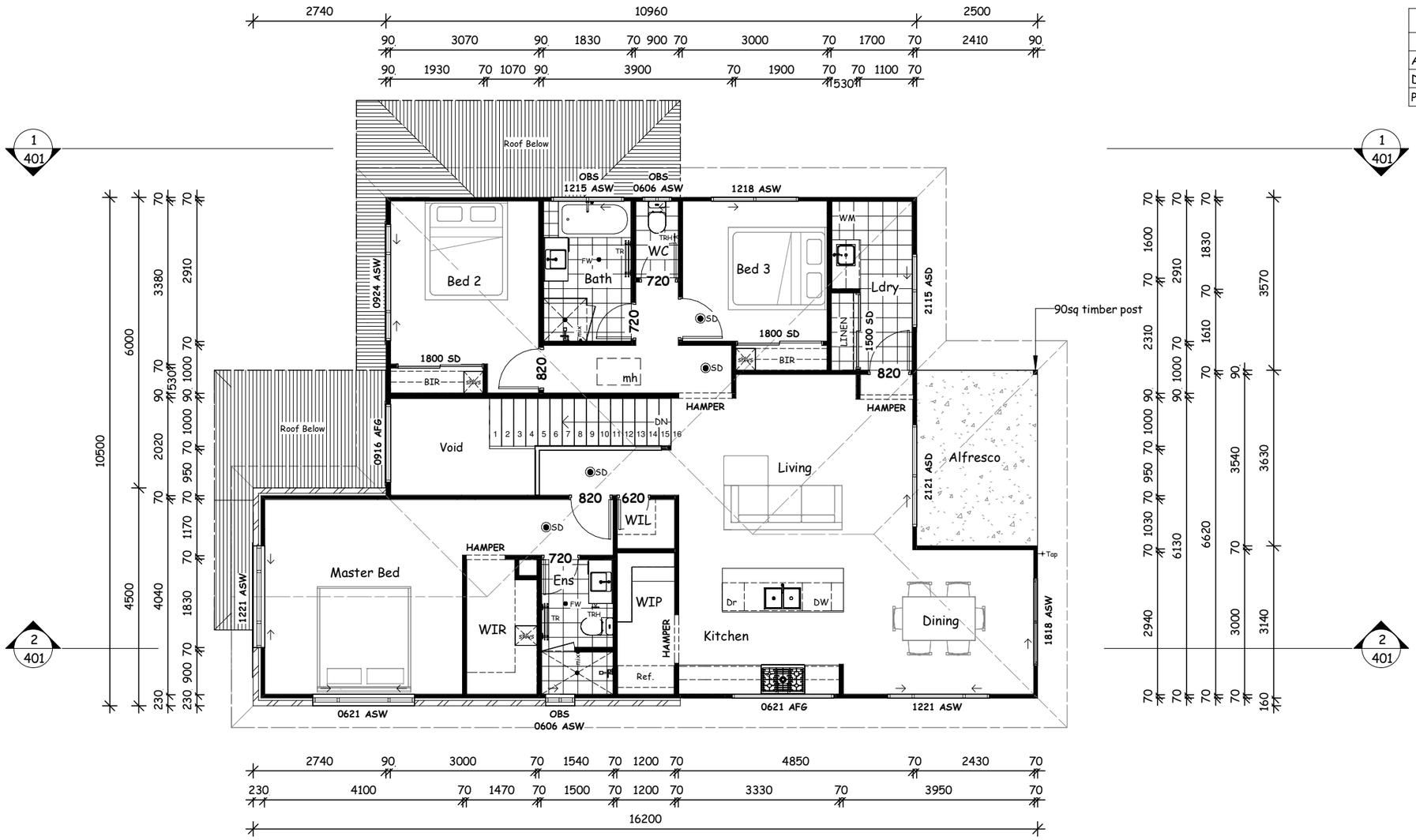
Area Schedule

Name	Area	Squares
Living - First	134.48 m²	14.47
Living - Ground	51.86 m²	5.58
Garage	37.75 m²	4.06
Alfresco	9.08 m²	0.98
Portico	5.03 m²	0.54
Grand total	238.20 m²	25.63

Concrete Schedule

Name	Material	Area
Alfresco	exposed aggregate concrete slab	9 m²
Driveway	exposed aggregate concrete slab	77 m²
Porch	exposed aggregate concrete slab	6 m²



PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

First Floor Plan

PRM Design
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LOT 7 GREENWOOD DRIVE, GOONELLABAH NSW

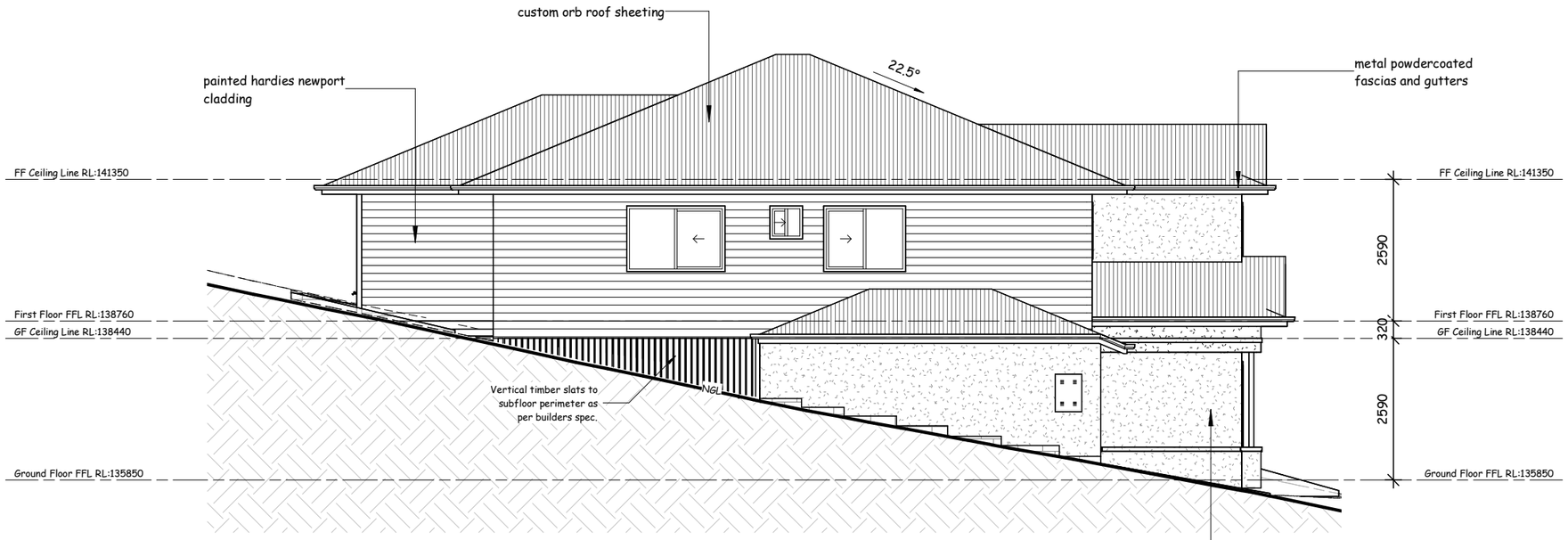
DESIGN:	CUSTOM			WIND CATEGORY:	CLIENT:
PLAN VERSION:	PRELIMINARY PLANS			TBC	
FACADE:	HAMPTON 1				Client/s Signature/s:
SCALE:	1 : 100 on A3			SOIL CLASS:	CURRENT REVISION / ISSUED DATE: B 01/12/21
DATE DRAWN:	28/11/21	JOB #:		TBC	REAL PROPERTY DESCRIPTION: TBC
DRAWN:	PM	CHECKED: PM	SHEET # 202		

PRELIMINARY PLAN

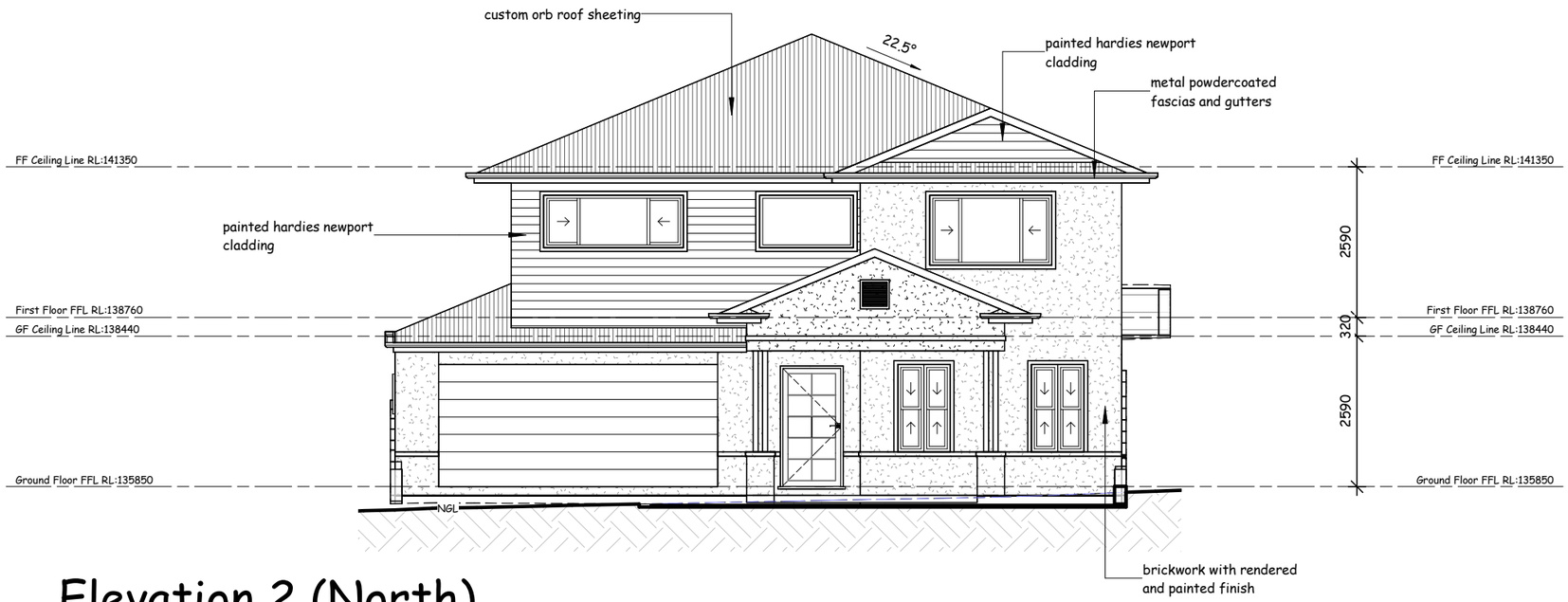
Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTES:

- Refer to colour specifications schedule for detailed internal and external colours/materials
- Articulation joints as per engineering details



Elevation 1 (East)



Elevation 2 (North)

Elevations

PRM Design
~ building design specialists ~

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QBCC Lic: 15065972

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LOT 7 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:	HAMPTON 1				
SCALE:	1 : 100 on A3				
DATE DRAWN:	28/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	301

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

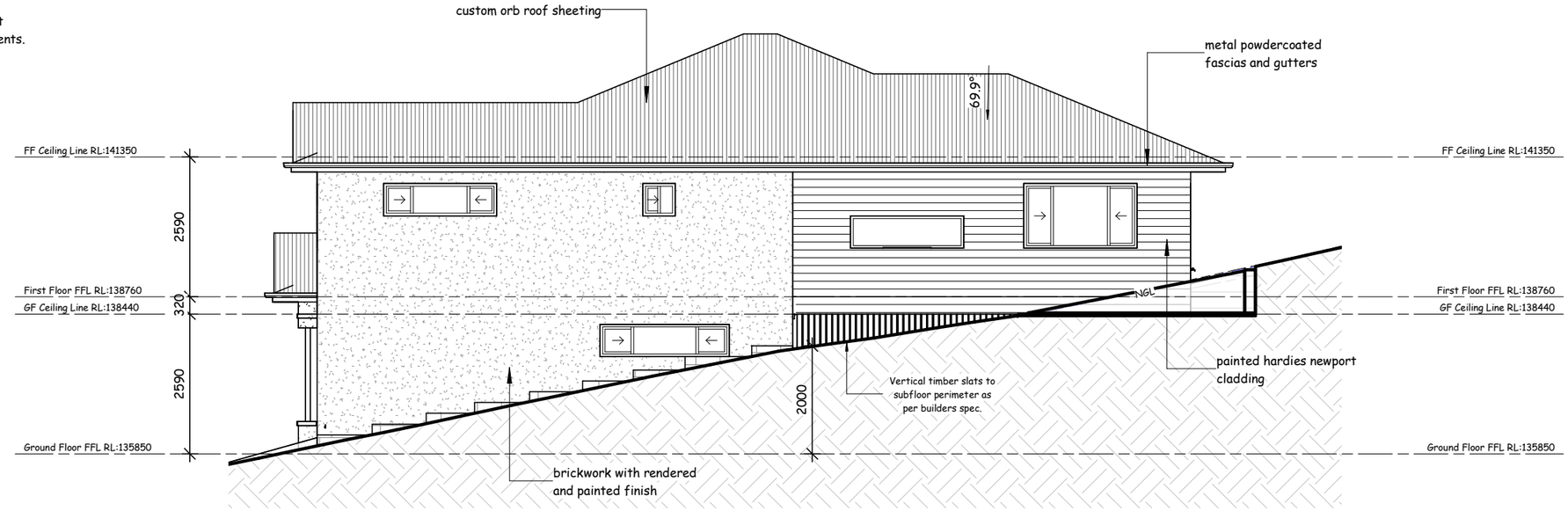
CURRENT REVISION / ISSUED DATE	B	01/12/21
REAL PROPERTY DESCRIPTION	TBC	

PRELIMINARY PLAN

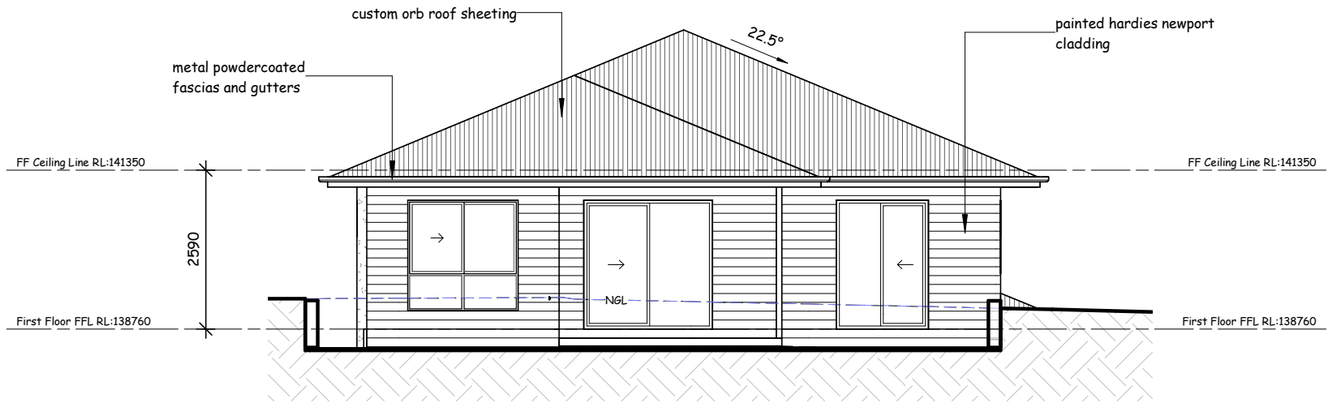
Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTES:

- Refer to colour specifications schedule for detailed internal and external colours/materials
- Articulation joints as per engineering details



Elevation 3 (West)



Elevation 4 (South)

Elevations

PRM Design
~ building design specialists ~

Contact Details:
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E: prmdesign@bigpond.com
QBCC Lic: 15065972

LOT 7 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:	HAMPTON 1				
SCALE:	1 : 100 on A3				
DATE DRAWN:	28/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	302

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

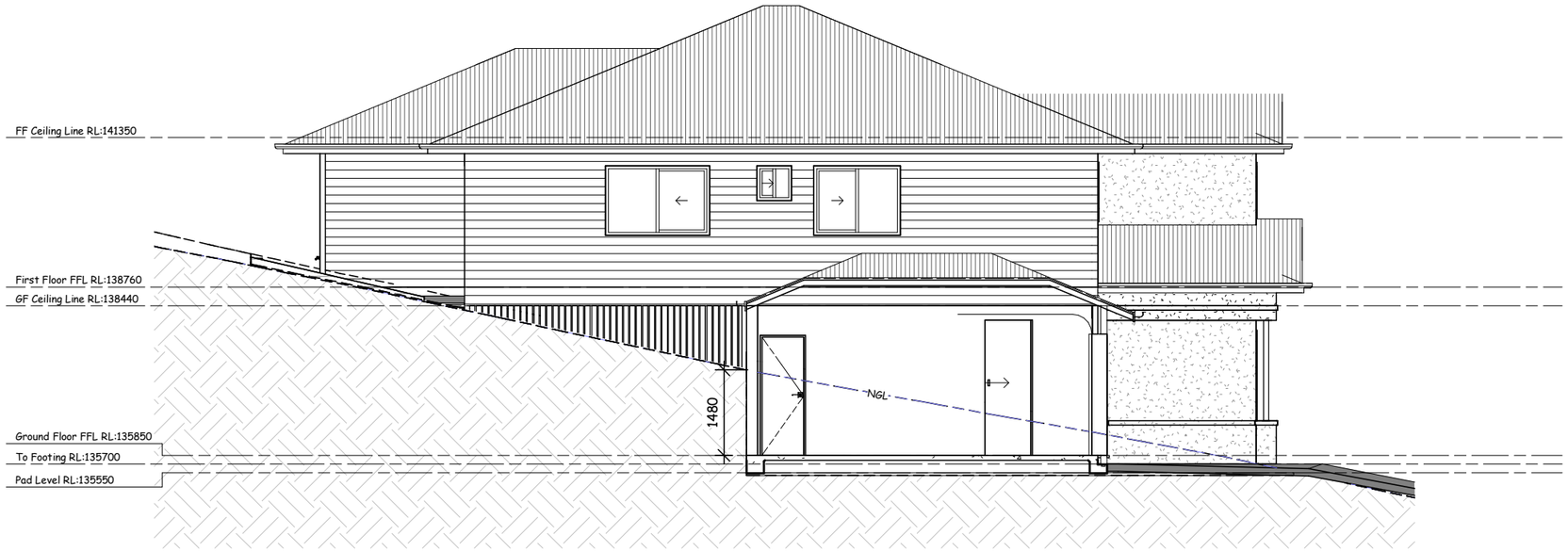
Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	B	01/12/21
REAL PROPERTY DESCRIPTION	TBC	

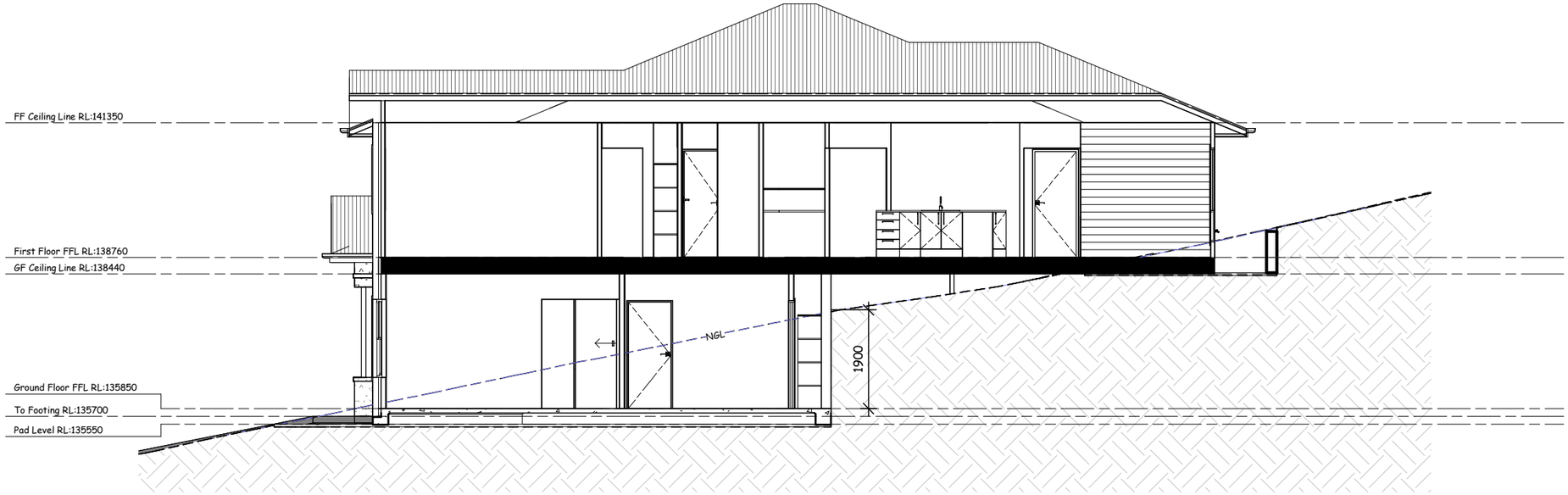
These drawings and documents are the sole property of PRM DESIGN.

PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.



Section 1



Section 2

Sections/Details

PRM Design
~ building design specialists ~

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E: prmdesign@bigpond.com
QBCC Lic: 15065972

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LOT 7 GREENWOOD DRIVE,
GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:	HAMPTON 1				
SCALE:	1 : 100 on A3				
DATE DRAWN:	28/11/21	JOB #:			
DRAWN:	PM	CHECKED:	PM	SHEET #	401

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	B	01/12/21
REAL PROPERTY DESCRIPTION	TBC	

PROPOSED RESIDENCE AT LOT 8 GREENWOOD DRIVE, GOONELLABAH NSW

General Notes :-

Do not scale plans, use written dimensions only.

The owner / builder subcontractor shall verify all dimensions, levels, setbacks and specifications prior to commencing works or ordering materials and shall be responsible for ensuring that all building
works conform to the National Construction Code 2015 (Vol 2) (NCC), current Australian standards, building regulations
and town planning requirements, report any discrepancies to the office.

All works shall comply with but not limited to the NCC and Australian standards listed below.

AS 1288 - 2006 Glass in buildings - selection and installation
AS 1562 - 1999 Design and installation of sheet roof and wall cladding
AS 1684 - 2010 Residential timber-framed construction - design criteria
AS 2049 - 2002 Roof tiles
AS 2050 - 2002 Installation of roof tiles
AS 2870 - 2011 Residential slab and footings
AS / NZS 2904 - 1995 Damp-proof courses and flashings
AS 3600 - 2009 Concrete structures
AS 3660 - 2014 Termite management
AS 3700 - 2011 Masonry structures
AS 3740 - 2010 Waterproofing of domestic wet areas
AS 3786 - 2014 Smoke alarms
AS 4055 - 2012 Wind loads for housing
AS 4100 - 1998 Steel structures

These plans shall be read in conjunction with any structural and civil engineering computations and drawings.

Soil Classification - refer to structural engineers soil test.

All buildings shall be protected against termite attack in accordance with AS 3660.1 - 2014.
and a durable notice shall be placed in the meter box indicating type of barrier and required periodical inspections.

Safety glazing to be used in the following cases :-

(1) All rooms - within 500mm vertical of the floor
(2) Bathrooms - within 1500mm vertical of the bath base
(3) Fully glazed doors
(4) Shower screens
(5) Within 300mm of a door and <1200mm above floor level
(6) Window sizes are nominal only. Actual sizes will vary with manufacturer. Flashings all round.

Stormwater to be taken to the legal point of discharge as determined by the relevant authority.

Tiled balcony's over livable areas are to be in the following order over the floor joists.
19mm compressed fibre cement sheet, with one layer of Parchem Emerproof 750, with a second layer of sand seed with a DFT of 1300 micron, installed to manufacturers specifications, and floor tiles over. All corners to have 20mm mastic sealant under the Parchem Emerproof 750. As per AS 4654

Footings not to encroach title boundaries or easements. It is recommended that where buildings are to be
located in close proximity of boundaries, a check survey be conducted by a licenced surveyor.

All steelwork in masonry to be hot dip galvanized.

All wet areas to comply with NCC 3.8.1.2 and AS 3740. Splashbacks shall be impervious for 150mm above sinks, troughs and hand basins within 75mm of the wall.

Provide wall ties at 600mm spacings both vertical and horizontal and within 300mm of articulation joints. Brick ties to be Galvanised steel.

Sub-floor ventilation minimum 7500mm sq for external walls and 1500mm sq for internal walls below bearer.

Stair requirements - Minimum tread 240mm, minimum riser 115mm, maximum riser 190mm. Space between open treads maximum 125mm. Treads to be non slip surface. Balustrades to be minimum 1000mm above landings with max opening of 125mm and in accordance with NCC 3.9.2.. For stainless steel balustrading, refer to table 3.9.2.1 (Wire balustrade construction - required wire tension and maximum permissible deflection) of the NCC.

The builder shall take all steps necessary to ensure the stability of existing and new structures through-out construction.

◉ Denotes location of smoke detectors (refer electrical layout plans). These are to be hard wired & interconnected with emergency back-up and comply with AS 3786 - 2014.

Wind speed as nominated on bracing plan.
Provide lift-off hinges to w.c. or open out door, or min 1200mm clearance from door to pan.
Exhaust fans from sanitary compartments to be ducted to the outside natural air, or to a vented roof space are as per AS 1668.2 - 2012.
These notes are neither exhaustive nor a substitute for regulations, statutory requirements , building practice or contractual obligations.
All construction materials supplied must take into account proximity to coastal or industrial environments, in accordance with manufacturers specifications.
These plans are protected by copyright and are the property of the author.

Revision	Revision Description	Revision Date
A	Preliminary Issue	29/11/21

Drawing List

Sheet Number	Sheet Name	Current Revision	Current Revision Date	Current Revision Issued By
001	Title Page	A	29/11/21	PM
101	Site Plan	A	29/11/21	PM
102	Shadow Diagrams	A	29/11/21	PM
201	Ground Floor Plan	A	29/11/21	PM
202	First Floor Plan	A	29/11/21	PM
301	Elevations	A	29/11/21	PM
302	Elevations	A	29/11/21	PM
401	Sections/Details	A	29/11/21	PM

Legend

AC	Air Conditioning	SD	Smoked Detector
AFL	Above Floor Level	MW	Microwave
AWW	Aluminium Awning Window	NCC	National Construction Code
ALW	Aluminium Louvre Window	NGL	Natural Ground Line
ASW	Aluminium Sliding Window	OHC	Overhead Cupboard
ADH	Aluminium Double Hung Window	OHS	Overhead Shelves
AFG	Aluminium Fixed Glass Window	PS	Plumbing Stack / Duct
ASD	Aluminium Sliding Door	RL	Relative Level
FB	Fixed Bottom	SL	Sidelight
XOX	Openable/Fixed/Openable	SP	Steel Post
AHD	Australian Height Datum	TRH	Toilet Roll Holder
AS	Australian Standards	TP	Timber Post
BCA	Building Code of Australia	TBC	To be confirmed
CJ	Construction Joint	TR	Towel Rail
CSD	Cavity Sliding Door	UBO	Under Bench Oven
DR	Drawers	WO	Wall Oven
DP	Downpipe	WM	Washing Machine
DW	Dishwasher	DRY	Dryer Machine
AFFL	Above Finish Floor Level	DW	Dishwasher
Mix	Mixer	WIR	Walk In Robe
FW	Floor Waste	OBS	Obscure Glass
HTR	Hand Towel Ring	REF	Refrigerator
HWS	Hot Water System	OMP	Outer Most Projection
LBW	Load Bearing Wall		

NOTE: 3D ARTIST IMPRESSIONS ARE INDICATIVE ONLY. FINAL PRODUCT MAY DIFFER FROM THAT ILLUSTRATED.

Title Page

PRM Design
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QBCC Lic: 15065972

LOT 8 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	1 : 100 on A3				
DATE DRAWN:	29/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	001

WIND CATEGORY: TBC
SOIL CLASS: TBC

CLIENT:
Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	29/11/21
REAL PROPERTY DESCRIPTION	TBC	

These drawings and documents are the sole property of PRM DESIGN.

Note:

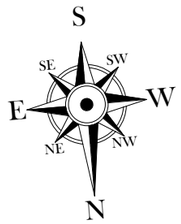
- site works, including retaining walls, may be subject to change to suit final site conditions.

PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

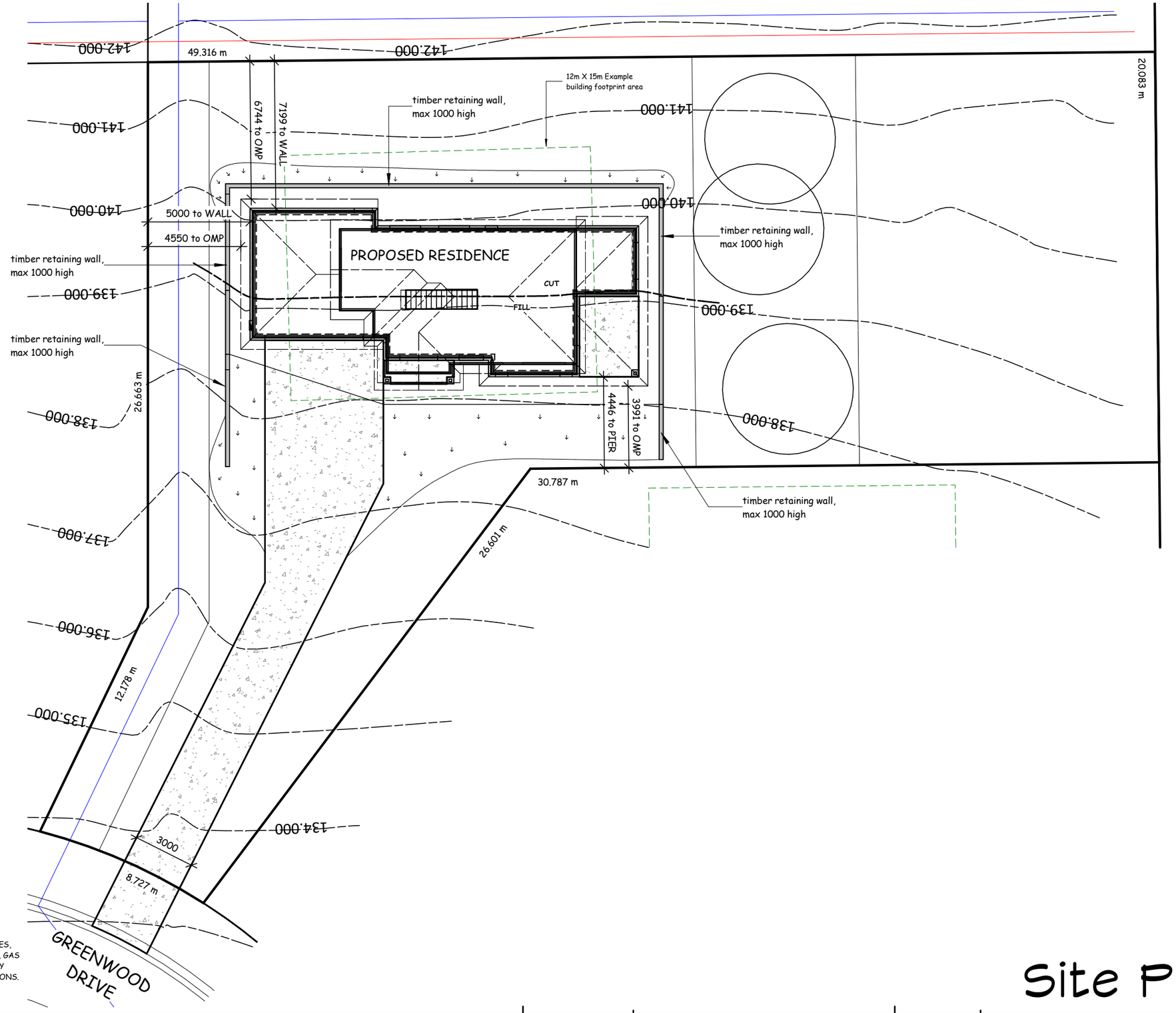
Site Coverage Schedule - Manual Calc		
Site Area	House Footprint Area	Site Coverage
1250 m²	135.00	10.80%

RL Details		
PAD	139.100	AHD
CUT	1300mm	
FILL	1150mm	
SLAB	139.400	AHD



Site Plan

1 : 200



NOTE: STORMWATER DRAINAGE CALCULATED FOR BUILDING ROOF AREAS AND OR PAVED AREAS SHOWN ON THIS PROPOSED DEVELOPMENT ONLY, AND MAY NOT BE ADEQUATE FOR ANY SUBSEQUENT ROOF OR PAVED AREAS.
MIN 100x75 DOWNPIPES (EACH TO DRAIN MAX 40.00m SQU ROOF AREA) DISCHARING INTO 100mm S/W DRAINAGE PIPEWORK (EACH RUN CARRYING MAX CAPACITY OF 8 litres/sec) MIN GRADE TO RUBBLE PITS ON SITE TO BE 1%. ALL STORMWATER & DRAINAGE TO BE IN COMPLIANCE WITH BCA PARTS 3.1.2 & 3.5.2 AS WELL AS ASNZS3500

DISCLAIMER : AS THE SITE LEVELS HAVE BEEN SUPPLIED BY OTHERS WE CANNOT TAKE RESPONSIBILITY FOR THEIR ACCURACY. ALL SITE LEVELS TO BE CHECKED AND CONFIRMED BY BUILDER BEFORE STARTING ANY WORKS.

NOTE : FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.

Site Plan

PRM Design
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LOT 8 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	As indicated on A3				
DATE DRAWN:	29/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	101

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	29/11/21
REAL PROPERTY DESCRIPTION	TBC	

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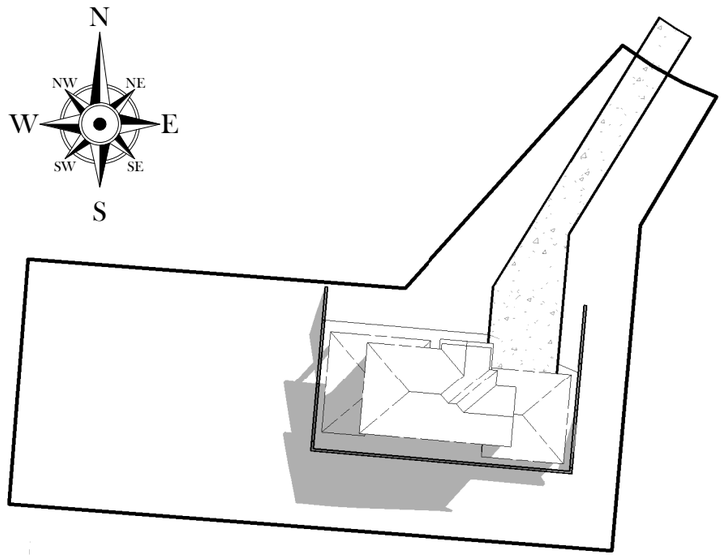
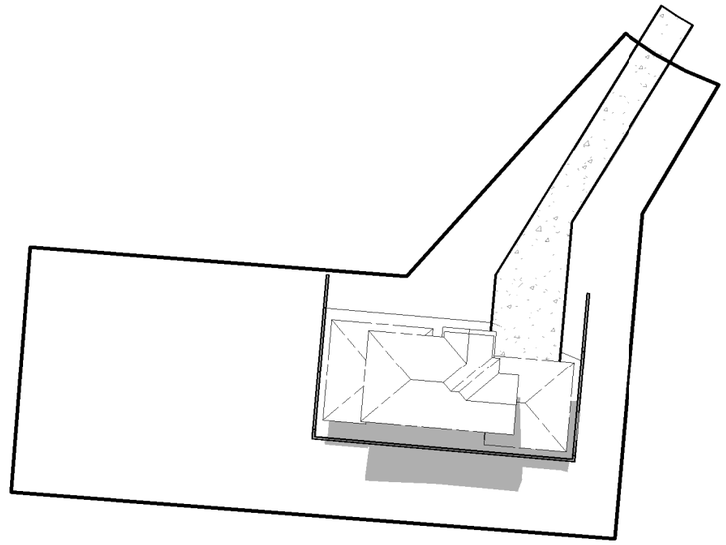
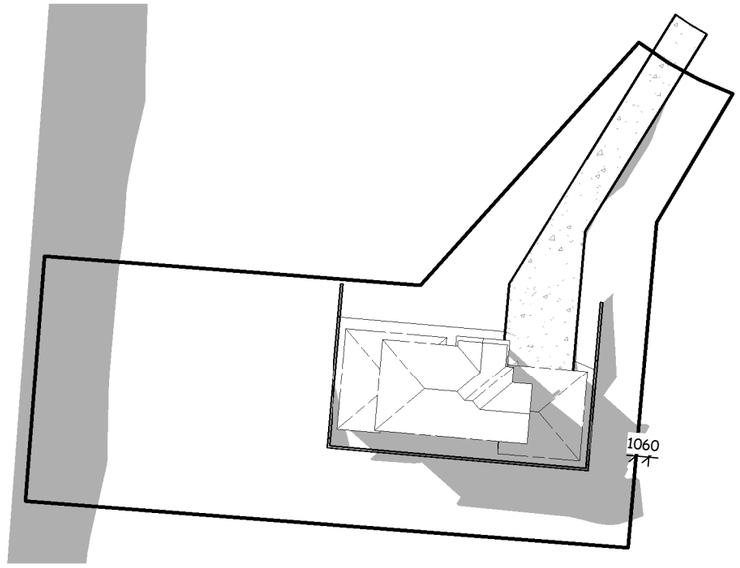


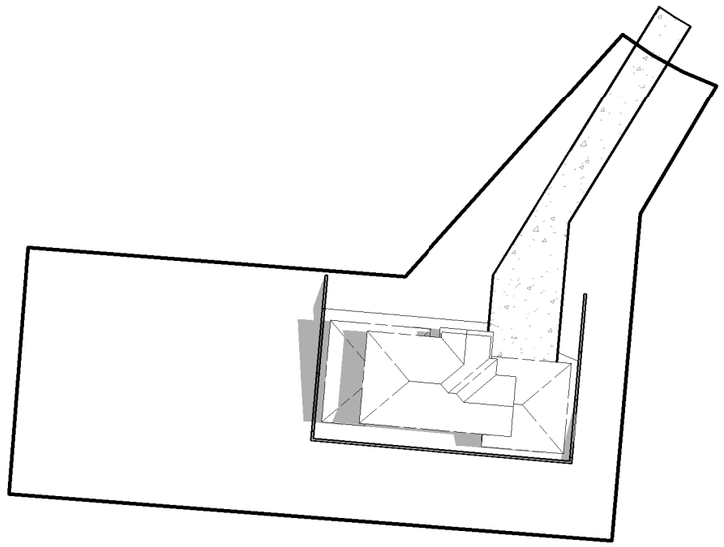
June 1st - 9am



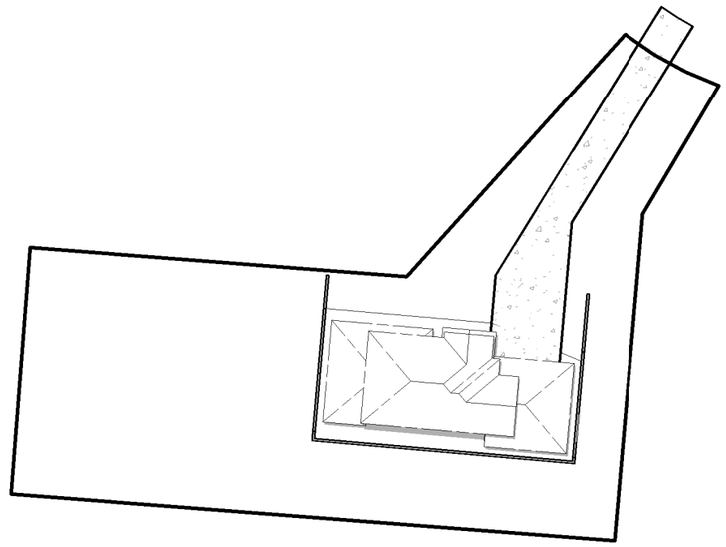
June 1st - 12pm



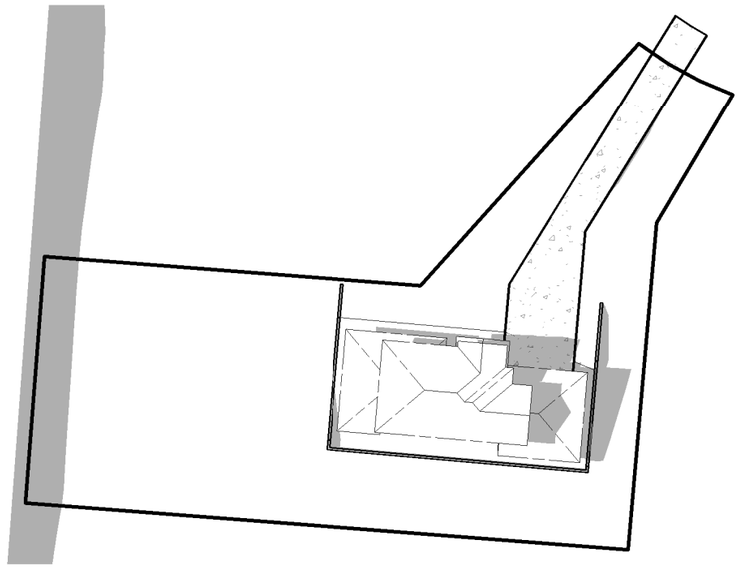
June 1st - 3pm



December 21st - 9am



December 21st - 12pm



December 21st - 3pm

Shadow Diagrams

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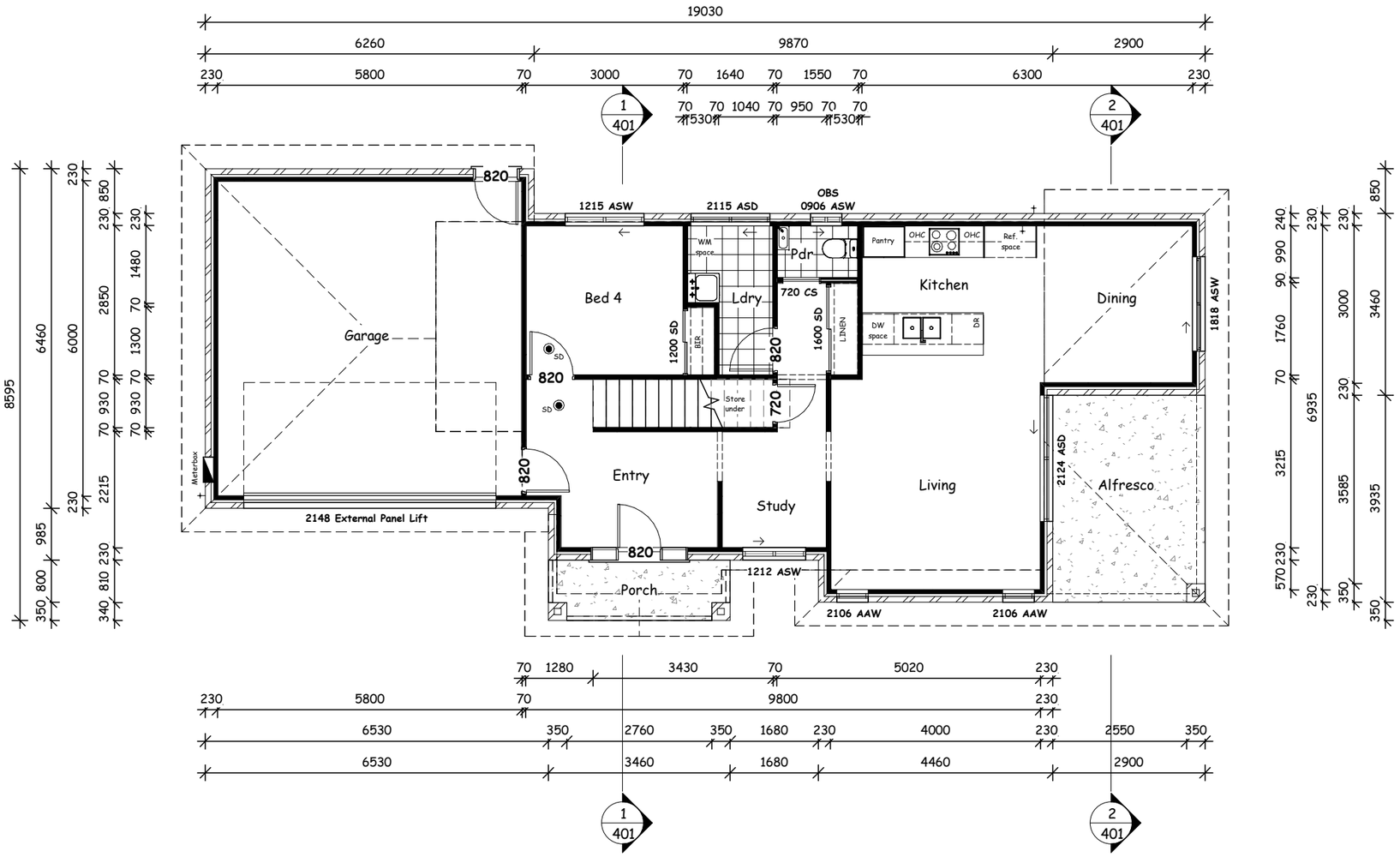
LOT 8 GREENWOOD DRIVE,
GOONELLABAH NSW

DESIGN:	CUSTOM			WIND CATEGORY:	CLIENT:
PLAN VERSION:	PRELIMINARY PLANS			TBC	
FACADE:					Client/s Signature/s:
SCALE:	1 : 500 on A3			SOIL CLASS:	CURRENT REVISION / ISSUED DATE: A 29/11/21
DATE DRAWN:	29/11/21	JOB #:		TBC	REAL PROPERTY DESCRIPTION: TBC
DRAWN:	PM	CHECKED: PM	SHEET # 102		

NOTES :
- FINAL POSITIONS OF DOWNPIPES, METERBOX, TAPS, AC ODU, WATERTANK, GAS BOTTLES AND HOT WATER SYSTEM, MAY DIFFER TO PLAN DUE TO SITE CONDITIONS.
- LIFT OFF HINGES TO WC DOOR
- SARKING & INSULATION TO EXTERNAL WALLS
- INSULATION TO CEILINGS
- ALL SHOWER ROSES TO BE AAA RATED
- WATER PRESSURE LIMITED TO 500 KPA AT THE METER
- ROOMS WITH NO NATURAL VENTILATION ARE TO HAVE MECHANICAL VENTILATION INSTALLED
- PROVIDE WATER AND POWER PROVISION TO DISHWASHER SPACE
- WINDOW, SGD & INTERNAL DOOR SIZES ARE NOMINAL ONLY & TO BE CONFIRMED WITH MANUFACTURER
- ALL DIMENSIONS ON PLAN ARE FRAME SIZES UNO
- ALL ROBE/LINEN SLIDING DOORS ARE SHOWN AS FRAME OPENING WIDTH

Area Schedule		
Name	Area	Squares
Living - Ground	79.72 m²	8.58
Living - First	72.93 m²	7.85
Garage	39.15 m²	4.21
Alfresco	11.41 m²	1.23
Porch	3.98 m²	0.43
Grand total	207.19 m²	22.29

Concrete Schedule		
Name	Material	Area
alfresco	exposed aggregate concrete slab	11 m²
driveway	exposed aggregate concrete slab	125 m²
porch	exposed aggregate concrete slab	4 m²



PRELIMINARY PLAN

Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

Ground Floor Plan

PRM Design
~ building design specialists ~

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LOT 8 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	1 : 100 on A3				
DATE DRAWN:	29/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	201

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	29/11/21
REAL PROPERTY DESCRIPTION	TBC	

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NOTES :
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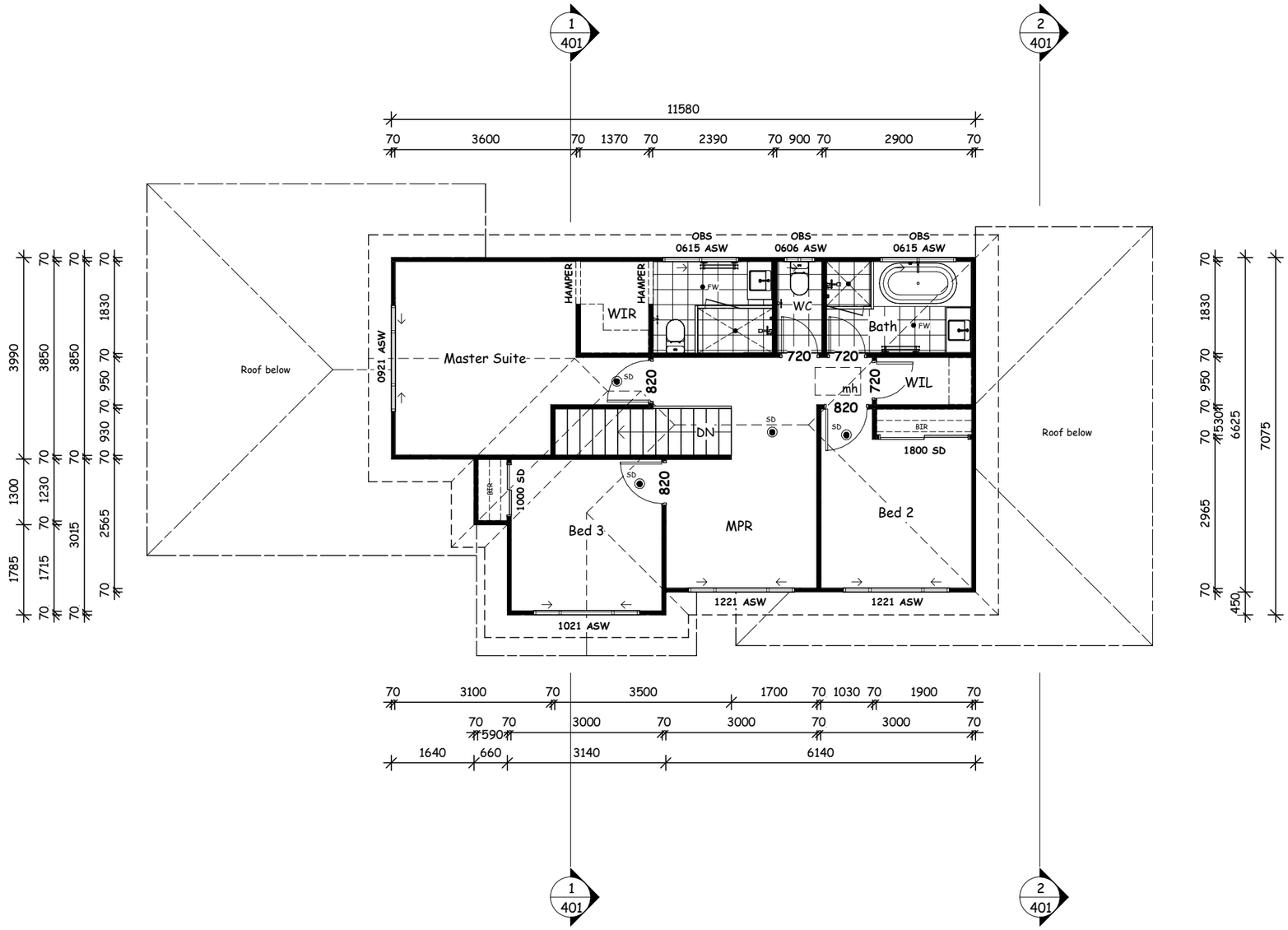

PRELIMINARY PLAN

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First Floor Plan

PRM Design
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LOT 8 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
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FACADE:					
SCALE:	1 : 100 on A3				
DATE DRAWN:	29/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	202

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	29/11/21
REAL PROPERTY DESCRIPTION	TBC	

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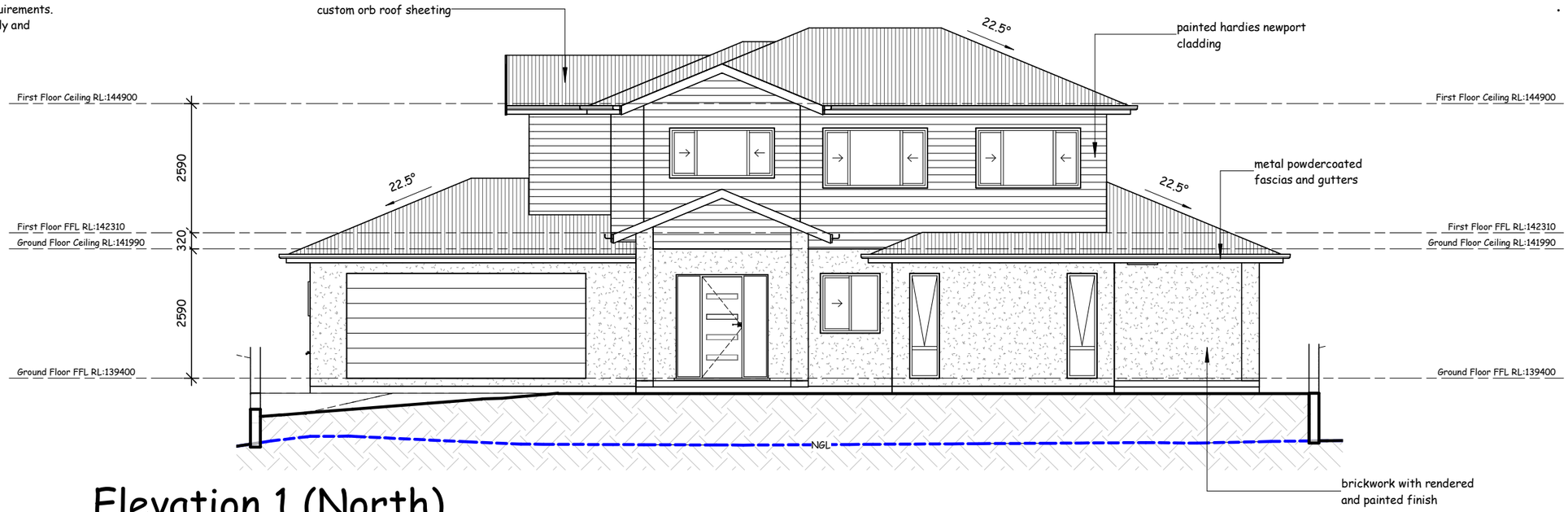
PRELIMINARY PLAN

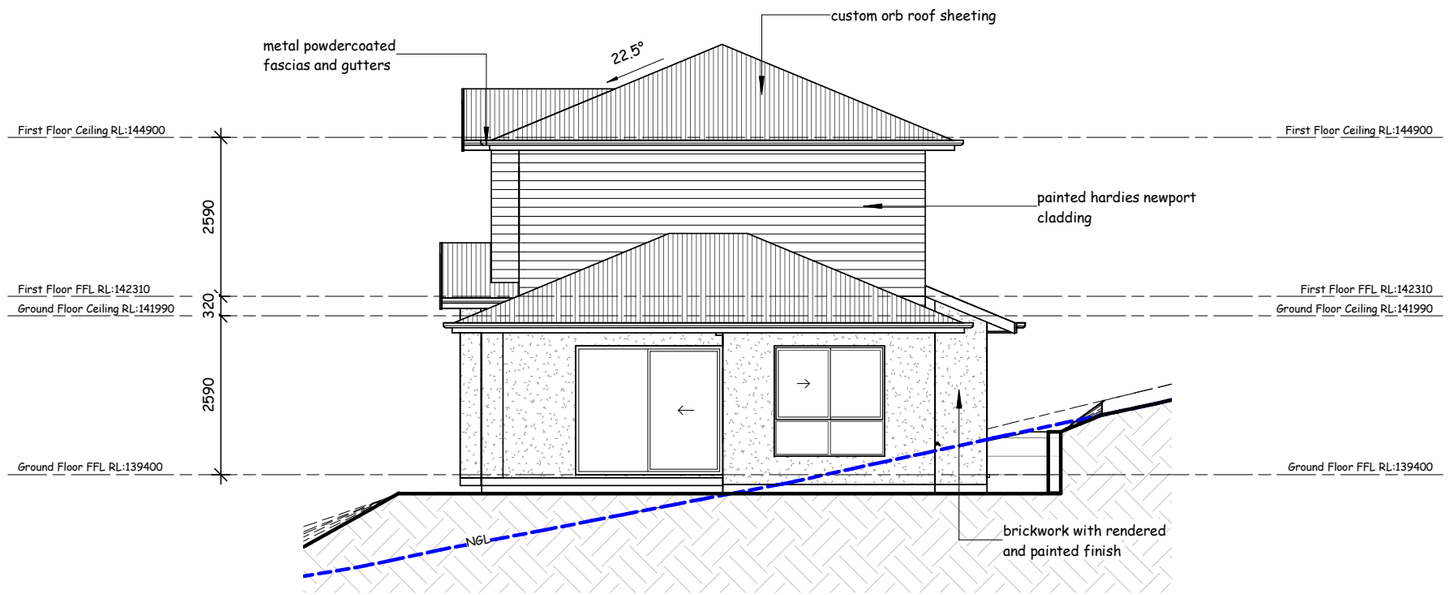
Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTES:

- Refer to colour specifications schedule for detailed internal and external colours/materials
- Articulation joints as per engineering details



Elevation 1 (North)



Elevation 2 (West)

Elevations

PRM Design
~ building design specialists ~

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LOT 8 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	1 : 100 on A3				
DATE DRAWN:	29/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	301

WIND CATEGORY: TBC

SOIL CLASS: TBC

CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	29/11/21
REAL PROPERTY DESCRIPTION	TBC	

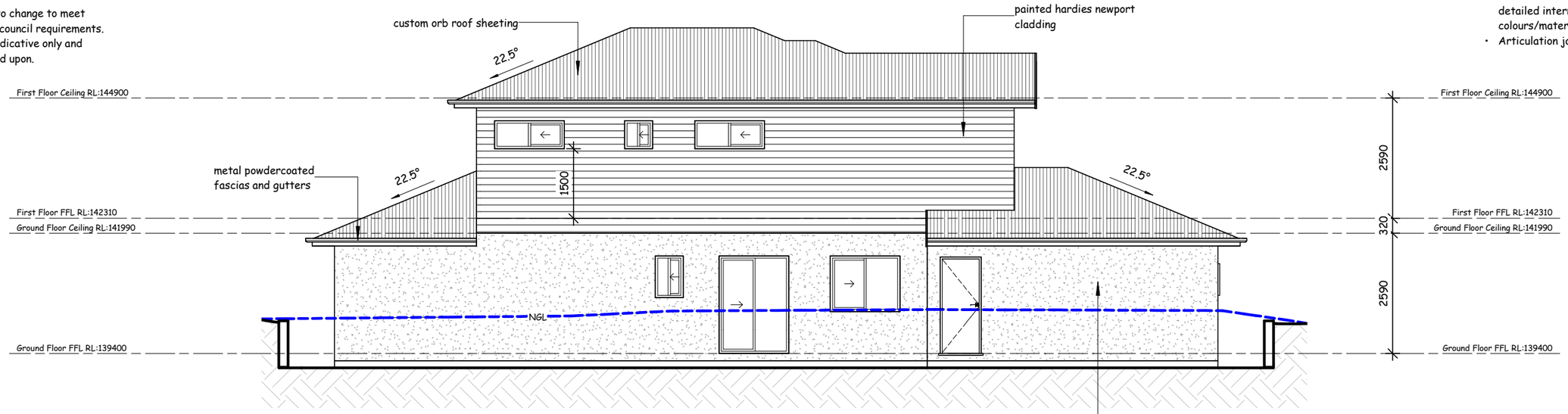
These drawings and documents are the sole property of PRM DESIGN.

PRELIMINARY PLAN

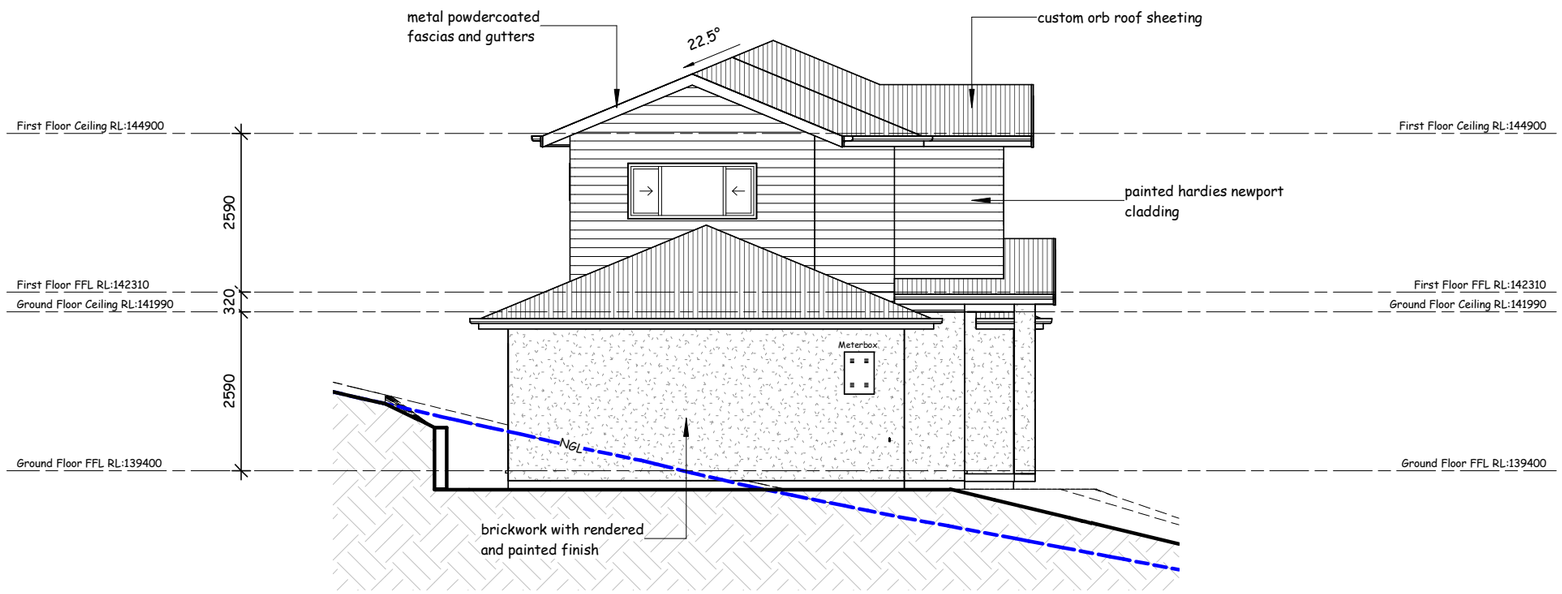
Plans are subject to change to meet site and covenant/council requirements. Ground lines are indicative only and should not be relied upon.

NOTES:

- Refer to colour specifications schedule for detailed internal and external colours/materials
- Articulation joints as per engineering details



Elevation 3 (South)



Elevation 4 (East)

Elevations

PRM Design
~ building design specialists ~

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QBCC Lic: 15065972

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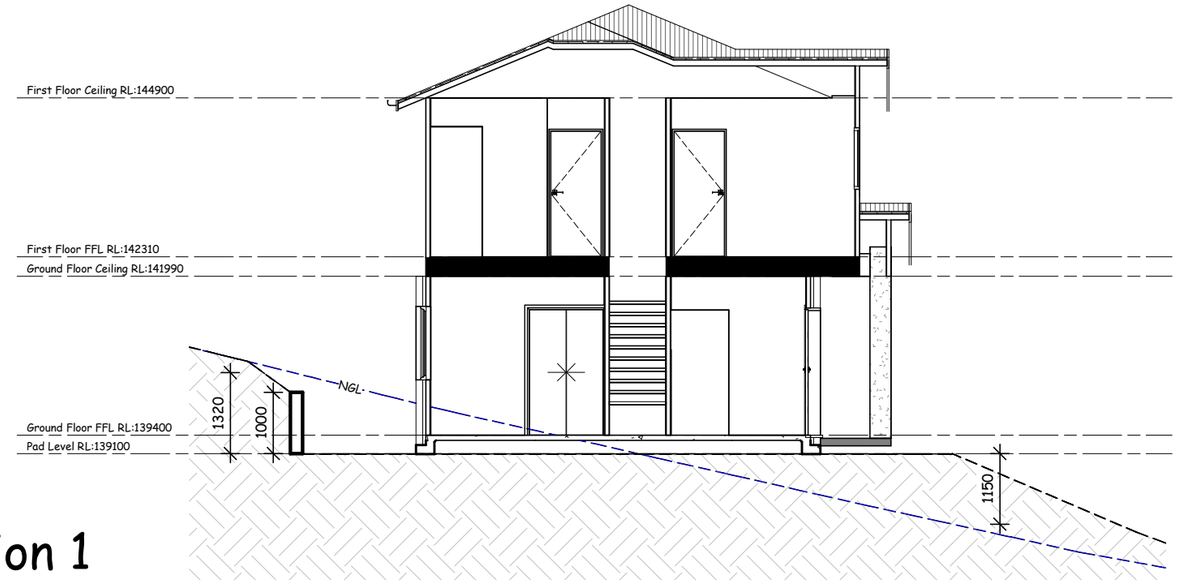
LOT 8 GREENWOOD DRIVE, GOONELLABAH NSW

DESIGN:	CUSTOM			WIND CATEGORY:	CLIENT:
PLAN VERSION:	PRELIMINARY PLANS			TBC	
FACADE:					Client/s Signature/s:
SCALE:	1 : 100 on A3			SOIL CLASS:	
DATE DRAWN:	29/11/21	JOB #:		TBC	CURRENT REVISION / ISSUED DATE: A 29/11/21
DRAWN:	PM	CHECKED: PM	SHEET # 302		REAL PROPERTY DESCRIPTION: TBC

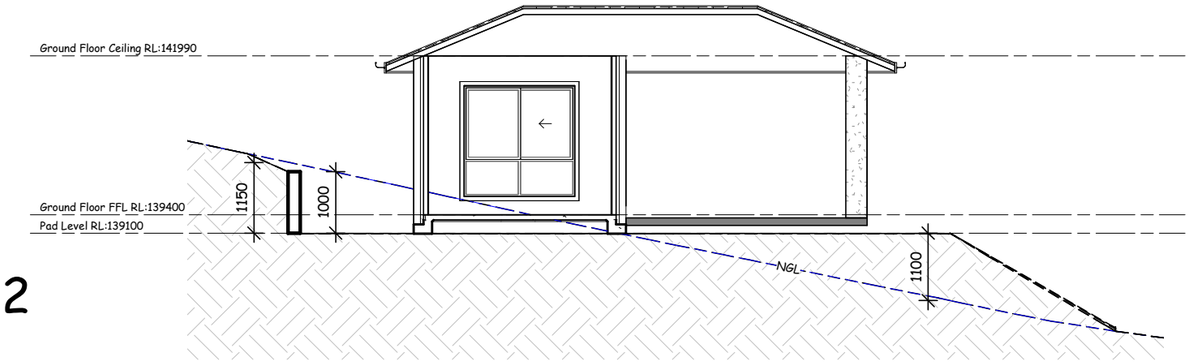
PRELIMINARY PLAN

Plans are subject to change to meet
site and covenant/council requirements.
Ground lines are indicative only and
should not be relied upon.



Section 1

1 : 100



Section 2

1 : 100

Sections/Details

PRM Design
~ building design specialists ~

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QBCC Lic: 15065972

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LOT 8 GREENWOOD DRIVE,
GOONELLABAH NSW

DESIGN:	CUSTOM				
PLAN VERSION:	PRELIMINARY PLANS				
FACADE:					
SCALE:	1 : 100 on A3				
DATE DRAWN:	29/11/21		JOB #:		
DRAWN:	PM	CHECKED:	PM	SHEET #	401

WIND CATEGORY: TBC

SOIL CLASS: TBC

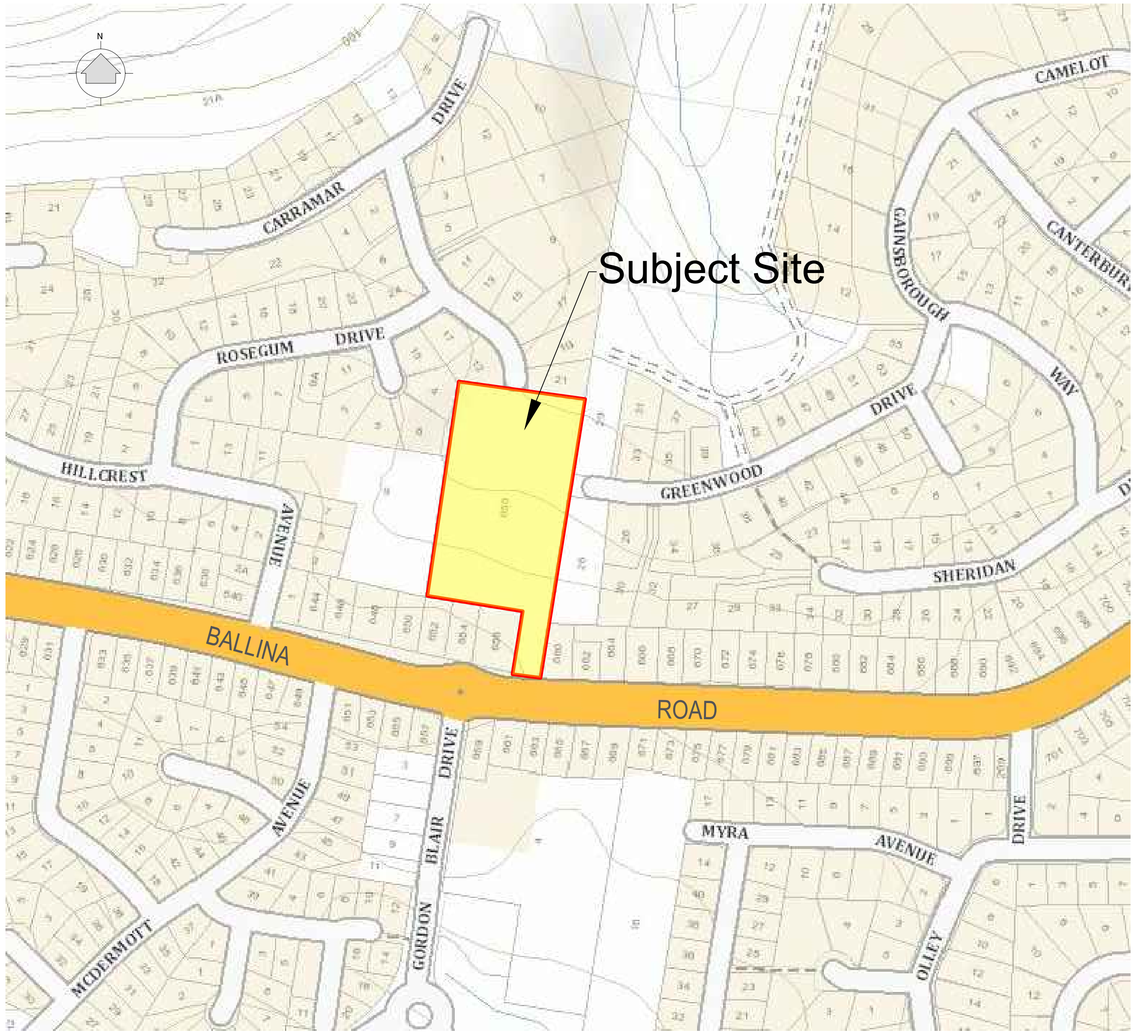
CLIENT:

Client/s Signature/s: .....

CURRENT REVISION / ISSUED DATE	A	29/11/21
REAL PROPERTY DESCRIPTION	TBC	

Development Application - Engineering Design Plans

658 Ballina Road, Goonellabah , NSW
Subdivision of Lot 4 in DP406893



File Ref: 21037-26.dwg

Title	Sheet No.	Rev No.
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Site Layout Existing - Overview	2	5
Site Layout Proposed - Overview	3	5
Lot Layout	4	5
Greenwood Drive Layout	5	5
Greenwood Drive Longitudinal Section	6	5
Greenwood Drive Cross Sections	7 - 9	5
Shared Driveway Layout (Lots 2, 3 & 4)	10	5
Shared Driveway Longitudinal Section	11	5
Shared Driveway Cross Sections	12 - 13	5
Electricity and Telecom Layout Plan	14	5
Sewer and Water Reticulation Layout Plan	15	5
Stormwater Drainage Layout Plan	16	5
Stormwater Basin Layout	17	5
Stormwater Basin Sections	18	5
Asset Protection Zone Sections	19	5
Bulk Earthworks Plan	20	5

Issue #	Changes	Drawn	Approved	Date
5	Additional notation added	DF	ARR	17/03/22
4	Amended design to suit revised lot layout	DF	ARR	25/02/22
3	Further amendments to address respondents feedback	DF	ARR	5/11/21
2	Amendments to address respondents feedback	DF	ARR	28/10/21
1	Original	DF	ARR	5/10/21

RCS GROUP
SURVEY PLAN DESIGN MANAGE

Suite 2, 80 Conway Street, Lismore NSW 2480
PO Box 4053 Goonellabah NSW 2480
P: (02) 6622 2112 F: (02) 6622 2107
E: info@surveyor.com.au ABN 54 055 030 576

LEGEND

- Site Boundary
- Property Boundary
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Bank Change of Grade
- Top of Bank
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- Existing Sealed Road

RCS GROUP
SURVEY PLAN DESIGN MANAGE

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Consulting Surveyors NSW

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IMPORTANT NOTES

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Drawing Title
EXISTING LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

N
GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		2 of 20

LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

PROPOSED LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

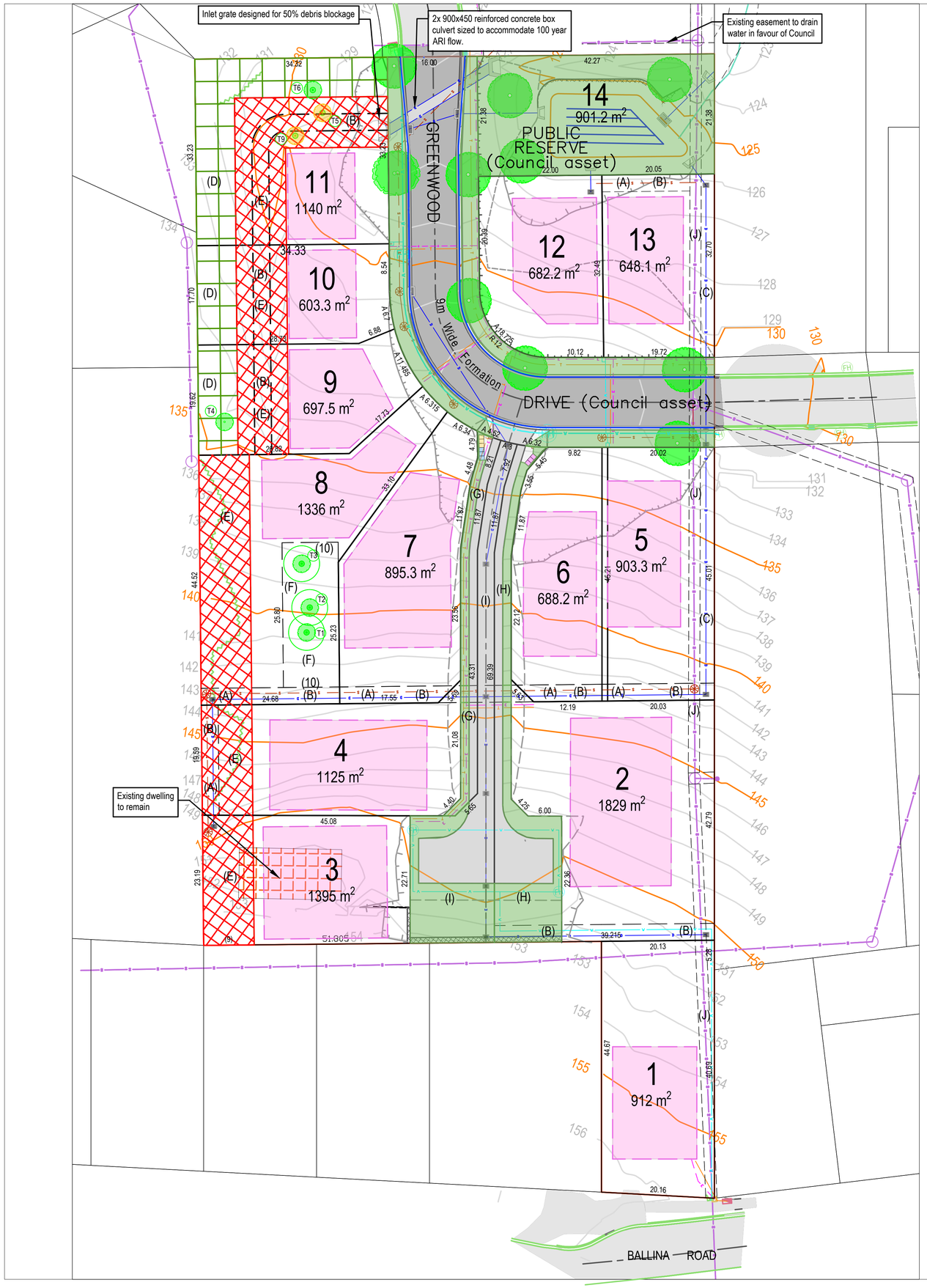
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

N
GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		3 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Tree to be retained
- Tree to be removed
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- New Hydrant
- Swale Bund (300mm freeboard)
- Swale Alignment
- Footpath
- Tree Identification Number
- New Koala Food Tree

Lot No	Lot Area m²	Available Building Area m²	Area in excess of minimum building envelope (12x15=180 m²)
1	912	300	120
2	1829	540	360
3	1395	440	260
4	1125	448	268
5	903.3	338	158
6	688.2	331	151
7	895.3	501	321
8	1336	326	146
9	697.5	268	88
10	603.3	188	8
11	1140	183	3
12	682.2	318	138
13	648.1	301	121
14	901.2	N/A	N/A

AVERAGE RESIDENTIAL LOT AREA : 989 m²
AVERAGE BUILDING ENVELOPE AREA : 345 m²

(A) Easement to Drain Sewage 3 Wide
(B) Easement to Drain Water 3 Wide
(C) Easement to Drain Water Variable Width
(D) Easement for Koala Corridor 7 Wide
(E) Easement for Bushfire Protection (APZ) 9 Wide
(F) Easment for Tree Protection 10 Wide
(G) Easement for Access and Services 3 Wide and Variable
(H) Easement for Access and Services 3 Wide and Variable
(I) Easement for Access and Services 3 Wide and Variable
(J) Easement for Sewerage Purposes Limited in Height & Depth - T249054 (DP 612269)

Koala Corridor 7m Wide

Bushfire Asset Protection Zone (APZ) 9m Wide

Available Building Area
6m setback from Road Frontages and 1m setback from Lot side boundaries and easements boundaries

Land to be dedicated to council:
Greenwood Drive (9 Wide)
Lot 14 - Public Reserve (901.2m²)

Assets to be dedicated to Council and timing of dedication

Greenwood Drive Extension – Subdivision works certification
Laneway – Subdivision works certification
Bio-Retention Basin – Subdivision works certification

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Drawing Title
LOT LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn DF	*Date Surveyed* 23/07/21
Designed DF	*Approved* ARR	*Date Issued* 17/03/22
	Locality Goonellabah	*Drawing No* 21037-CIV
Parish Lismore	*County* Rous	*Revision No.* 5
Local Government Area Lismore		*Sheet No* 4 of 20

62
DP 715333

65
DP 715333

19
DP 258652

20
DP 258652

4
DP 221919

2
DP 1255349

1
DP 1255349

Overland flow diversion drain

drain

diversion

flow

Overland

Greenwood

Drive

(Council asset)

PUBLIC
RESERVE
(Council asset)

14

11

12

13

10

9

8

7

6

5

CH 20.00
CH 37.30
CH 40.00
CH 60.00
CH 79.07
CH 80.00
CH 100.00
CH 110.28
CH 120.00
CH 140.00
CH 160.00
CH 168.90

LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
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- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
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Drawing Title
GREENWOOD DRIVE LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

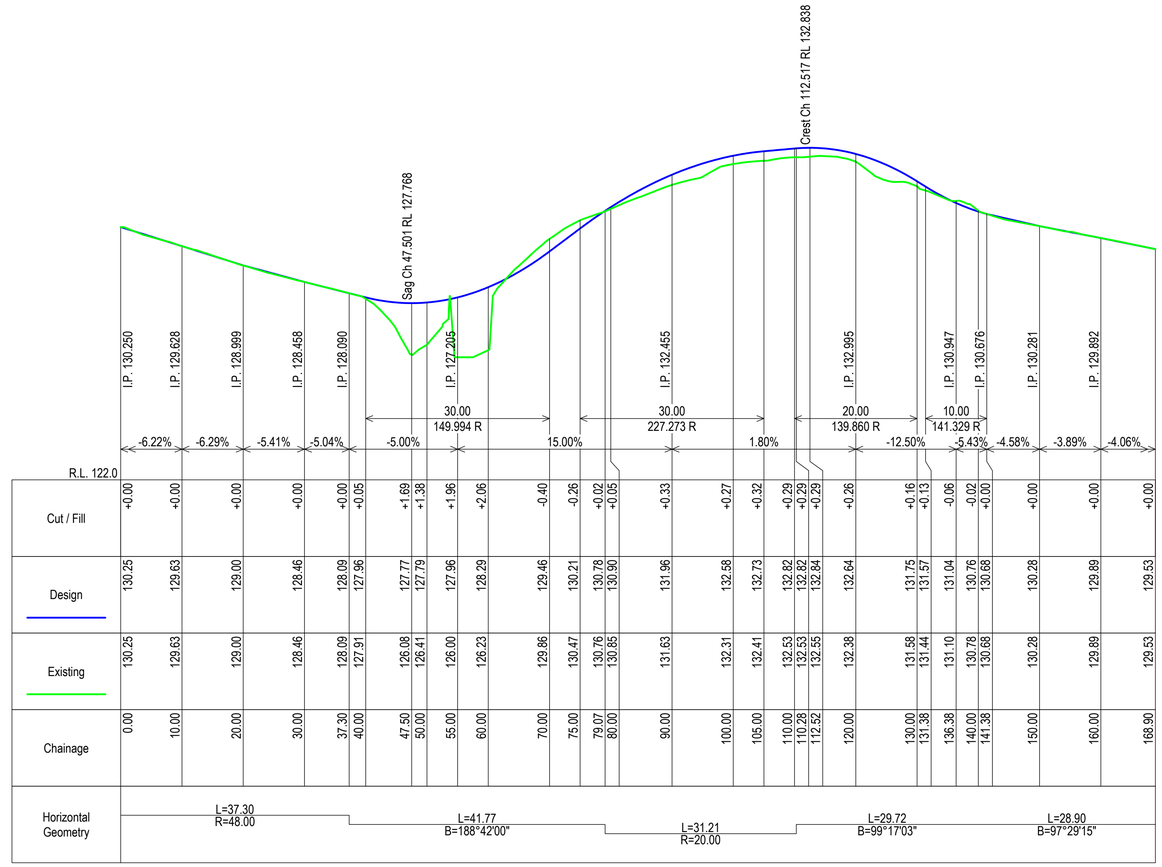
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

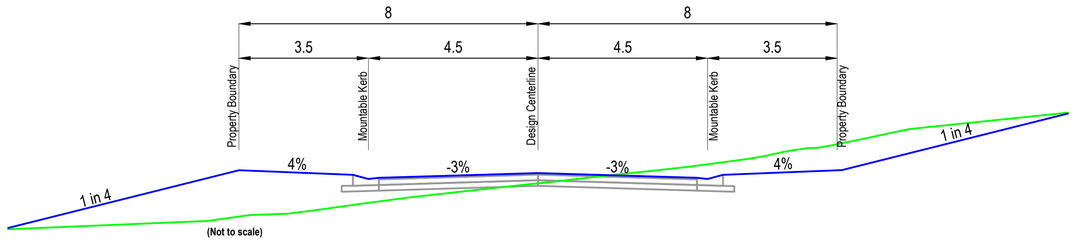
	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**5** of **20**



H 1:500
V 1:100

Greenwood Drive - Ch.0.00 to Ch.168.90

Typical Section - Greenwood Drive (16 wide)



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Drawing Title
GREENWOOD DRIVE LONGITUDINAL SECTION

Project
Development Application
Subdivision of Lot 4 DP 406893

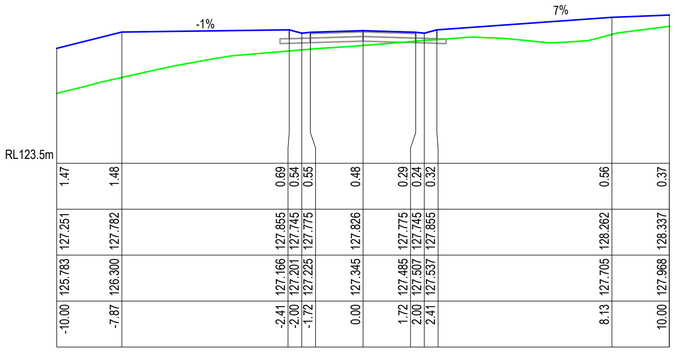
Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn **DF**	*Date Surveyed* **23/07/21**
Designed **DF**	*Approved* **ARR**	*Date Issued* **17/03/22**
	Locality **Goonellabah**	*Drawing No* **21037-CIV**
Parish **Lismore**	*County* **Rous**	*Revision No.* **5**
Local Government Area **Lismore**		*Sheet No* **6** of **20**



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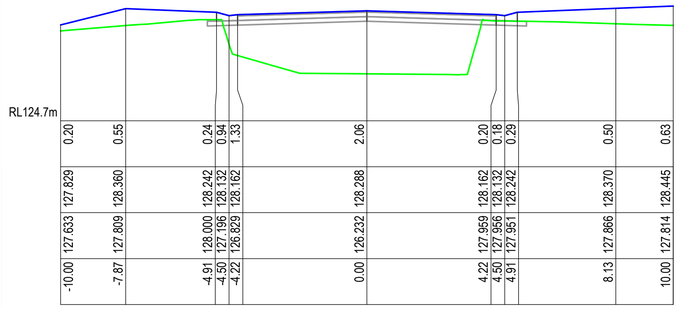
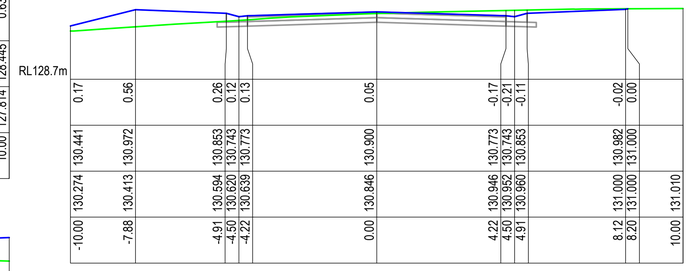
125.783	126.300	127.166	127.201	127.225	127.345	127.485	127.507	127.537	127.705	127.968
127.251	127.782	127.855	127.745	127.775	127.826	127.775	127.745	127.855	128.262	128.337
1.47	1.48	0.69	0.54	0.55	0.48	0.29	0.24	0.32	0.56	0.37

Ch 43.30 m



-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	10.00
127.633	127.809	128.000	127.196	126.829	126.232	127.959	127.956	127.951	127.866	127.814
127.829	128.360	128.242	128.132	128.162	128.288	128.162	128.132	128.242	128.370	128.445
0.20	0.55	0.24	0.94	1.33	2.06	0.20	0.18	0.29	0.50	0.63

Ch 60.00 m



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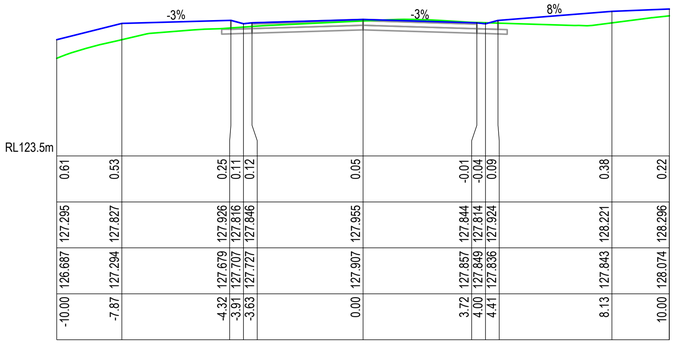
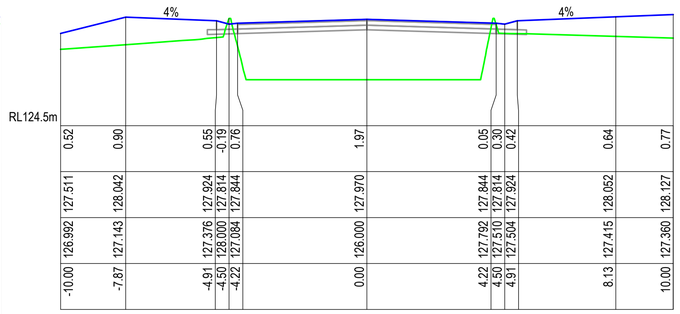
130.274	130.413	130.594	130.620	130.639	130.846	130.946	130.952	130.960	131.000	131.000	131.010
130.441	130.972	130.853	130.743	130.773	130.900	130.773	130.743	130.853	130.982	131.000	
0.17	0.56	0.26	0.12	0.13	0.05	-0.17	-0.21	-0.11	-0.02	0.00	

Ch 80.00 m



-10.00	-7.87	-4.32	-3.91	-3.63	0.00	3.72	4.00	4.41	8.13	10.00	
126.687	127.294	127.679	127.707	127.727	127.907	127.857	127.849	127.836	127.843	128.074	
127.295	127.827	127.926	127.816	127.846	127.955	127.844	127.814	127.924	128.221	128.296	
0.61	0.53	0.25	0.11	0.12	0.05	-0.01	-0.04	0.09	0.38	0.22	

Ch 40.00 m



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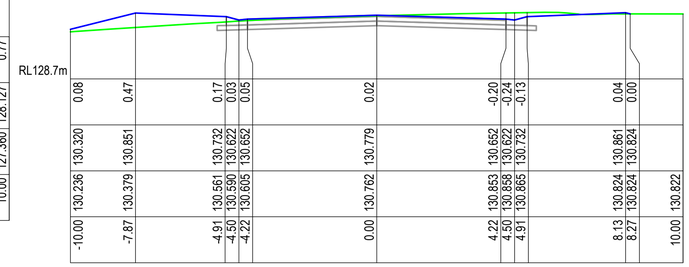
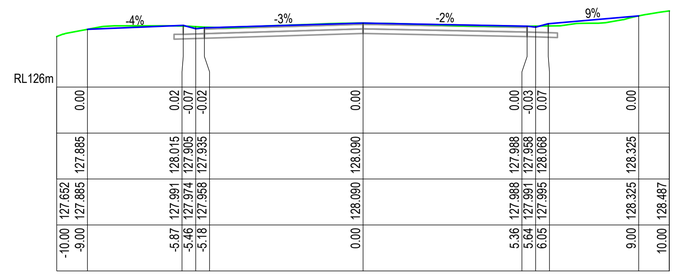
126.992	127.143	127.376	128.000	127.084	126.000	127.792	127.510	127.504	127.415	127.360
127.511	128.042	127.924	127.814	127.844	127.970	127.844	127.814	127.924	128.052	128.127
0.52	0.90	0.55	-0.19	0.76	1.97	0.05	0.30	0.42	0.64	0.77

Ch 55.30 m



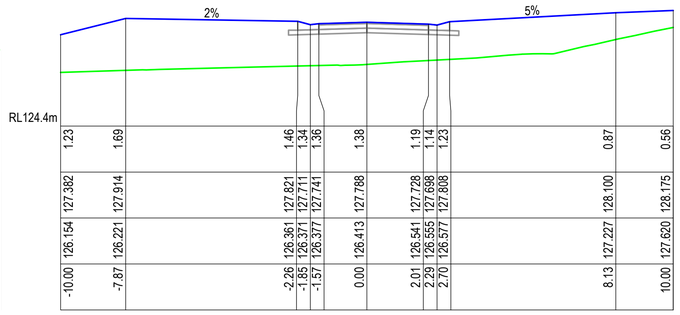
-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.27	10.00
130.236	130.379	130.561	130.590	130.605	130.762	130.853	130.858	130.865	130.824	130.824	130.822
130.320	130.851	130.732	130.622	130.652	130.779	130.652	130.622	130.732	130.861	130.824	
0.08	0.47	0.17	0.03	0.05	0.02	-0.20	-0.24	-0.13	0.04	0.00	

Ch 79.07 m



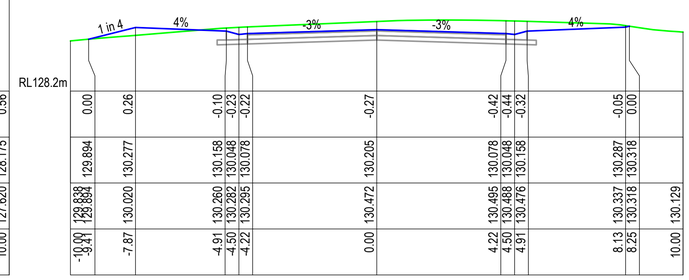
-10.00	-9.00	-5.87	-5.46	-5.18	0.00	5.36	5.64	6.05	9.00	10.00
127.652	127.885	127.991	127.974	127.958	128.090	127.988	127.991	127.995	128.325	128.487
127.885	127.885	128.015	127.905	127.935	128.090	127.988	127.958	128.068	128.325	
0.00		0.02	-0.07	-0.02	0.00	0.00	-0.03	0.07	0.00	

Ch 37.30 m



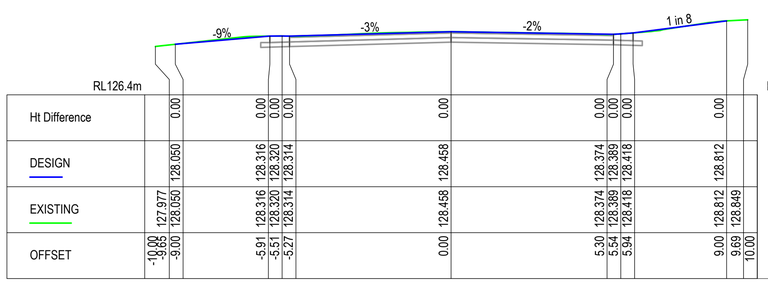
-10.00	-7.87	-2.26	-1.85	-1.57	0.00	2.01	2.29	2.70	8.13	10.00
126.154	126.221	126.361	126.371	126.377	126.413	126.541	126.555	126.577	127.227	127.620
127.382	127.914	127.821	127.711	127.741	127.788	127.728	127.698	127.808	128.100	128.175
1.23	1.69	1.46	1.34	1.36	1.38	1.19	1.14	1.23	0.87	0.56

Ch 50.00 m



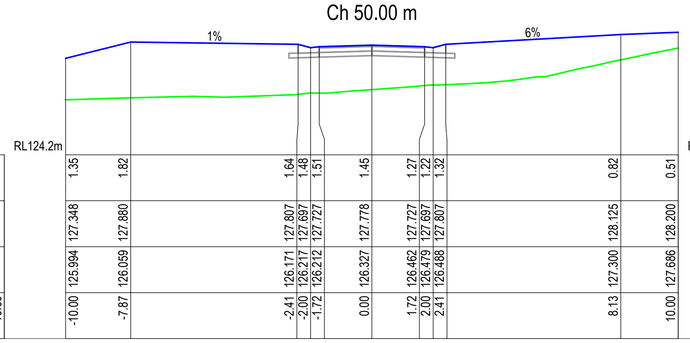
-10.00	-9.41	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.25	10.00
129.838	129.894	130.020	130.260	130.282	130.295	130.472	130.495	130.488	130.476	130.337	130.318	130.129
129.894	130.277	130.158	130.048	130.078	-0.27	130.078	130.048	130.158	130.287	130.318	
0.00	0.26	-0.10	-0.23	-0.22		-0.42	-0.44	-0.32	-0.05	0.00	

Ch 75.00 m



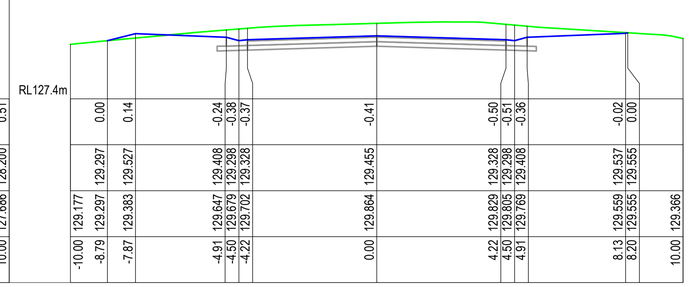
Ht Difference	0.00		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
DESIGN		128.050	128.316	128.320	128.314	128.458		128.374	128.389	128.418	128.812
EXISTING	127.977	128.050	128.316	128.320	128.314	128.458		128.374	128.389	128.418	128.812	128.849
OFFSET	-10.00	-9.00	-5.91	-5.51	-5.27	0.00		5.30	5.54	5.94	9.00	9.69	10.00

Ch 30.00 m
Greenwood Drive



-10.00	-7.87	-2.41	-2.00	-1.72	0.00	1.72	2.00	2.41	8.13	10.00
125.994	126.059	126.171	126.217	126.212	126.327	126.462	126.479	126.488	127.300	127.686
127.348	127.880	127.807	127.697	127.727	127.778	127.727	127.697	127.807	128.125	128.200
1.35	1.82	1.64	1.48	1.51	1.45	1.27	1.22	1.32	0.82	0.51

Ch 49.30 m



-10.00	-8.79	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.20	10.00
129.177	129.297	129.383	129.647	129.679	129.702	129.864	129.829	129.805	129.769	129.559	129.555	129.366
	129.297	129.527	129.408	129.298	129.328	129.455	129.328	129.298	129.408	129.537	129.555	
	0.00	0.14	-0.24	-0.38	-0.37	-0.41	-0.50	-0.51	-0.36	-0.02	0.00	

Ch 70.00 m

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Consulting Surveyors NSW

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Drawing Title
GREENWOOD DRIVE CROSS SECTIONS (Sheet 1 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

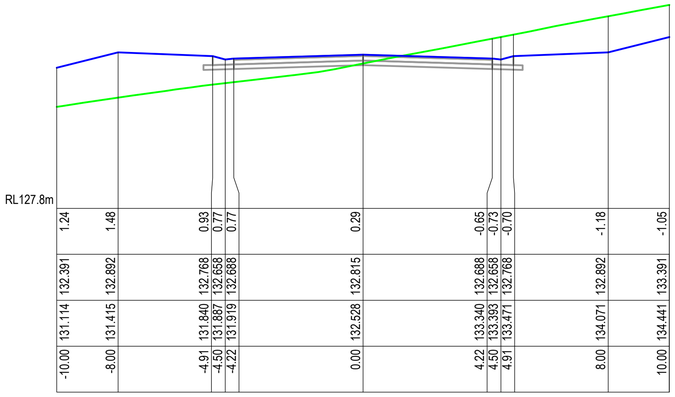
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

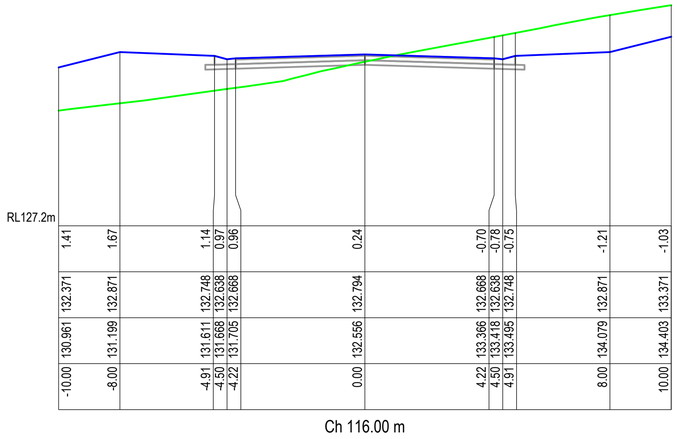
Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	7 of 20



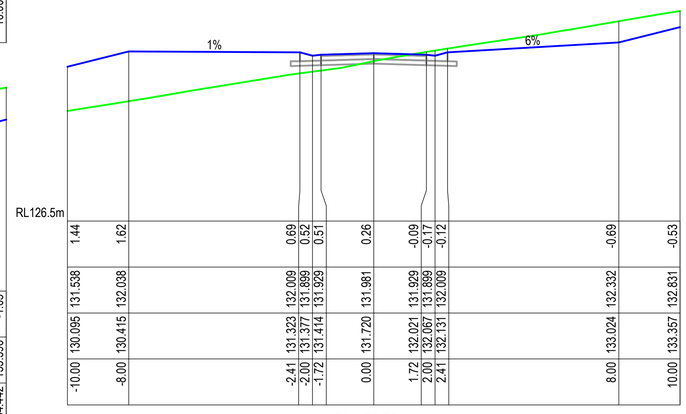
-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00
131.114	131.415	131.840	131.887	131.919	132.528	133.340	133.393	133.471	134.071	134.441
132.391	132.892	132.768	132.658	132.688	132.815	132.688	132.658	132.768	132.892	133.391
1.24	1.48	0.93	0.77	0.77	0.29	-0.65	-0.73	-0.70	-1.18	-1.05

Ch 110.00 m



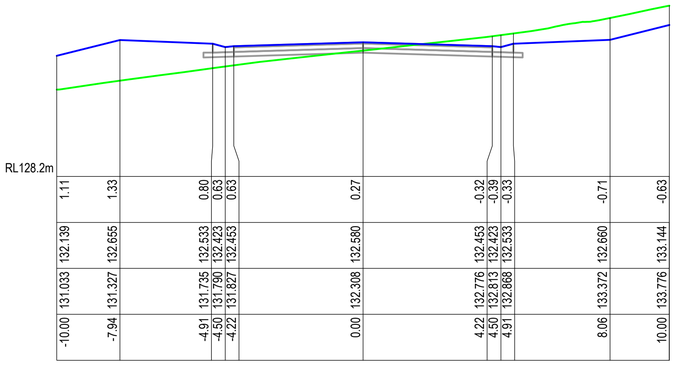
-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00
130.961	131.199	131.611	131.668	131.705	132.556	133.366	133.418	133.495	134.079	134.403
132.371	132.871	132.748	132.638	132.668	132.794	132.668	132.638	132.748	132.871	133.371
1.41	1.67	1.14	0.97	0.96	0.24	-0.70	-0.76	-0.75	-1.21	-1.03

Ch 116.00 m



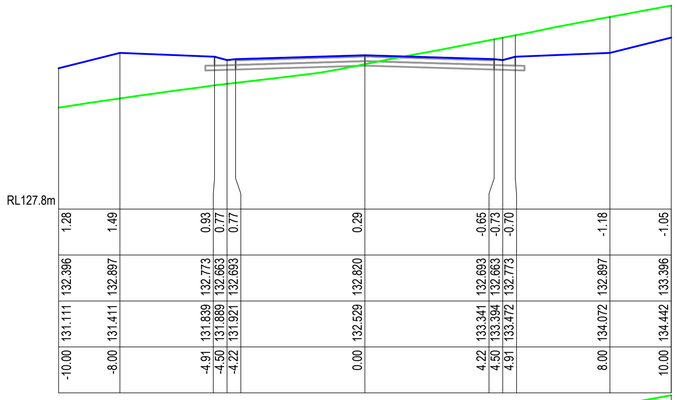
-10.00	-8.00	-2.41	-2.00	-1.72	0.00	1.72	2.00	2.41	8.00	10.00
130.095	130.415	131.323	131.377	131.414	131.720	132.021	132.067	132.131	133.024	133.357
131.538	132.038	132.009	131.899	131.929	131.981	131.929	131.869	132.009	132.332	132.831
1.44	1.62	0.69	0.52	0.51	0.26	-0.09	-0.17	-0.12	-0.69	-0.53

Ch 128.00 m



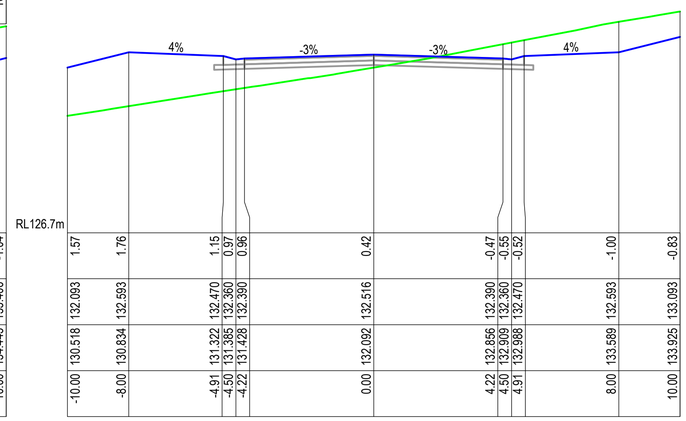
-10.00	-7.94	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.06	10.00
131.033	131.327	131.735	131.790	131.827	132.308	132.776	132.813	132.868	133.372	133.776
132.139	132.655	132.533	132.423	132.453	132.580	132.453	132.423	132.533	132.660	133.144
1.11	1.33	0.80	0.63	0.63	0.27	-0.32	-0.39	-0.33	-0.71	-0.63

Ch 100.00 m



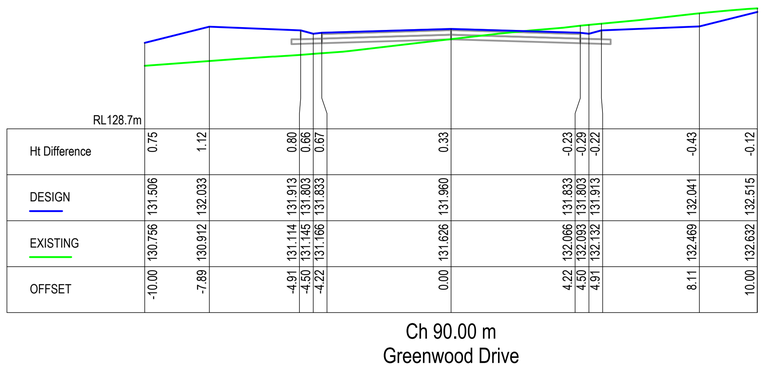
-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00
131.111	131.411	131.839	131.889	131.921	132.529	133.341	133.394	133.472	134.072	134.442
132.396	132.897	132.773	132.663	132.693	132.820	132.693	132.663	132.773	132.897	133.396
1.28	1.49	0.93	0.77	0.77	0.29	-0.65	-0.73	-0.70	-1.18	-1.05

Ch 110.28 m



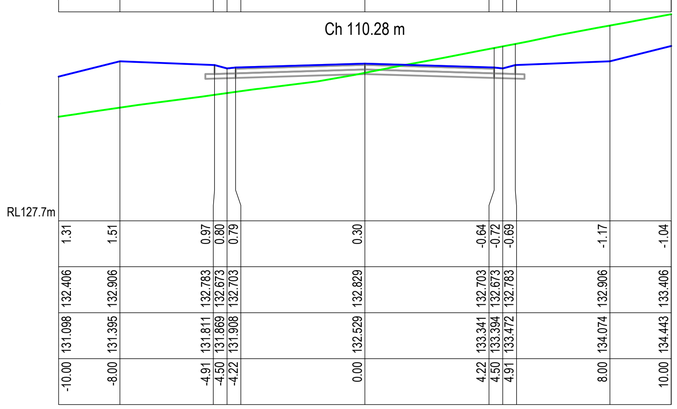
-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00
130.518	130.834	131.322	131.385	131.428	132.092	132.856	132.909	132.988	133.589	133.925
132.093	132.593	132.470	132.360	132.390	132.516	132.390	132.360	132.470	132.593	133.093
1.57	1.76	1.15	0.97	0.96	0.42	-0.47	-0.55	-0.52	-1.00	-0.83

Ch 122.00 m



OFFSET	-10.00	-7.89	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.11	10.00
EXISTING	130.756	130.912	131.114	131.145	131.166	131.626	132.066	132.093	132.132	132.469	132.632
DESIGN	131.506	132.033	131.913	131.803	131.833	131.960	131.833	131.803	131.913	132.041	132.515
Ht Difference	0.75	1.12	0.80	0.66	0.67	0.33	-0.23	-0.29	-0.22	-0.43	-0.12

Ch 90.00 m
Greenwood Drive



-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00
131.098	131.395	131.811	131.869	131.908	132.529	133.341	133.394	133.472	134.074	134.443
132.406	132.906	132.783	132.673	132.703	132.829	132.703	132.673	132.783	132.906	133.406
1.31	1.51	0.97	0.80	0.79	0.30	-0.64	-0.72	-0.69	-1.17	-1.04

Ch 111.00 m

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Consulting Surveyors NSW

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Drawing Title

GREENWOOD DRIVE CROSS SECTIONS (Sheet 2 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

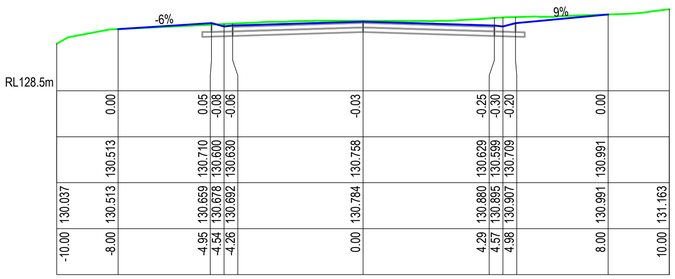
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

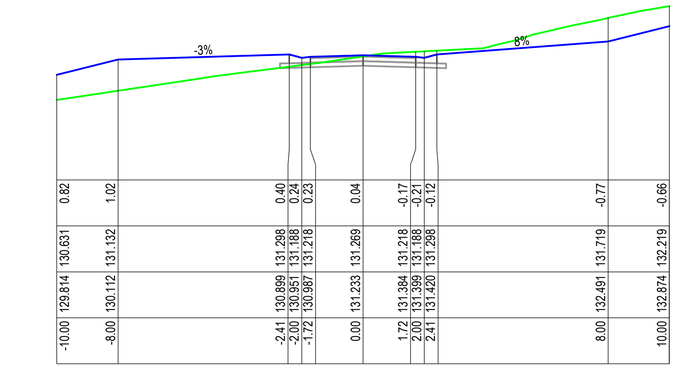
Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	8 of 20



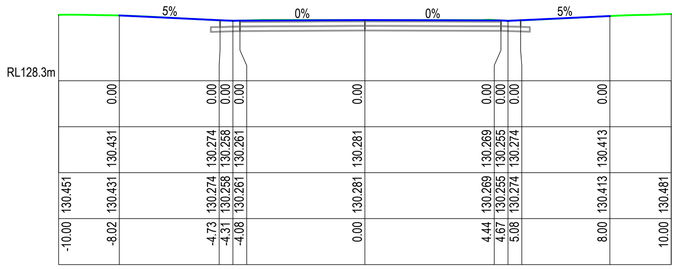
	0.00		0.05	-0.08	-0.06		-0.03		-0.25	-0.30	-0.20		0.00										
	130.513		130.710	130.600	130.630		130.758		130.629	130.599	130.709		130.991										
130.037	130.513		130.659	130.678	130.692		130.784		130.880	130.895	130.907		130.991		131.163								
-10.00	-8.00		-4.95	-4.54	-4.26		0.00		4.29	4.57	4.98		8.00		10.00								

Ch 140.00 m



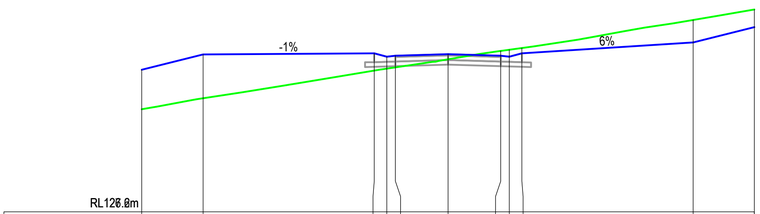
0.82	1.02		0.40	0.24	0.23		0.04		-0.17	-0.21	-0.12		-0.77		-0.66								
130.631	131.132		131.298	131.188	131.218		131.269		131.218	131.188	131.298		131.719		132.219								
129.814	130.112		130.899	130.995	130.987		131.233		131.394	131.399	131.420		132.491		132.874								
-10.00	-8.00		-2.41	-2.00	-1.72		0.00		1.72	2.00	2.41		8.00		10.00								

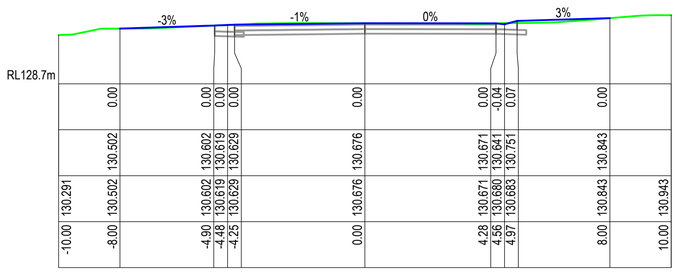
Ch 134.00 m



	0.00		0.00	0.00	0.00		0.00		0.00	0.00	0.00		0.00										
	130.431		130.274	130.258	130.261		130.281		130.269	130.255	130.274		130.413										
130.451	130.431		130.274	130.258	130.261		130.281		130.269	130.255	130.274		130.413		130.481								
-10.00	-8.02		-4.73	-4.33	-4.08		0.00		4.44	4.67	5.08		8.00		10.00								

Ch 150.00 m





	0.00		0.00	0.00	0.00		0.00		0.00	-0.04	0.07		0.00										
	130.502		130.602	130.619	130.629		130.676		130.671	130.641	130.751		130.843										
130.291	130.502		130.602	130.619	130.629		130.676		130.671	130.680	130.683		130.843		130.943								
-10.00	-8.00		-4.90	-4.48	-4.25		0.00		4.28	4.56	4.97		8.00		10.00								

Ch 141.38 m

Ht Difference	1.29	1.43		0.56	0.39	0.38		0.17		-0.16	-0.23	-0.17		-0.73		-0.57							
DESIGN	131.237	131.737		131.773	131.663	131.693		131.745		131.693	131.663	131.773		132.129		132.629							
EXISTING	129.948	130.306		131.209	131.273	131.314		131.578		131.851	131.890	131.946		132.861		133.203							
OFFSET	-10.00	-8.00		-2.41	-2.00	-1.72		0.00		1.72	2.00	2.41		8.00		10.00							

Ch 130.00 m

Greenwood Drive

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Drawing Title

GREENWOOD DRIVE CROSS SECTIONS (Sheet 3 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	9 of 20

Retaining wall
CH 97.55
Max height
2m
Tie into existing retaining wall
1 in 4 batters.
Provide driveway access to existing building within Lot 3
Garbage collection and mail delivery at base of driveway
CH 80.000
CH 60.00
CH 40.00
CH 30.16
CH 27.93
CH 25.70
CH 20.00
CH 18.30
CH 16.07
CH 13.83
CH 0.00
R6
12
8
6

LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Overland Flow Diversion Drain

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Drawing Title
SHARED DRIVEWAY LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

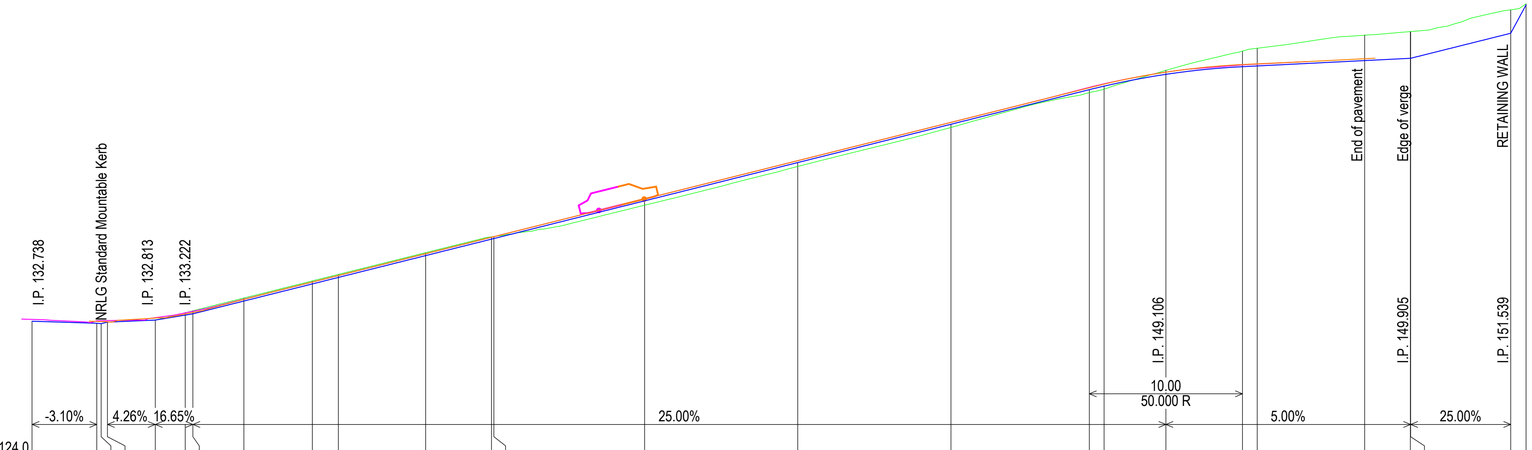
GRID NORTH
MGA 94 ZONE 56

	Drawn **DF**	*Date Surveyed* **23/07/21**
Designed **DF**	*Approved* **ARR**	*Date Issued* **17/03/22**
	Locality **Goonellabah**	*Drawing No* **21037-CIV**
Parish **Lismore**	*County* **Rous**	*Revision No.* **5**
Local Government Area **Lismore**		*Sheet No* **10** of **20**

B99 Standard Vehicle Clearance Test

Front Clearance

Rear Clearance



R.L. 124.0

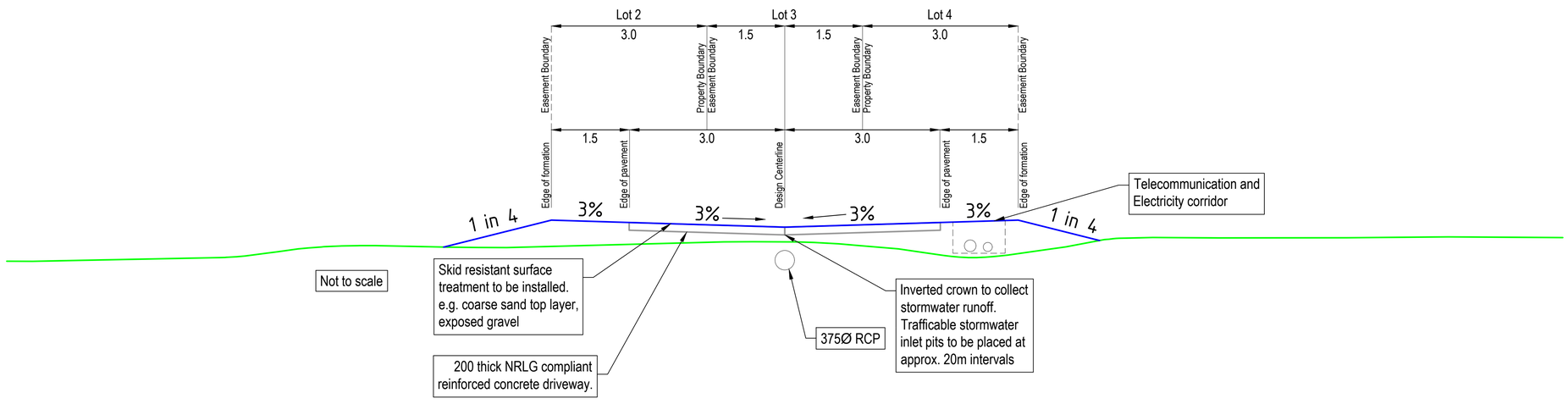
Chainage	Cut / Fill	Design	Existing
0.00	+0.00	132.74	132.74
4.23	+0.00	132.61	132.61
4.51	+0.00	132.58	132.58
4.92	-0.01	132.88	132.89
8.04	+0.00	132.81	132.81
10.00	-0.16	133.14	133.30
10.50	-0.20	133.22	133.42
13.83	-0.19	134.06	134.25
18.30	-0.20	135.17	135.37
20.00	-0.19	135.60	135.79
25.70	-0.20	137.02	137.22
30.00	-0.15	138.10	138.25
30.16	-0.13	138.14	138.27
40.00	+0.29	140.60	140.31
50.00	+0.26	143.10	142.84
60.00	+0.21	145.60	145.39
69.04	+0.19	147.86	147.67
70.00	+0.20	148.09	147.89
74.04	-0.26	148.86	149.12
79.04	-1.01	149.36	150.37
80.00	-1.16	149.40	150.56
87.02	-1.65	149.76	151.41
90.00	-1.75	149.90	151.65
90.02	-1.74	149.91	151.65
96.55	-1.53	151.54	153.07
97.55		153.39	153.47

Horizontal Geometry: L=13.83 B=206°20'22"; L=4.47 R=30.00; L=7.39 B=197°48'15"; L=4.46 R=30.00; L=67.39 B=189°17'03"

H 1:200
V 1:200

Shared Driveway - Lots 2, 3 & 4 - Ch.0.00 to Ch. 97.55

Typical Section - Shared Driveway - Lots 2, 3 & 4 (9 wide)



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Drawing Title
SHARED DRIVEWAY LONGITUDINAL SECTION

Project
Development Application
Subdivision of Lot 4 DP 406893

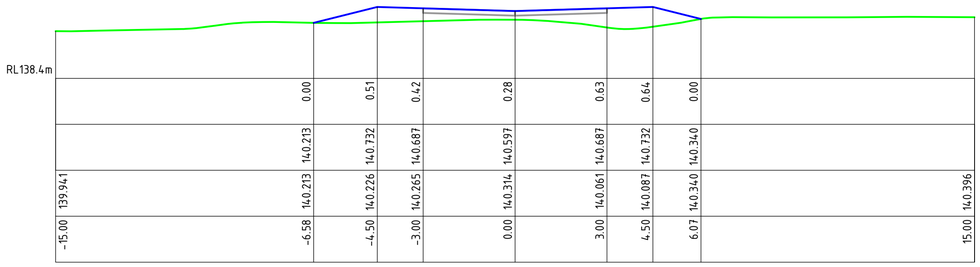
Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

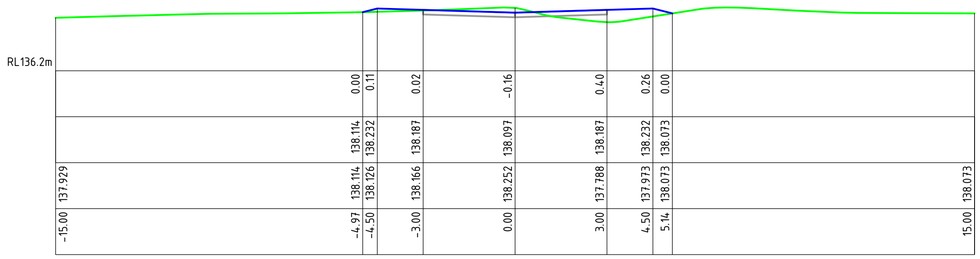
Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		11 of 20



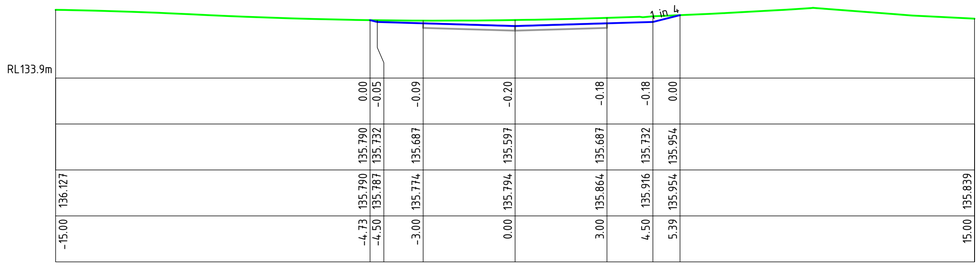
		0.00	0.51	0.42	0.28	0.63	0.64	0.00	
	140.213	140.213	140.732	140.687	140.597	140.687	140.732	140.340	
139.941	140.213	140.226	140.265	140.314	140.061	140.087	140.340		140.396
-15.00	-6.58	-4.50	-3.00	0.00	3.00	4.50	6.07		15.00

Ch 40.00 m



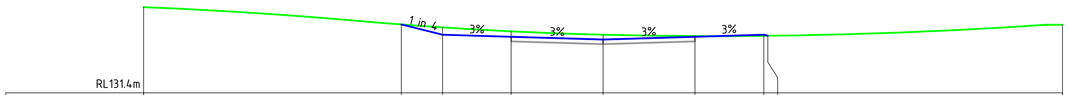
		0.00	0.11	0.02	-0.16	0.40	0.26	0.00	
		138.114	138.232	138.187	138.097	138.187	138.232	138.073	
137.929		138.114	138.126	138.166	138.252	137.788	137.973	138.073	138.073
-15.00		-4.97	-4.50	-3.00	0.00	3.00	4.50	5.14	15.00

Ch 30.00 m



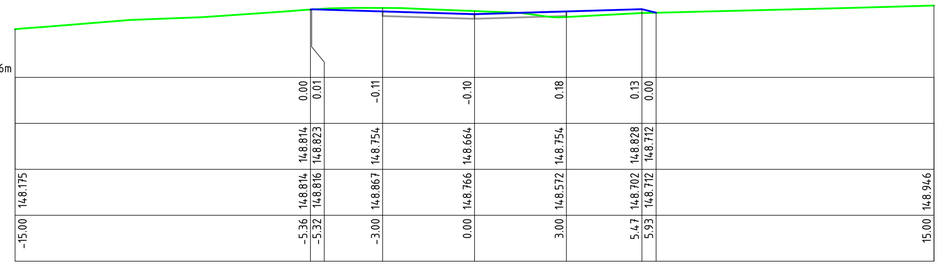
		0.00	-0.05	-0.09	-0.20	-0.18	-0.18	0.00	
		135.790	135.732	135.687	135.597	135.687	135.732	135.954	
136.127		135.790	135.787	135.774	135.794	135.864	135.916	135.954	135.839
-15.00		-4.73	-4.50	-3.00	0.00	3.00	4.50	5.39	15.00

Ch 20.00 m



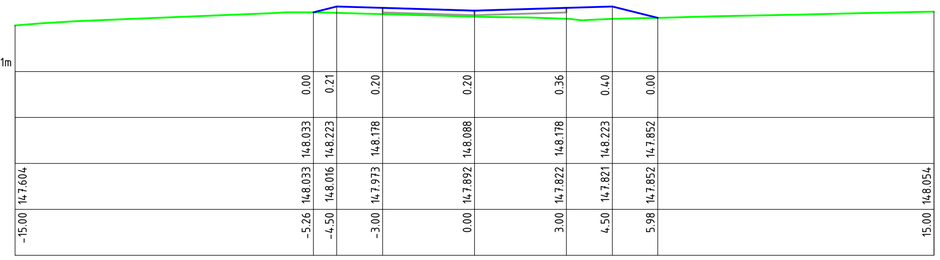
Ht Difference		0.00	-0.24	-0.18	-0.16	-0.02	0.03	0.00	
DESIGN		133.633	133.296	133.229	133.139	133.229	133.296	133.264	
EXISTING	134.197	133.633	133.536	133.406	133.297	133.253	133.262	133.264	133.619
OFFSET	-15.00	-6.59	-5.24	-3.00	0.00	3.00	5.25	5.38	15.00

Ch 10.00 m
Shared Driveway



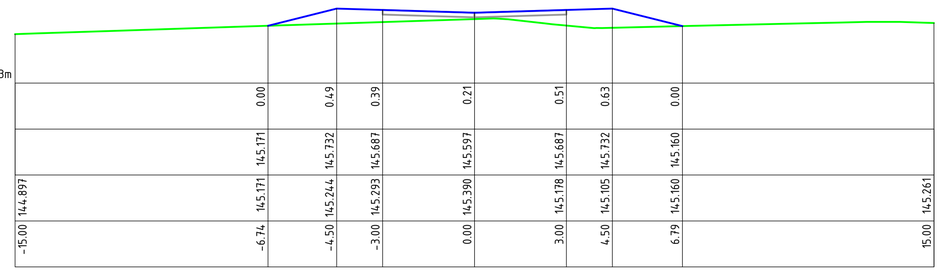
		0.00	0.01	-0.11	-0.10	0.18	0.13	0.00	
	148.814	148.814	148.823	148.754	148.664	148.754	148.828	148.712	
148.175	148.814	148.816	148.867	148.766	148.572	148.702	148.712		148.946
-15.00	-5.36	-5.32	-3.00	0.00	3.00	5.47	5.93		15.00

Ch 72.85 m



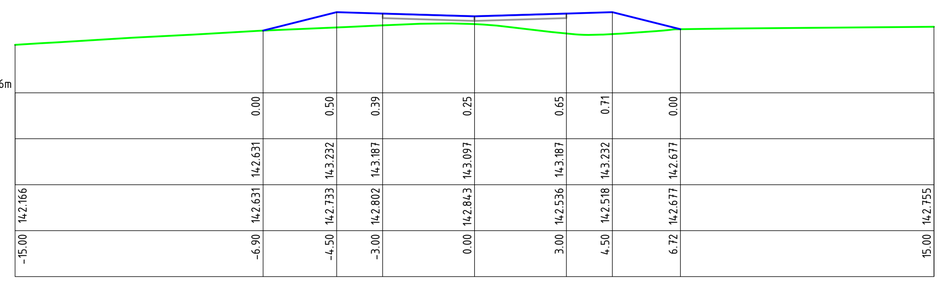
		0.00	0.21	0.20	0.20	0.36	0.40	0.00	
		148.033	148.223	148.178	148.088	148.178	148.223	147.852	
147.604		148.033	148.016	147.973	147.892	147.822	147.821	147.852	148.054
-15.00		-5.26	-4.50	-3.00	0.00	3.00	4.50	5.98	15.00

Ch 70.00 m



		0.00	0.49	0.39	0.21	0.51	0.63	0.00	
		145.171	145.732	145.687	145.597	145.687	145.732	145.160	
144.897		145.171	145.244	145.293	145.390	145.178	145.105	145.160	145.261
-15.00		-6.74	-4.50	-3.00	0.00	3.00	4.50	6.79	15.00

Ch 60.00 m



		0.00	0.50	0.39	0.25	0.65	0.71	0.00	
		142.631	143.232	143.187	143.097	143.187	143.232	142.677	
142.166		142.631	142.733	142.802	142.843	142.536	142.518	142.677	142.755
-15.00		-6.90	-4.50	-3.00	0.00	3.00	4.50	6.72	15.00

Ch 50.00 m

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Drawing Title

SHARED DRIVEWAY CROSS SECTIONS (Sheet 1 of 2)

Project
Development Application
Subdivision of Lot 4 DP 406893

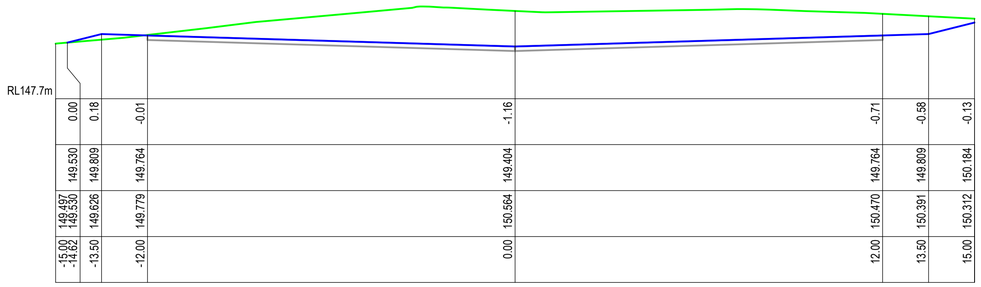
Client
Praedium Partnership

0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

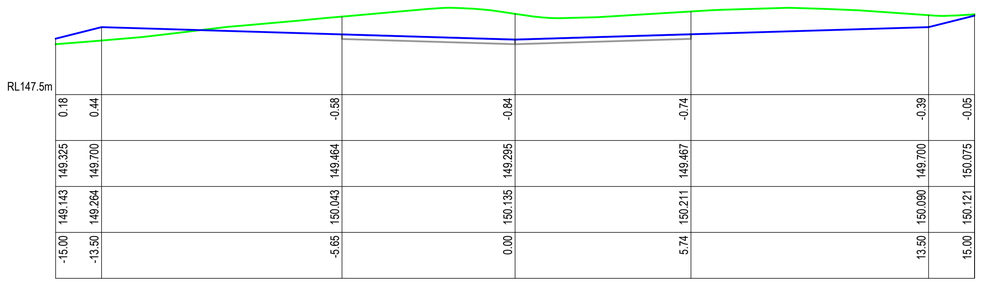
Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**12** of **20**



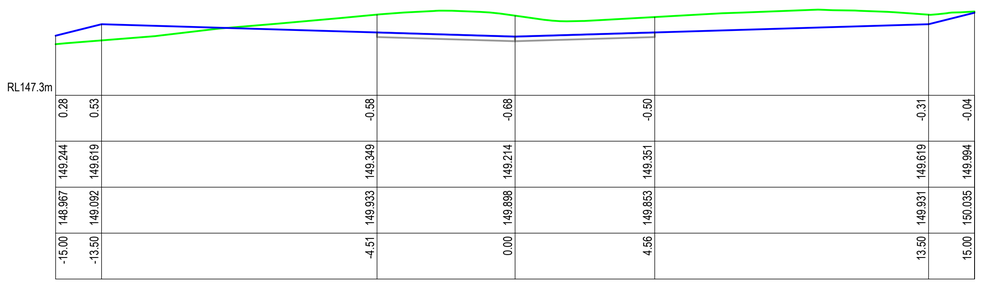
-15.00	-13.50	-12.00	0.00	12.00	13.50	15.00
149.497 / 149.530	149.626	149.779	150.564	150.470	150.391	150.312
149.530	149.809	149.764	149.404	149.764	149.809	150.184
0.00	0.18	-0.01	-1.16	-0.71	-0.58	-0.13

Ch 80.00 m



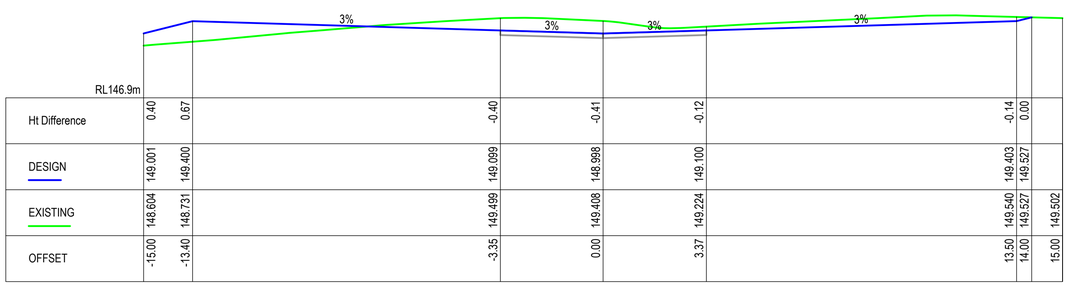
-15.00	-13.50	-5.65	0.00	5.74	13.50	15.00
149.143	149.264	150.043	150.135	150.211	150.090	150.121
149.325	149.700	149.464	149.295	149.467	149.700	150.075
0.18	0.44	-0.58	-0.84	-0.74	-0.39	-0.05

Ch 78.02 m



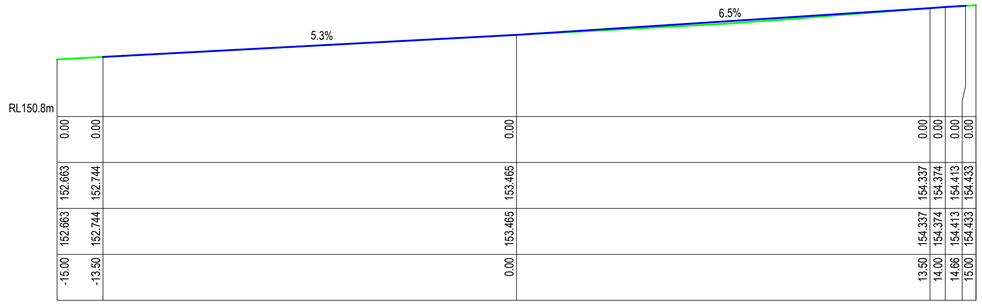
-15.00	-13.50	-4.51	0.00	4.56	13.50	15.00
148.967	149.092	149.933	149.898	149.853	149.931	150.035
149.244	149.619	149.349	149.214	149.351	149.619	149.994
0.28	0.53	-0.58	-0.68	-0.50	-0.31	-0.04

Ch 77.02 m



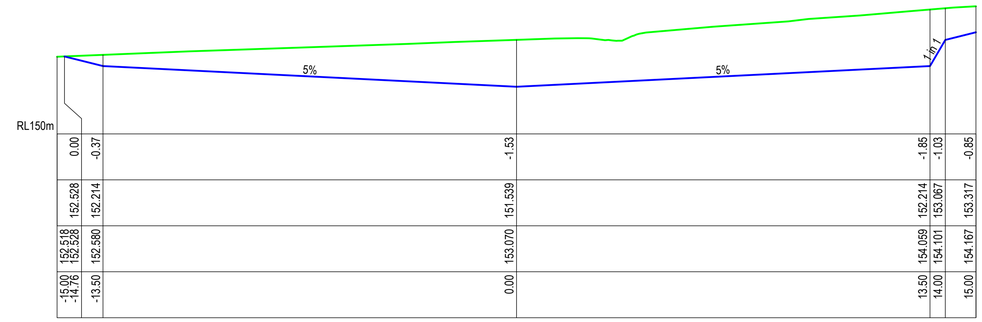
Ht Difference	0.40	0.67	-0.40	-0.41	-0.12	-0.14	0.00
DESIGN	149.001	149.400	149.099	148.998	149.100	149.403	149.527
EXISTING	148.604	148.731	149.499	149.408	149.224	149.540	149.527
OFFSET	-15.00	-13.40	-3.35	0.00	3.37	13.50 / 14.00	15.00

Ch 75.05 m
Shared Driveway



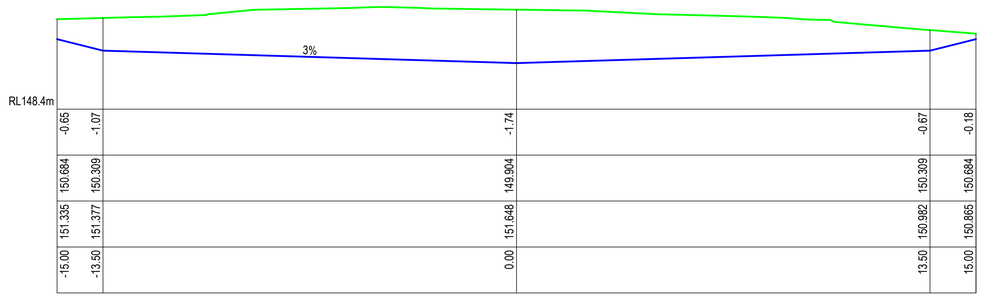
-15.00	-13.50	0.00	0.00	0.00	13.50	15.00
152.663	152.744	152.744	153.465	153.465	154.337	154.433
152.663	152.744	152.744	153.465	154.337	154.374	154.433
0.00	0.00	0.00	0.00	0.00	0.00	0.00

Ch 97.55 m



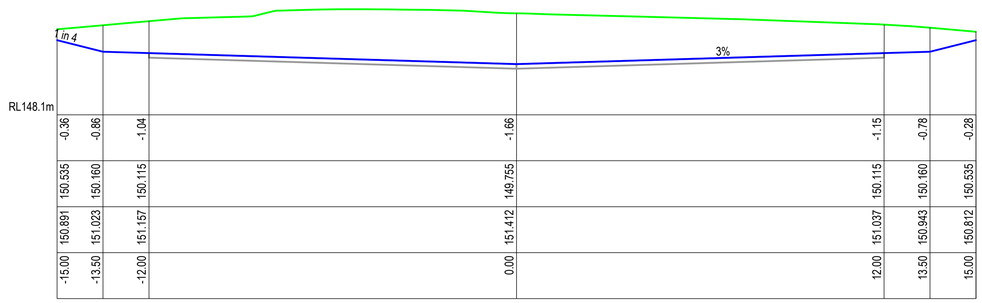
-15.00 / -14.76	-13.50	0.00	153.070	151.539	152.214	153.317
152.518 / 152.528	152.580	153.070	154.099	154.101	153.067	154.167
152.528	152.214	151.539	152.214	152.214	153.067	153.317
0.00	-0.37	-1.53	-1.85	-1.03	-0.85	

Ch 96.55 m



-15.00	-13.50	0.00	151.648	149.904	150.309	150.684
151.335	151.377	151.377	151.648	150.309	150.982	150.865
150.684	150.309	150.309	149.904	150.684	150.982	150.865
-0.65	-1.07	-1.07	-1.74	-0.67	-0.67	-0.18

Ch 90.00 m



-15.00	-13.50	-12.00	0.00	12.00	13.50	15.00	
150.891	151.023	151.157	151.412	149.755	150.115	150.160	150.535
150.535	150.160	150.115	149.755	150.115	150.160	150.535	150.812
-0.36	-0.86	-1.04	-1.66	-1.15	-0.78	-0.28	

Ch 87.02 m

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Drawing Title
SHARED DRIVEWAY CROSS SECTIONS (Sheet 2 of 2)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

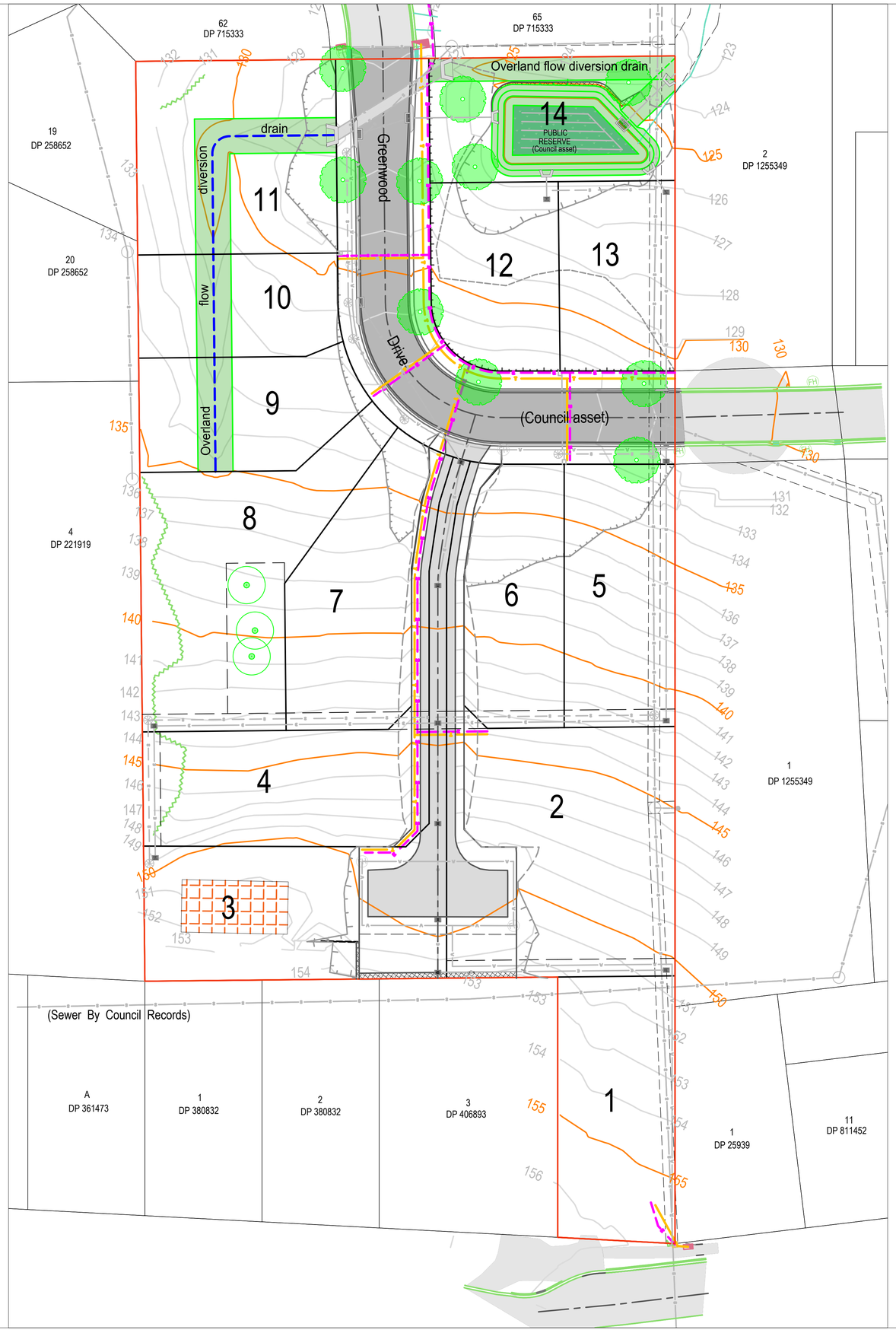
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	13 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

ELECTRICITY AND TELECOMMUNICATIONS LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

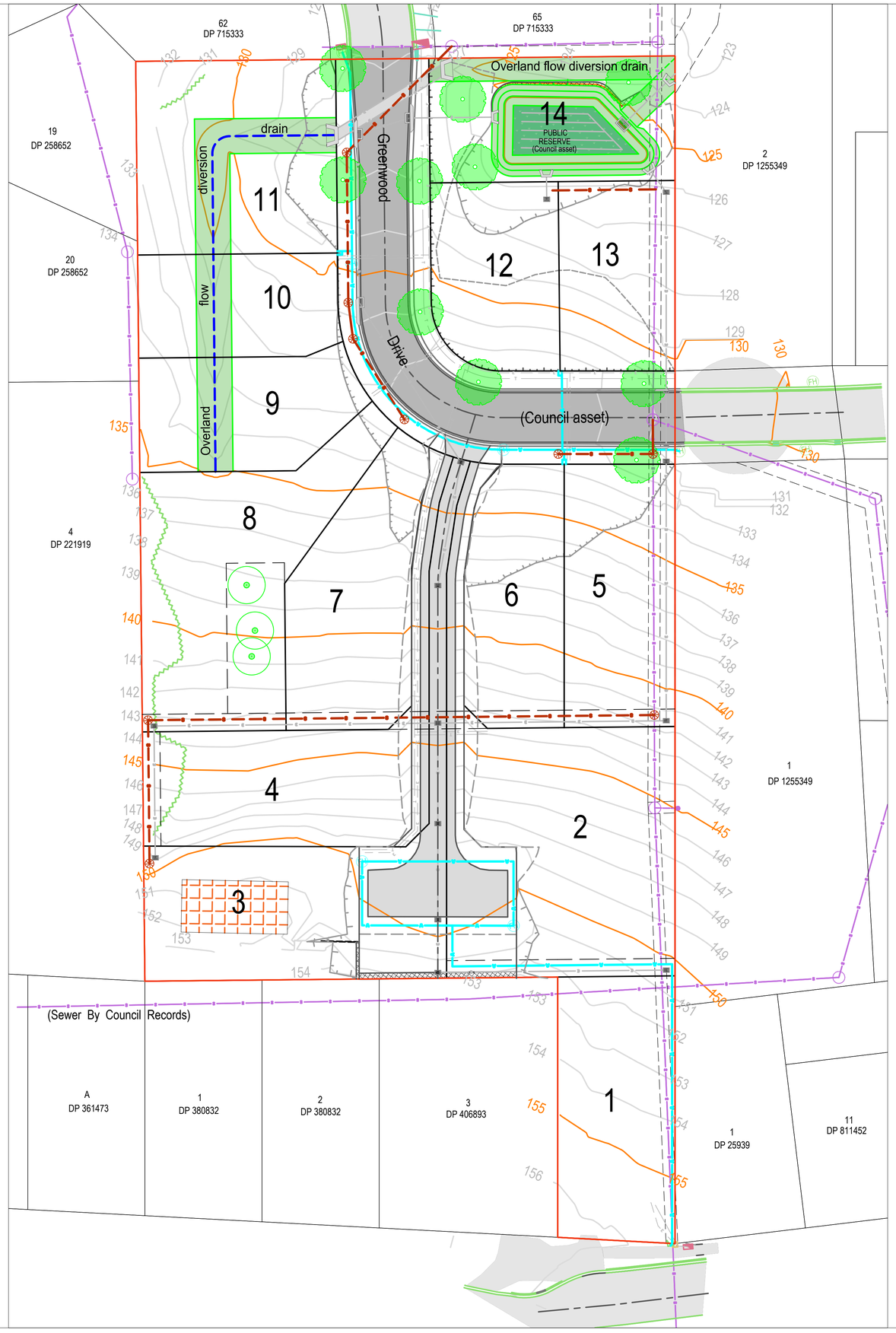
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		14 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

SEWER AND WATER RETICULATION LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

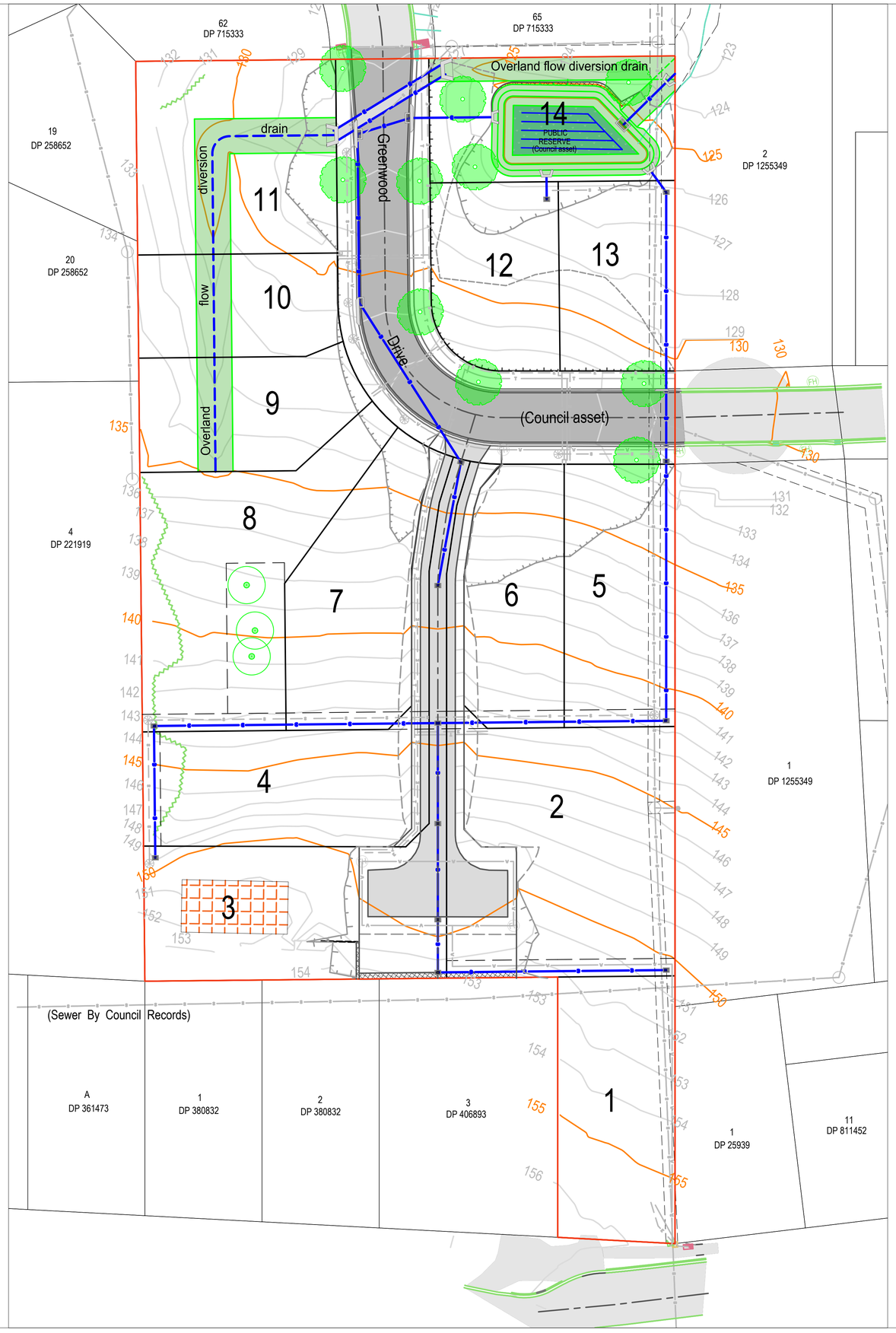
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		15 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

STORMWATER DRAINAGE LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

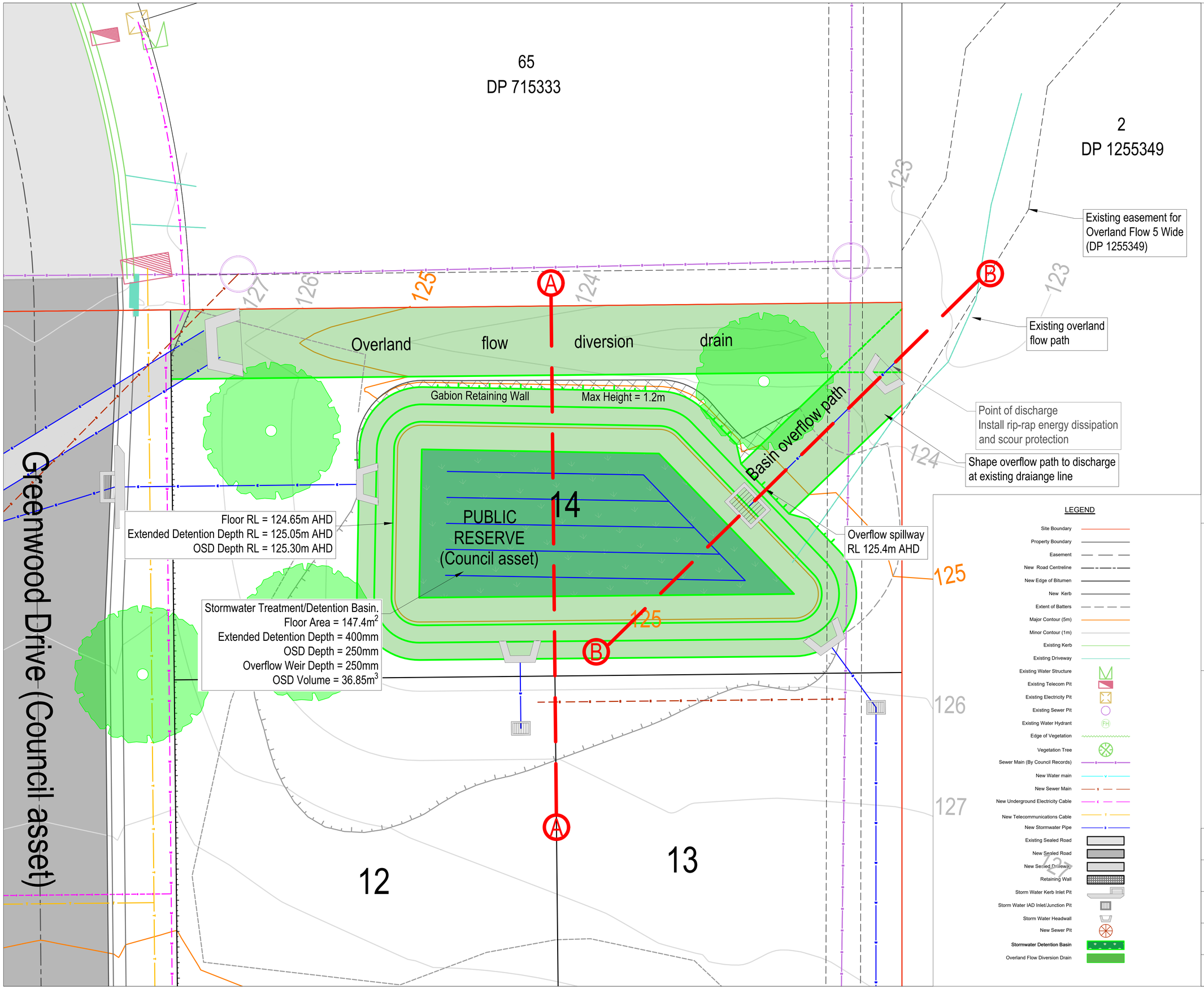
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		16 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- **Stormwater Detention Basin**
- Overland Flow Diversion Drain

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Drawing Title
STORMWATER BASIN LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
1:100
At A1 Size Sheet

GRID NORTH
MGA 94 ZONE 56

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
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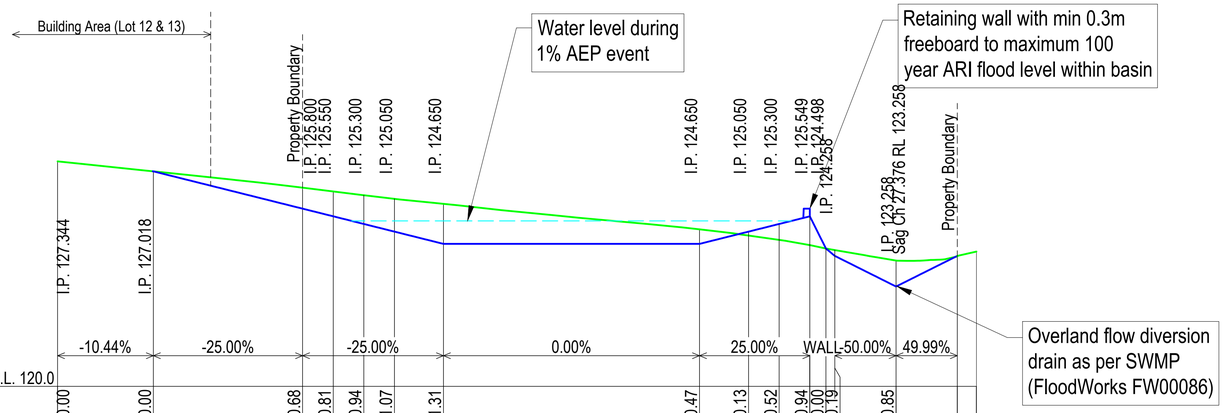
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		17 of 20



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	B=8°42'00"																	

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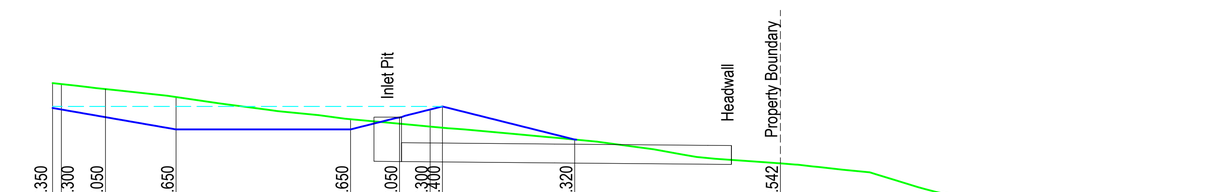

R.L. 118.0

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Horizontal Geometry	L=30.00																	
	B=54°44'09"																	

Basin Section B - B

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Drawing Title
STORMWATER BASIN
EXAMPLE SECTIONS

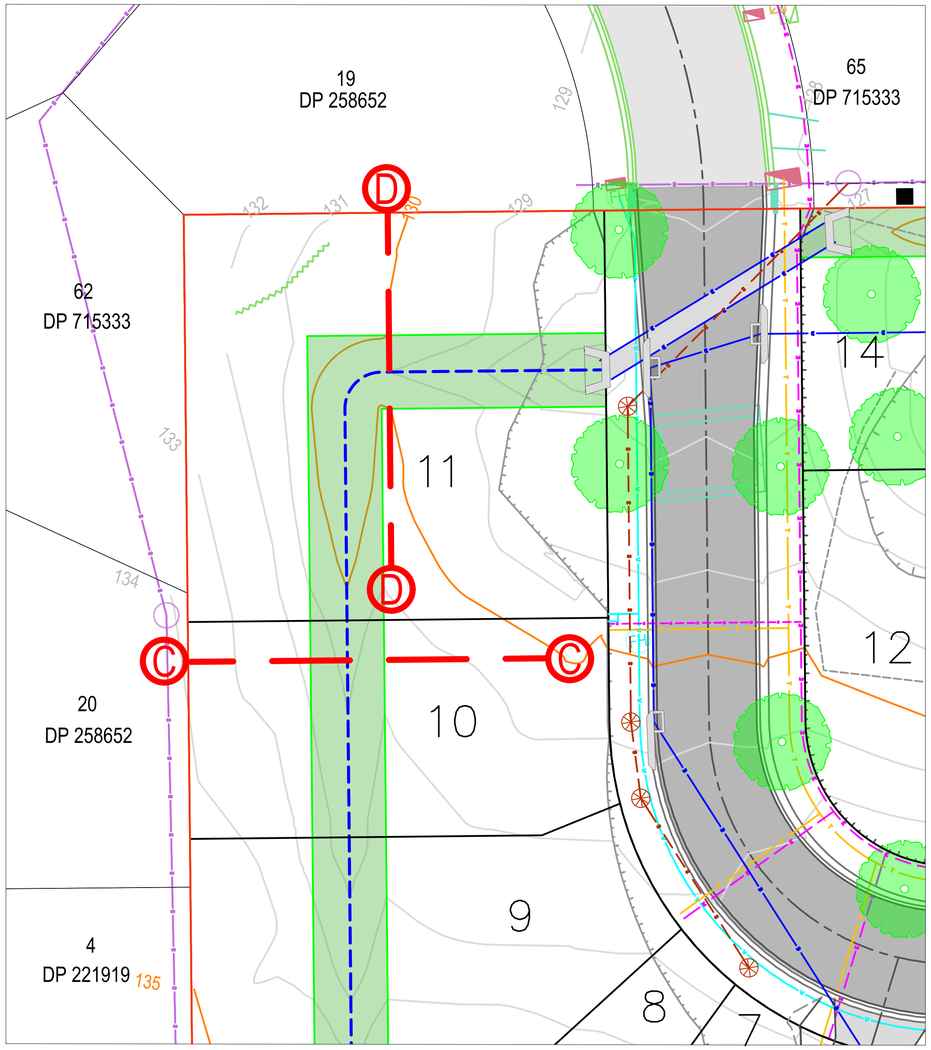
Project
Development Application
Subdivision of Lot 4 DP 406893

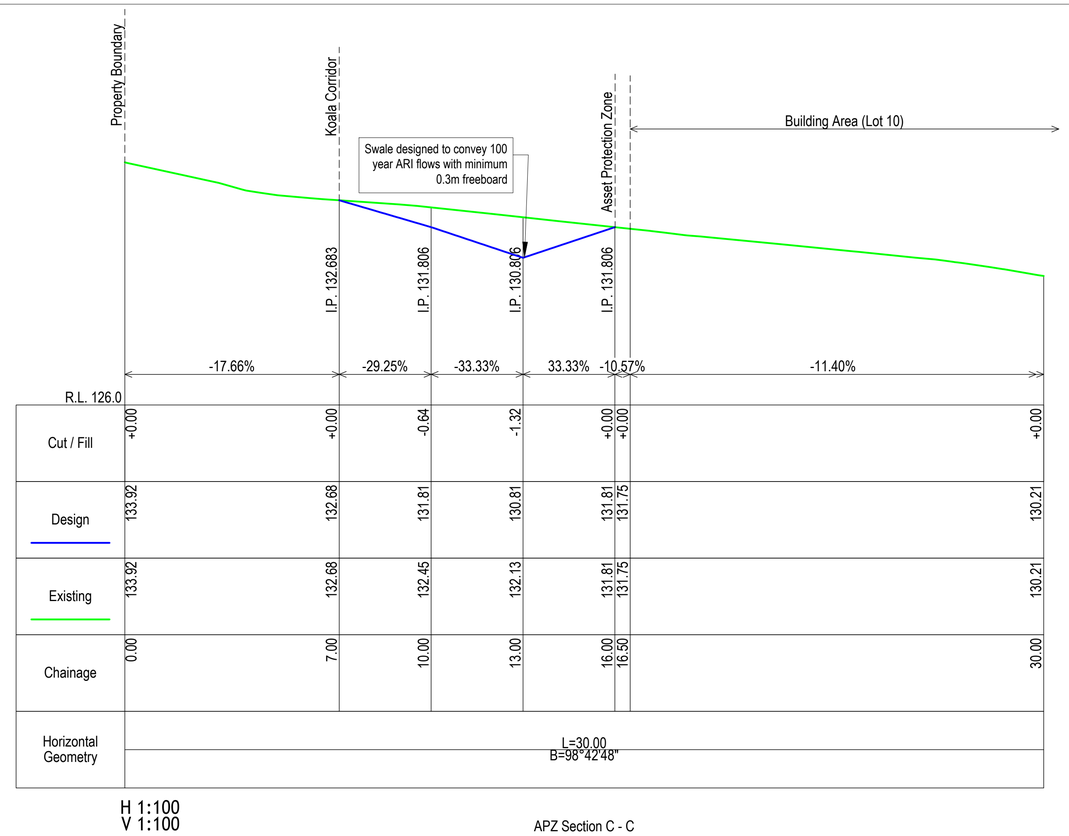
Client
Praedium Partnership

0 2 4 6 8
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**18** of **20**





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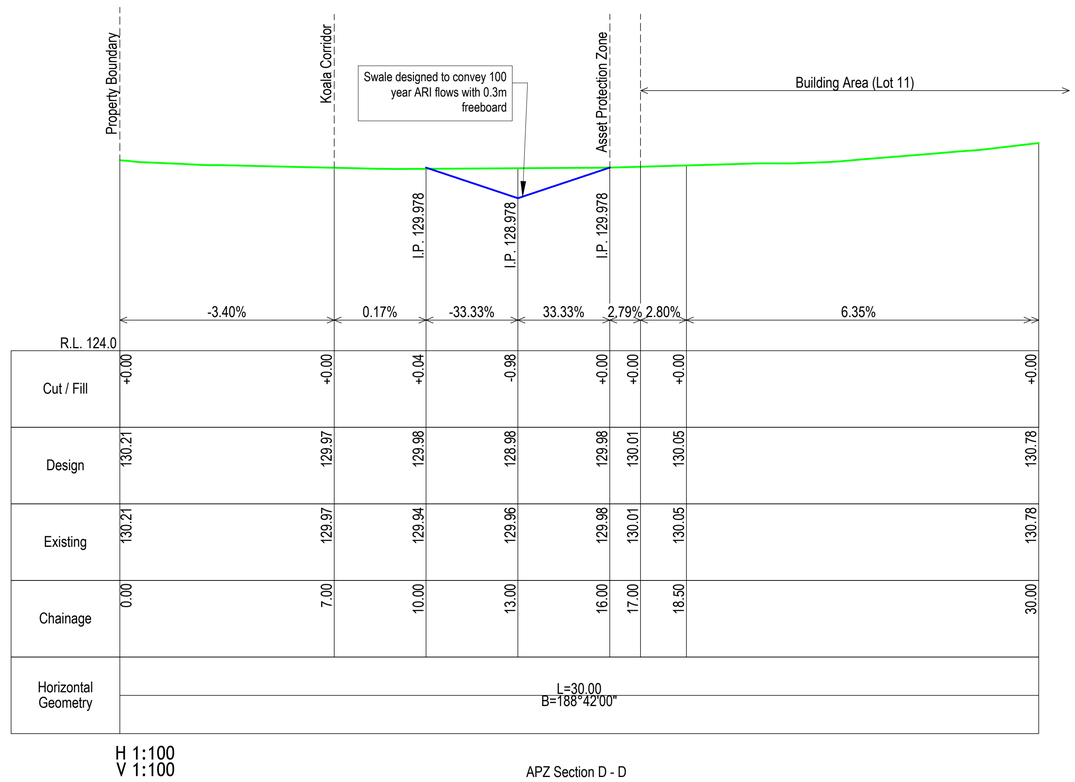
APZ Section C - C



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APZ Section D - D

LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
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Drawing Title
ASSET PROTECTION ZONE
EXAMPLE SECTIONS

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 5 10 15 20
1:250
At A1 Size Sheet

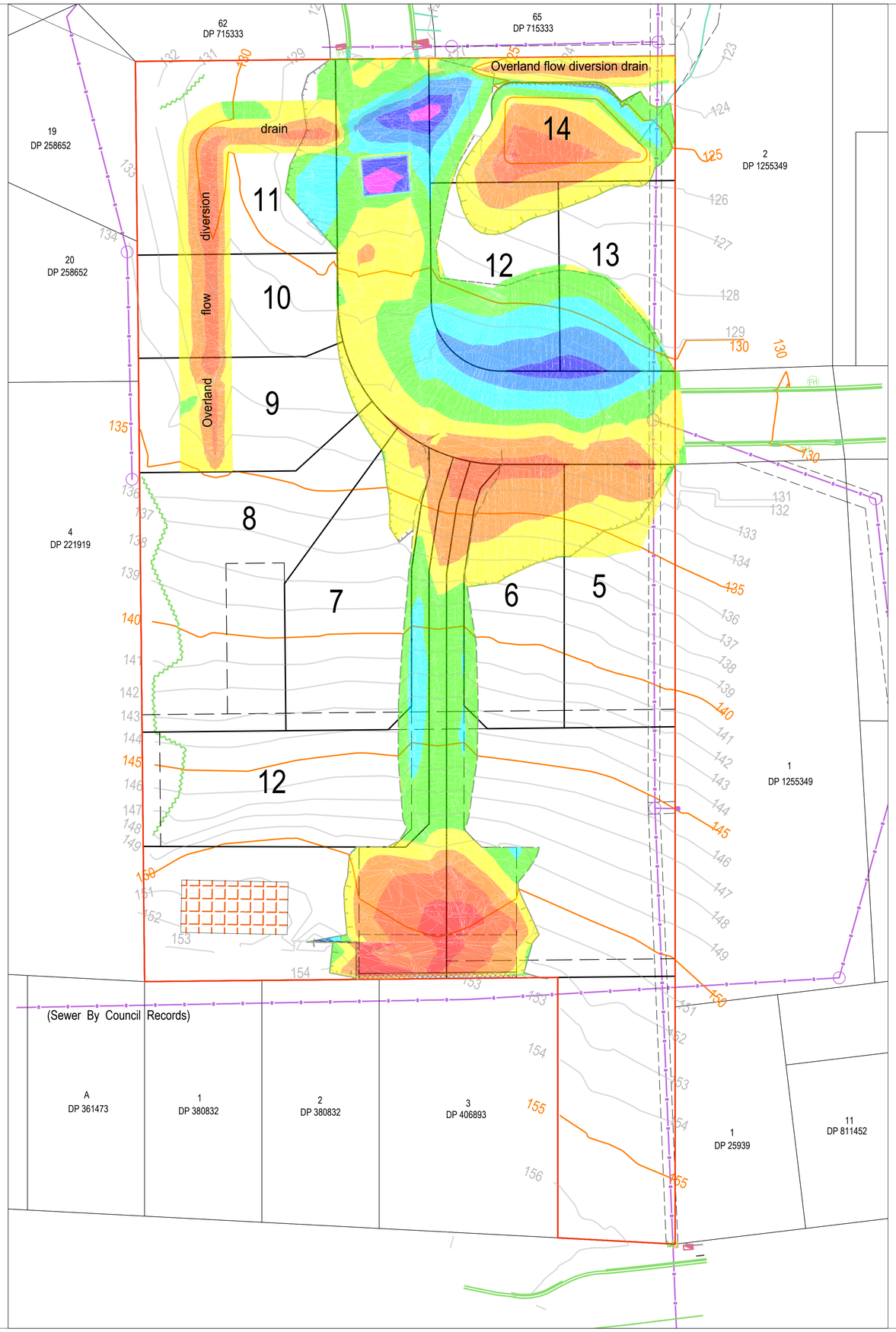
GRID NORTH
MGA 94 ZONE 56

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**19** of **20**



LEGEND

- Site Boundary
- Property Boundary
- Easement
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)

Levels Table

Min. Level	Max. Level	Colour
-2.500	-2.000	
-2.000	-1.500	
-1.500	-1.000	
-1.000	-0.500	
-0.500	0.000	
0.000	0.500	
0.500	1.000	
1.000	1.500	
1.500	2.000	
2.000	2.560	

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Drawing Title
EARTHWORKS PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
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Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		20 of 20

658 Ballina Rd

Concept Stormwater Management Plan

Client	: 658 Ballina Road Pty Ltd c/o CA Construction Management
Prepared by	: Australian Wetlands Consulting Pty Ltd
Project #	: 1-211472
Date	: March 2022

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AWC

658 Ballina Rd

Concept Stormwater Management Plan

Project control

Project name: **658 Ballina Rd**
Concept Stormwater Management Plan

Project #: 1-211472
Client: 658 Ballina Road Pty Ltd
c/o CA Construction Management
Contact: Craig Adams (CA Construction Management)

Prepared by: Australian Wetlands Consulting Pty Ltd

8 George Street
Bangalow, NSW, 2479

P | (02) 6687 1550
E | admin@awconsult.com.au

Date:	Revision:	Prepared by:	Reviewed by:	Distributed to:
08/10/2021	A	Katie Menzies Jesse Munro	Katrina Curran	Craig Adams (CA Construction Management)
28/10/2021	B	Jesse Munro	Damian McCann	Craig Adams (CA Construction Management)
08/03/2022	C	Jesse Munro	Damian McCann	Craig Adams (CA Construction Management)
21/03/2022	D	Katie Menzies		Craig Adams (CA Construction Management)

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AWC's management system has been certified to ISO 9001

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1 Introduction and Background

AWC was commissioned by CA Construction Management to prepare a Concept Stormwater Management Plan (CSWMP) for the proposed residential development on Lot 4 DP 406893 at 658 Ballina Rd, Goonellabah ("the site"). The site is located approximately 500 metres north of the Goonellabah Shopping Village with a total area of 1.54 ha. The proposed development will include subdivision of the site into 14 lots comprising 13 medium density residential lots and one open space lot.

The change in surface type from undeveloped, vegetated land to residential development, when unmitigated has the potential to significantly alter the local hydrology due to increasing stormwater runoff from impervious surfaces. These changes to hydrology can have significant impacts to waterways and the local environment. Water Sensitive Design (WSD) represents a tool for urban development that aims to retain the pre-development hydrology through the design of the urban layout that allows for stormwater capture and treatment prior to release to the local environment.

This Concept SWMP outlines a strategy for sustainably managing stormwater runoff in a manner that is site sensitive and consistent with Chapter 22 of the LCC DCP and best practice in WSD. This report identifies opportunities for site sympathetic treatment options and suggestions on how to integrate water management into the urban layout. This strategy also reflects the ecological context of the receiving environment.

1.1 Background

A Development Application (DA No. 2019/438) was submitted to Lismore City Council (LCC) in December 2019 seeking consent for subdivision of the site into 16 lots, extension of Greenwood Drive with cul-de-sac, and associated infrastructure. In October 2020 the DA was refused due to non-compliances with the *Environment Planning and Assessment Act 1979* (EP&A Act). In February 2021 proceedings commenced in Class 1 of the Land and Environment Court's jurisdiction appealing against the DA refusal. Contentions were raised in relation to the existing SWMP submitted with the DA. In order to resolve these contentions a new revised CSWMP has been prepared (this document) which satisfies the requirements of the Lismore Development Control Plan (LCC DCP, 2012) and the EP&A Act.

Continuation of the above proceedings (in November and December 2021, and January to March 2022) has seen discussions and design work resulting in an amended subdivision layout which subsequently required modification of Revision B CSWMP. This amended CSWMP has been prepared and included re-modelling of the treatment system and removal of the superseded OSD calculations. The findings of the Floodworks (2021) Hydraulic Assessment supersede the OSD volumes previously calculated.

1.2 Aims and Objectives

The aim of this document is to outline a strategy for the management of stormwater on the proposed development site. This strategy has been developed to ensure that the environmental values of the downstream receiving environment are not significantly impacted. The requirements for water management plans for major developments are outlined in Chapter 22 (Water Sensitive Design) of the LCC DCP (2012) and require that Residential Subdivisions:

- Must be designed in accordance with the *Northern Rivers Local Government Development and Design Manual* (AUS-SPEC & Northern Rivers Local Government, 2013)
- Include WSD measures that are designed to achieve the stormwater performance criteria (Refer to Section 3.4).

1.3 Site Description

The site is located at 658 Ballina Rd, Goonellabah, legally described as Lot 4 DP406893. The site is zoned residential land (R1). The site was historically cleared of native vegetation and used for farming exotic fruit and nut trees including mangoes, pecans and bananas.

1.3.1 Topography and Drainage

The site has a northern aspect, with a varying slope from moderately steep in the southern end of the site to relatively gentle in the northern end. The average grade of the existing site is 15%. A minor drainage line crosses the northwest corner of the site and directs water into a small concrete reservoir that will be removed as part of the proposed development. Further downstream of the site is Lagoon Creek which discharges to Wilsons Creek at Howards Grass.

The topography of the site and location of the drainage line are shown in Figure 1.1. The site is shaded red and stream indicated by a yellow line. Site surveys and engineering plans show the site contours and drainage lines (refer Appendix A and Appendix).

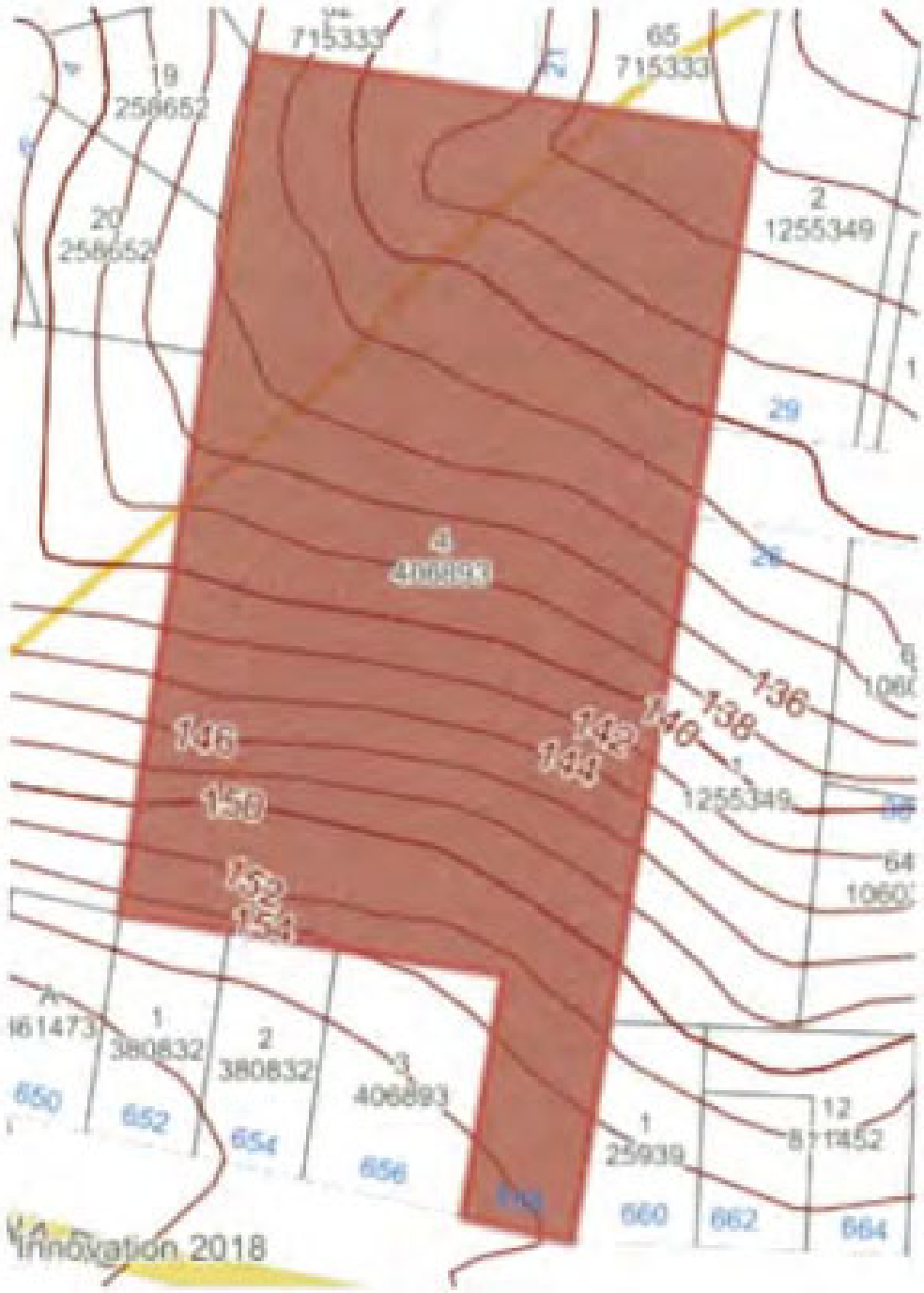


Figure 1.1 Site topography (Source: Statement of facts and contentions)

The legal point of discharge is in the northeast corner of the site with an easement to drain water via an "*Easement For Overland Flow 5 Wide (DP1255349)* (refer Plate 1). Appendix A contains a topographic survey of the existing site and surrounds which shows surrounding and downstream drainage easements. The property at the north east of the site (Lot 65 DP 715333, 21 Greenwood Drive) is constrained by an easement (*"Easement to Drain Water 2 Wide DP 715333"* refer Appendix A) that takes the stormwater from the existing northern part of Greenwood Drive and some surface flow from the subject site (existing headwall – refer Plate 2) via a piped system and discharges to the drainage easement in Lot 2 DP 1255349 (refer Plate 1). Beyond the extents of Lot 2 DP 1255349 is an existing natural rock lined and vegetated intermittent drainage line.

Plate 1 Existing overland flow path through Lot 2 DP 1255349. Note formed and rock lined channel

Plate 2 Existing headwall on the northern boundary of the subject site, collecting surface flow into the piped stormwater system within the easement on Lot 65 DP 715333 (21 Greenwood Dr.)

1.3.2 Soils

The site's soils are mapped as Dermosols (using the Australian Soil Classification) in *Soil Landscapes of the Lismore-Ballina 1:100,000 Sheets* (NSW Government and DPIE, 1994). A simplified description of Dermosols is provided by Metcalfe and Bui (2016) as "*[structured B horizons (having a concentration of silicate clay, iron, aluminium and organic material) and gradational to minor changes in texture with depth*".

1.3.3 Vegetation and Ecology

The site is predominantly vegetated with exotic pasture grasses and some regenerating native vegetation mostly along the fringe of the western boundary of the site which adjoins a lot containing native vegetation. There are several mature Mango trees within the pasture. The site currently hosts an existing dwelling which is proposed to be retained on the proposed Lot 1. The site is located within a known area of "Core Koala Habitat" and is important for connectivity for koalas as the section of Ballina Rd at the entrance to site forms what is considered to be a significant "black spot" for koala vehicle strike (Biolink, 2017).

The site drains to the north east direction via surface flows and minor depressions. An unnamed drainage line is located to the north east that is heavily vegetated (mixed native and exotic species) and naturally rock lined. The unnamed drainage line continues down the north facing slope and onto the flats at Lagoon Grass where it joins Lagoon Creek, a tributary of the Wilson River.

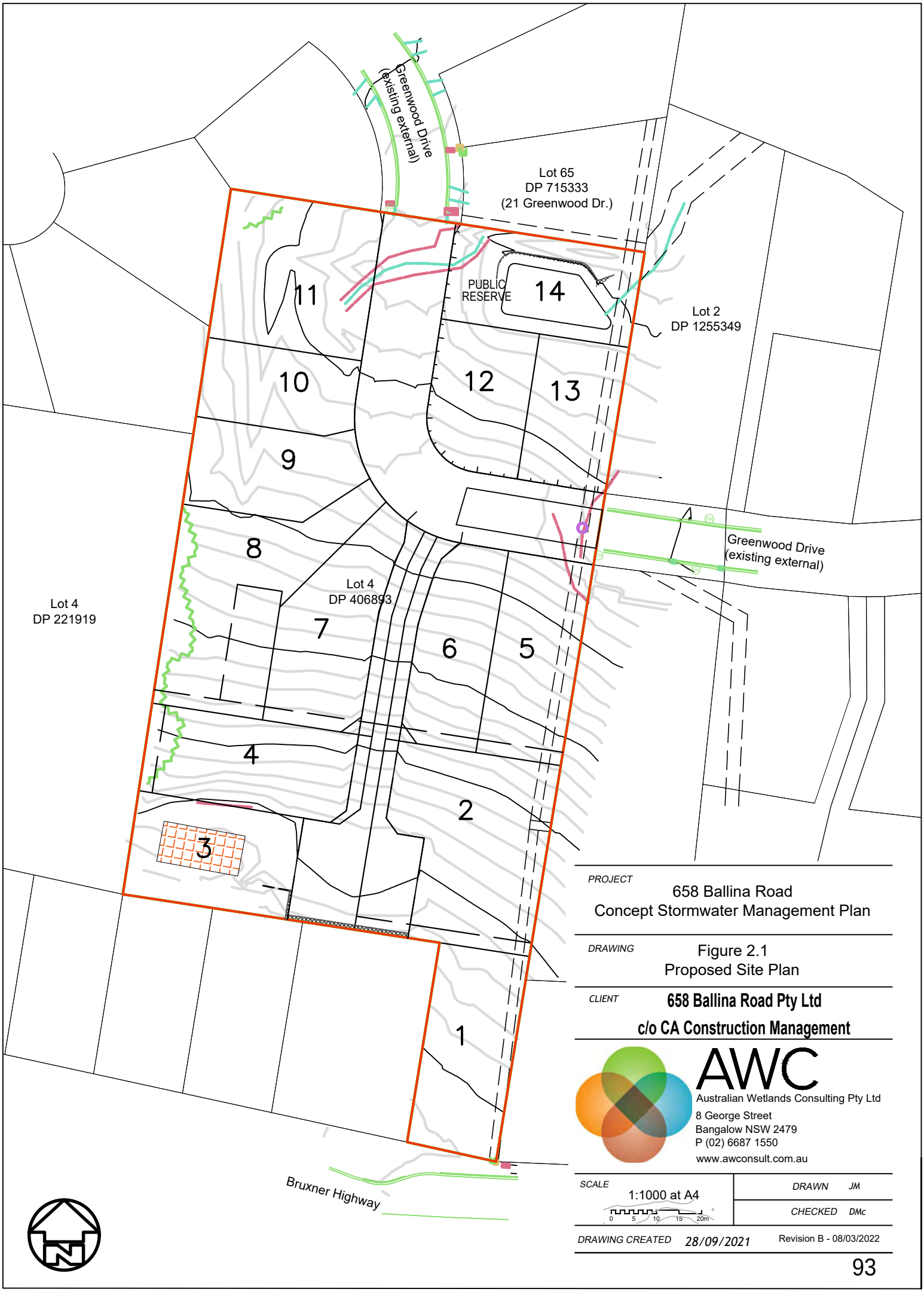
1.3.4 Catchment Description and Context

The site drains to Lagoon Creek which directs flows to the Wilsons River. Water quality in the Wilsons River is generally very poor. Poor water quality is linked to a lack of riparian vegetation and agricultural land use (Ryder *et al.*, 2015). The site is located within a drinking water catchment and upstream of the Wilsons River Source. Presently most of the catchment is under agricultural production and the development of this site represents an opportunity to enhance water quality through the implementation of WSD.

2 Description of Proposed Development

The proposed development site plan is shown in Figure 2.1 and includes 14 lots, comprising 13 residential lots and one public reserve lot. The development includes a section of new road joining the two existing sections of Greenwood Drive external to the site with direct access for nine proposed lots (lots 5-13). An access handle, comprising easements for access and services will be provided for lots 2-4. Proposed lot 1 will have access directly from Ballina Road. Further detail is provided in the engineering plans (RCS, 2022) provided in Appendix D.

The stormwater conveyance system will be constructed to capture all surface flows from the impervious surfaces and any overland flows and direct them to the legal point of discharge at the northeast corner of the site. Some flows are directed around the proposed On-Site Detention (OSD) and stormwater treatment system detailed this report. Trunk drainage network (pits and pipes) has been designed by RCS Group.


Greenwood Drive
(existing external)
Lot 65
DP 715333
(21 Greenwood Dr.)
PUBLIC
RESERVE
14
11
10
12
13
9
Lot 2
DP 1255349
8
Lot 4
DP 406893
7
6
5
Greenwood Drive
(existing external)
Lot 4
DP 221919
4
2
3
1
Bruxner Highway
PROJECT
658 Ballina Road
Concept Stormwater Management Plan
DRAWING
Figure 2.1
Proposed Site Plan
CLIENT
658 Ballina Road Pty Ltd
c/o CA Construction Management
AWC
Australian Wetlands Consulting Pty Ltd
8 George Street
Bangalow NSW 2479
P (02) 6687 1550
www.awconsult.com.au
SCALE
1:1000 at A4
0 5 10 15 20m
DRAWN JM
CHECKED DMc
DRAWING CREATED 28/09/2021
Revision B - 08/03/2022

3 Stormwater Quality

3.1 Performance Criteria

Stormwater from development sites is required to be treated to ensure quality meets the performance criteria in Table 3.1 in accordance with the Lismore DCP.

Table 3.1 WSD stormwater quality performance criteria, LCC DCP Chapter 22 (2012)

Component	Performance Criteria	Intent
Total Suspended Solids	75% reduction in the mean annual load compared to baseline	Minimise the risk of water quality degradation in downstream waterways and thereby protect aquatic ecosystems
Total Phosphorus	65% reduction in the mean annual load compared to baseline	
Total Nitrogen	40% reduction in the mean annual load compared to baseline	
Gross Pollutants	90% reduction in the mean annual load compared to baseline	

3.2 Methodology

To demonstrate compliance with the performance criteria outlined in Table 3.1, stormwater quality modelling was undertaking using MUSIC (Model for Urban Stormwater Improvement Conceptualisation), a software designed to simulate rainfall and pollution generation and the performance of WSD treatment devices. The approach to modelling was undertaken in accordance with the *MUSIC Modelling Guidelines* (Water by Design, 2018). These guidelines were developed for use in Southeast Queensland and considered accepted WSD design guidelines according to *The Handbook* (AUS-SPEC &NRLG, 2013).

3.3 MUSIC Input Parameters

3.3.1 Climate Data

Rainfall data was sourced from the Alstonville weather station as the closest location with an appropriate pluviograph record. The duration of the model is 22 years (12/10/1996 28/03/2009). Average monthly areal potential evapotranspiration data from 1961 to 1990 (BOM 2005) were used for the duration of the model.

3.3.2 Land Use

The proposed development will result in an urban residential site. A MUSIC model was developed based on the civil design for the site (which provides the area of proposed roads on the site) and assuming 200 m^2 of roof and 100 m^2 of paved area per site. A split-catchment approach was taken to the model for the internal development area by using separate source nodes for roof areas and paved areas (roof), roads (road) and grassed areas (grassed). Two external catchments (refer Figure 3.1) have uncontrolled flows currently entering the site. Overland flow from the catchment

to the west (Catchment D) is proposed to be captured along the western boundary using a swale and directed off the site. An existing urban catchment area at the southern boundary (Catchment E) will be captured in the proposed trunk drainage system of the proposed development and be treated in the bioretention system.

Catchment D to the west was not included in the MUSIC model with flows bypassing the treatment device. Catchment E was included in the MUSIC modelling. Relative catchment proportions are detailed in Table 3.2. Impervious fractions adopted for the model are provided in Table 3.3. Refer Figure 3.1 for catchment plan. A detailed catchment plan is provided in Figure 3.1.

Pollutant and rainfall runoff parameters for the source nodes have been sourced from the *MUSIC Modelling Guidelines* (Water by Design, 2018). Appendix B provides tables with all parameters used in the setup of each type of source node type.

Table 3.2 Catchment areas and source node types

Catchment	Total Area (ha)	MUSIC source node type
A	0.14	Roof (residential)
A	0.162	Road (residential)
A	0.563	Grassed (residential)
B	0.10	Roof (residential)
B	0.076	Road (residential)
B	0.409	Grassed (residential)
C	0.090	Grassed (residential)
E	0.360	Residential (lumped catchment)

Table 3.3 Impervious fractions

MUSIC source node / catchment	Impervious fraction
Roof (residential)	100 %
Road (residential)	60 %
Grassed (residential)	20 %
Catchment C	20 %
Catchment E	45 %

Catchment A - Total 0.865 ha
0.14 ha roof,
0.162 ha road,
0.563 ha grassed

Catchment B - Total 0.585 ha
0.10 ha roof
0.076 ha road
0.409 ha grassed

Catchment C - Total 0.09 ha
0.09ha grassed
(0 roof, 0 road)

Catchment D - Total 1.79 ha
Bypass treatment system
External catchment

Catchment E - Total 0.36 ha
Lumped residential
External catchment

Internal Catchment

External Catchment

PROJECT
658 Ballina Road
Concept Stormwater Management Plan

DRAWING
Figure 4-1
Catchment Plan

CLIENT
658 Ballina Road Pty Ltd
c/o CA Construction Management

AWC
Australian Wetlands Consulting Pty Ltd
8 George Street
Bangalow NSW 2479
P (02) 6687 1550
www.awconsult.com.au

SCALE 1:1250 at A4
0 5 10 15 20m

DRAWN JM
CHECKED DMc

DRAWING CREATED 28/09/2021
Rev D 08/03/2022

3.3.3 Treatment

Stormwater treatment at the site will be provided by a bioretention basin within proposed lot 14 which will capture and treat flows from the site before they are discharged off site. This will treat flows from the development site (roads, roofs and grassed areas) and Catchment E being the urban catchment to the south of the site. The bioretention basin filter will have a surface area of at least 117 m^2 and an extended detention depth of 0.4 m.

A portion of the required OSD storage will be contained in the same basin as the bioretention treatment; the OSD storage will be above the EDD (refer Figure 4.1, Section 4.6 and *Hydraulic Assessment* by Floodworks (2021)). Some flexibility with extended detention will need to be applied at the next stage of project development to provide for suitable integration with the surrounding land uses and address necessary safety requirements.

A model was set up for each sub-catchment to ensure that sufficient treatment could be allocated (refer Figure 3.2). Appendix B provides tables with all parameters used in the setup of each treatment node type. A copy of the MUSIC file will be provided via email.

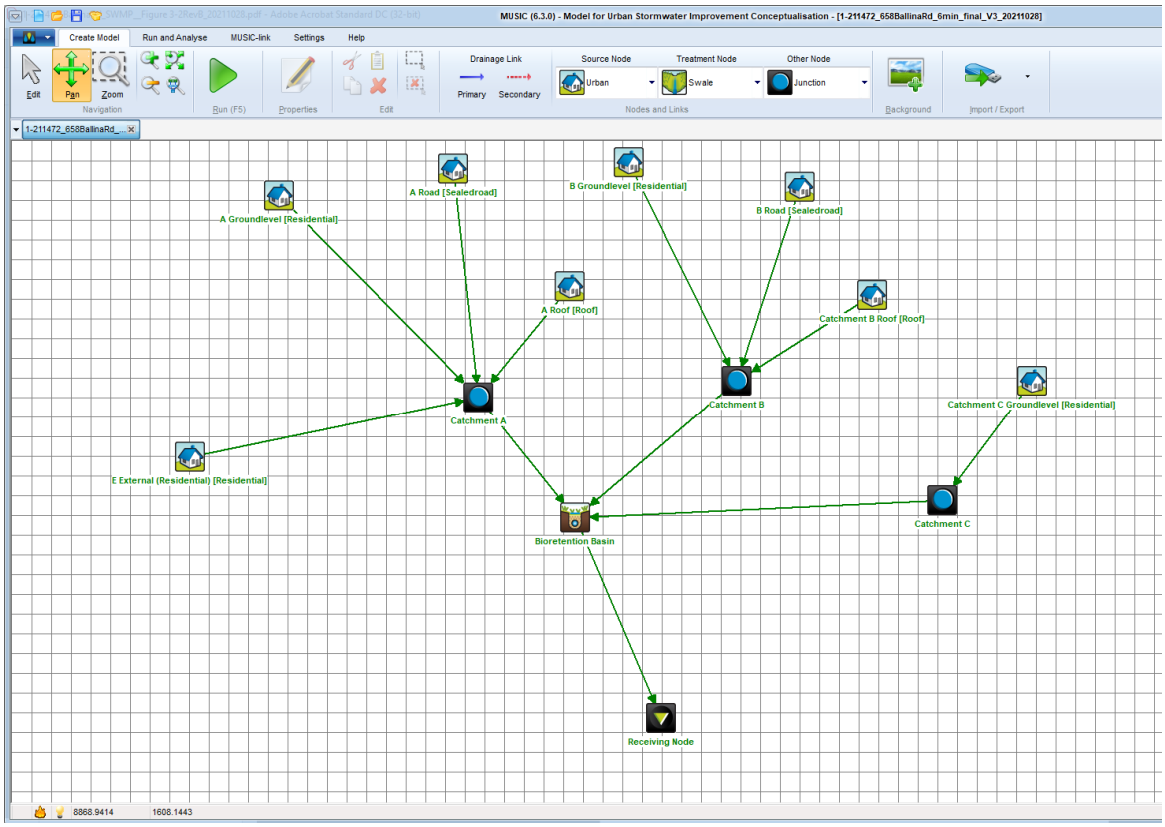


Figure 3.2 MUSIC Model layout

To remain conservative, rainwater tanks were not included in the model however these are to be included on each lot. LCC encourages non-potable water storage and use as part of a holistic water cycle management. Additionally, BASIX (Building Sustainability Index) performance typically leads to use of rainwater tanks. The use of tanks on the dwelling sites will reduce the flow to the treatment system effectively providing a higher level of treatment than modelled.

3.3.4 Music Modelling Results

MUSIC modelling results shows bioretention filter area of 117 m² achieves the required performance criteria (refer Table 3.4). The basin earthworks were designed with a bioretention filter surface area of 147.5 m².

Table 3.4 Bioretention requirements and performance

Component	Value	Notes
Bioretention filter area	117 m²	Treatment areas modelled to achieve pollutant reduction targets of 75%,65%, 40% (TSS:TP:TN)
Extended detention depth	0.4 m	
TSS removal	75.1 %	Performance criteria- 75% removal
Total Phosphorus removal	69.1 %	Performance criteria- 65% removal
Total Nitrogen removal	48.5 %	Performance criteria- 40% removal
Gross pollutants removal	99.9 %	Performance criteria- 90% removal
Refer Appendix B for all MUSIC input parameters.		

3.4 Proposed Treatment System

A bioretention basin will be designed and constructed to accept and treat all stormwater flow from the proposed development and overland flows emanating from the external Catchment E. The basin will have a minimum of 117 m² filter area and 0.5 m filter depth with a 0.4 m extended detention depth. Concept design plans are provided in Appendix C with some detail provided in the engineering plan set (RCS Group) provided in Appendix . These plans and this assessment show that the site can provide treatment to the required standard. Further design works will be required as part of the detailed Construction Certificate documentation phase.

4 Concept Development

4.1 Demand Reduction and Onsite Reuse

One of the key objectives identified in the LCC Water Sensitive Design DCP is the reduction in demand for reticulated supply (refer Table 4.1). In addition to LCC requirements all lots will be required to demonstrate that they can achieve the required 40 % reduction in demand required under the BASIX (Building Sustainability Index) Guidelines. It is recommended that rainwater tanks be installed an all lots and that connection to toilets, laundry and gardens be included. This will allow for rainwater to be sourced and supplied locally to non-potable end uses and effectively reduce demand on reticulated supply.

Table 4.1 WSD potable water consumption performance criteria, LCC DCP Chapter 22 (2012)

Component	Performance Criteria	Intent
Reticulated water consumption for residential development	40 % reduction in the consumption of reticulated water compared to baseline (to be consistent with BASIX)	Increase the level of water recycling, reduce the demand for reticulated water from the bulk water supply network, and help to alleviate the need for upgrades to bulk water infrastructure

4.2 Ecological Protection

Stormwater treatment devices are constructed to reduce pollutants discharging to the downstream environment. Adjacent to the proposed subdivision is an existing drainage line and easement to drain stormwater where treated stormwater is to be discharged; the existing drainage line is heavily vegetated, and naturally rock lined. Without effective treatment, there are potential negative environmental impacts to the downstream landscapes and ecosystems due to increased pollutant discharge and concentrated stormwater flow. These impacts can be effectively managed through appropriate design and inclusion of stormwater treatment devices. As detailed in the Concept Drawings (refer Appendix C) the outlets are designed to allow for dispersion of flows and enhancement of native plantings.

A key aim of the stormwater strategy is to safely transition stormwater flows from the proposed new urban environment to the surrounding 'natural' environment without negative environmental impacts. This will be achieved by incorporating native and endemic plant species into the vegetated bioretention basin where they adjoin natural areas. Integration with the local environment can be achieved through site sympathetic design and plant selection. The planting guide *My local Native Garden* developed by Rous County Council and Lismore City Council provides a good basis for plant selection for stormwater treatment devices and surrounding areas (Rous County Council and Lismore City Council, 2016).

4.3 Responsibility

Lismore City Council requires supervision of construction, system establishment, commissioning and ongoing maintenance of WSD devices be detailed in a Water Management Plan. It is recommended that construction management allows for supervision and input from suitably

qualified personnel with experience in WSD practice in all stages of development to ensure objectives detailed in this strategy are achieved. System establishment will require a two year period from plant installation. This establishment period is required to ensure that system function is optimized and to allow for development of a healthy plant community. Following this two-year establishment period, asset handover to LCC will take place.

4.4 Maintenance

Regular maintenance is required for all stormwater treatment devices to ensure effective operation and minimise operational costs over the life of the asset. Maintenance requirements include litter removal, weeding, sediment removal and inspection of hydraulic structures for erosion and scour. Maintenance requirements are the responsibility of the developer during the establishment period prior to asset handover.

Maintenance access should be integrated with pedestrian access where feasible and allow for connection with roads and car parks. Access to all stormwater outlets should allow for routine maintenance and inspections. Outlets should be maintained to ensure free drainage from all devices. The next design phase will require careful assessment of access to outlets to ensure system function and surrounding environment impacts are considered.

4.5 Surface Flow from Upslope

A boundary diversion drain will be installed within the bushfire easement along the western and northern boundary to convey surface flows away from the proposed dwellings. The swale will discharge at the north western corner of the site, at the existing legal point of discharge and 5m wide easement for overland flow.

Stormwater flow from the three existing dwelling sites in Catchment C (refer Figure 3.1) will be directed to the trunk drainage network of the proposed development and undergo treatment prior to delivery to the legal point of discharge.

4.6 On Site Detention (OSD)

On site detention (OSD) is detailed in the *Hydraulic Assessment* prepared by Floodworks (Floodworks 2021) and comprises:

- 109 m^3 of storage in the basin over and above the bioretention extended detention depth (EDD) (refer Figure 4.1)
- 3 m^3 active OSD storage in rainwater tanks at each of the proposed dwellings (refer Figure 4.2)

Refinement of the combined bioretention and OSD basin design will be required detailed design (CC) phase. This CSWMP and the Hydraulic Assessment (Floodworks, 2021) have provided a proof of concept for the DA stage.

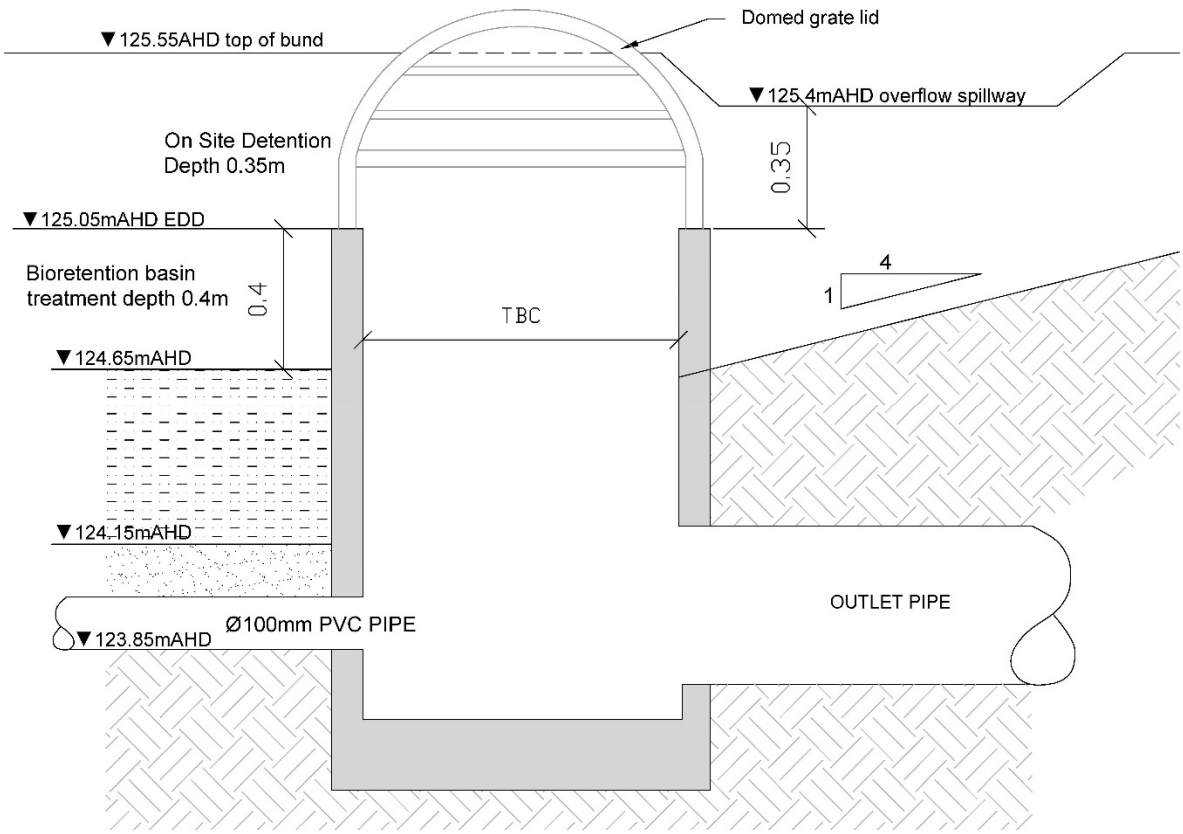


Figure 4.1 Schematic OSD storage and bioretention basin treatment arrangement

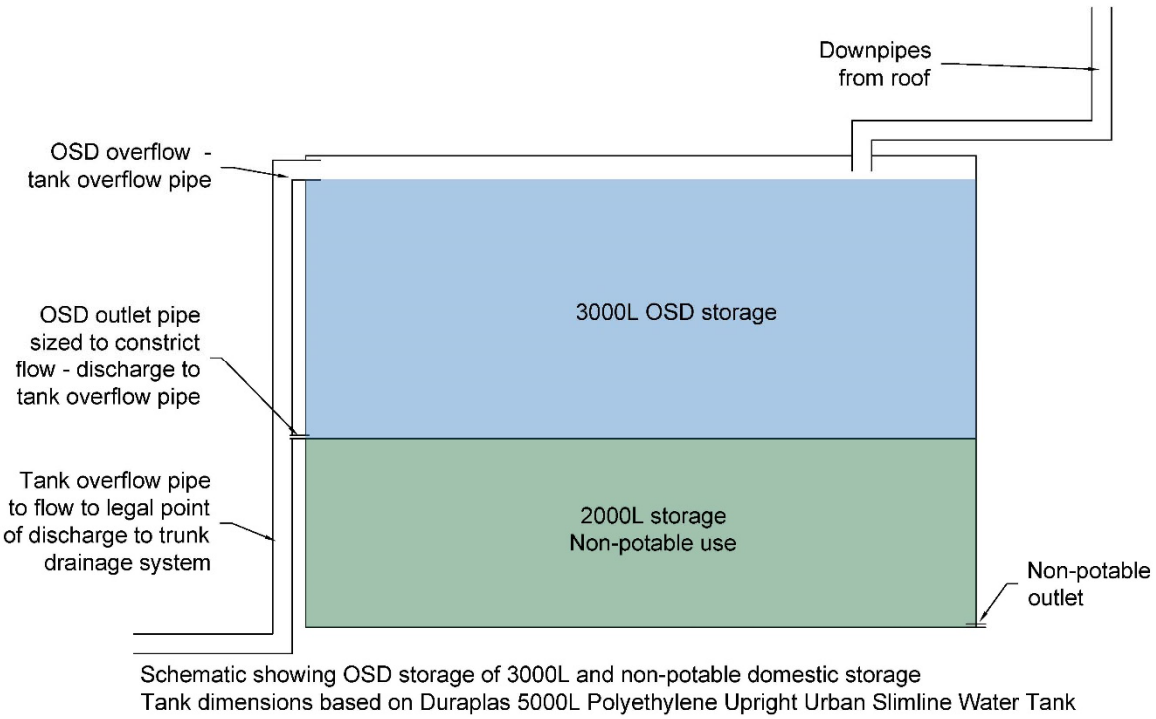


Figure 4.2 Schematic OSD storage and non potable water storage tank arrangement

5 Conclusions and Recommendations

This amended Concept Stormwater Management Plan has been prepared for submission to LCC as part of DA stage documentation. The proposal is to subdivide the existing allotment resulting in roads, 13 dwelling lots and a public reserve that will be used for stormwater treatment and OSD measures. This assessment shows that appropriate stormwater treatment can be achieved at the site.

Detailed hydraulic assessment has been undertaken by Floodworks (2021) that provide On Site Detention (OSD) volumes required to achieve compliance with relevant section of the LCC DCP.

The legal point of discharge located at the north eastern corner of the subject site comprises a 5m wide easement for overland flow on the neighbouring property (refer survey in Appendix A) (Lot 2 DP 1255349). The proposed stormwater management system will deliver treated stormwater to that point.

MUSIC modelling shows a bioretention basin with 117 m² surface area and EDD of 0.4 m will exceed the required pollutant reduction targets of 75% TSS, 65% TN, 40% TP and 90% gross pollutants in accordance with the LCC DCP. A bioretention basin with surface area of 147.4 m² has been designed to concept level (refer engineering plans in Appendix D).

Preliminary OSD sizing was undertaken by Floodworks (2021), however this needs to be revised considering the amended subdivision layout. OSD storage in rainwater collection tanks with controlled discharge, and within a dual purpose bioretention/OSD basin is recommended.

Overland flow from the upslope areas to the west of the subject site will be collected in a surface swale and diverted along the western and northern boundaries and delivered to the legal point of discharge without treatment. Overland flow from an external residential catchment upslope of the development site will be captured in the proposed trunk drainage network and treatment system prior to discharge off site.

6 References

AUS-SPEC & Northern Rivers Local Government (NRLG), 2013, *Handbook of Stormwater Drainage Design, D5 – Stormwater Drainage Design*, Aus-Spec Reference

Biolink Ecological Consultants (2017). *Koala Habitat & Population Assessment*

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Lismore City Council (2012). *Development Control Plan – Part A, Chapter 22 Water Sensitive Design*

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State Government of NSW and Department of Planning, Industry and Environment (1994). *Soil Landscapes of the Lismore-Ballina 1:100,000 Sheets, available at: https://datasets.seed.nsw.gov.au/dataset/soil-landscapes-of-the-lismore-ballina-1-100000-sheets554a6*, accessed September 2021

Water by Design (2018). *MUSIC Modelling Guidelines*, SEQ Healthy Waterways Partnership. Brisbane Queensland.

Appendix A

Site Survey (Heath & McPhail Surveying – HM17154-1 Issue D, 23.07.2021)

10 5 0 10 20 30 40 50 60 70

SCALE 1:700 @ A2

Disclaimer:
This Detail Survey is not a "survey" as defined by the Surveying Act, 2002.
This survey is not a full Detail & Contour Survey. The purpose of this survey is for design purposes only over the surveyed area of Lot 4 in DP 406893 by Heath & McPhail Surveying.
A Title Search has been carried however the Title Boundaries have not been marked as part of this survey.
If any construction is planned close to the boundaries it would be advisable to carry out further survey work to determine the boundary dimensions.
Only partial location of structures & retaining walls etc have been included as part of this survey.
Not all individual trees have been located within this surveyed area. The trees have been located to enable orientation & identification of features on site. Only trees with a trunk diameter (DBH) greater than 100mm have been located as shown on this survey. The overall spread of the trees shown are approximate only.
No "Dial Before You Dig" searches have been carried out as part of this survey.
There may be services on site that have not been located as part of this survey.
Prior to any demolition, excavation or construction on the site, the relevant authorities should be contacted for possible location of underground services and detailed locations of all services.
Council or the relevant authorities should be contacted regarding any future dealings within the land as to the location of all underground services to comply to the relevant setbacks from any of these services.
This plan may not be copied unless these notes are included.

Reference Table to correspond with Tree numbers shown in red on plan

Tree Number	Common Name	Scientific Name	Overall Spread
1	Pecan	*Carya illinoinensis*	10
2	Pecan	*Carya illinoinensis*	10
3	Poinciana	Delonix regia	20
4	Macadamia	*Macadamia Integrifilia*	4
5	Pecan	*Carya illinoinensis*	8
6	Pecan	*Carya illinoinensis*	10
7	Pecan	*Carya illinoinensis*	8
8	Pecan	*Carya illinoinensis*	6
9	Pecan	*Carya illinoinensis*	8
10	Pecan	*Carya illinoinensis*	10
11	Pecan	*Carya illinoinensis*	10
12	Pecan	*Carya illinoinensis*	8
13	Mango	*Mangifera indica*	10
14	Mango	*Mangifera indica*	10
15	Mango	*Mangifera indica*	8
16	Mango	*Mangifera indica*	10
17	Mango	*Mangifera indica*	10
18	Mango	*Mangifera indica*	10
19	Stone fruit		4
20	Mango	*Mangifera indica*	10
21	Mango	*Mangifera indica*	10
22	Mango	*Mangifera indica*	10
23	Pecan	*Carya illinoinensis*	6
24	Pecan	*Carya illinoinensis*	10
25	Mango	*Mangifera indica*	6
26	Pecan	*Carya illinoinensis*	8
27	Pecan	*Carya illinoinensis*	10
28	Pecan	*Carya illinoinensis*	6
29	Mango	*Mangifera indica*	8
30	Mango	*Mangifera indica*	8
31	Mango	*Mangifera indica*	8
32	Mango	*Mangifera indica*	6
33	Macadamia	*Macadamia Integrifilia*	4
34	Pecan	*Carya illinoinensis*	10
35	Mango	*Mangifera indica*	4
36	Mango	*Mangifera indica*	8
37	Mango	*Mangifera indica*	6
38	Mango	*Mangifera indica*	6
39	Mango	*Mangifera indica*	6
40	Mango	*Mangifera indica*	6
41	Mango	*Mangifera indica*	6
42	Mango	*Mangifera indica*	6
43	Mango	*Mangifera indica*	6
44	Mango	*Mangifera indica*	6
45	Mango	*Mangifera indica*	6
46	Eucalypt		4
47	Eucalypt		4
48	Mango	*Mangifera indica*	8
49	Mango	*Mangifera indica*	8
50	Mango	*Mangifera indica*	8
51	Mango	*Mangifera indica*	8
52	Mango	*Mangifera indica*	4
53	Pecan	*Carya illinoinensis*	8
54	Pecan	*Carya illinoinensis*	10
55	Macadamia	*Macadamia Integrifilia*	6
56	Macadamia	*Macadamia Integrifilia*	6
57	Eucalypt		4
58	Eucalypt		4
59	Eucalypt		4

Note: Point co-ordinates including height information can be inquired from the DWG file.

Sewer Manhole Reference Table

Manhole No.	Top RL	Invert RL
MH 16A90	123.26	inlet from south 121.46
		inlet from west 121.52
		outlet to north 120.96
MH 16A91	131.25	inlet from east 128.98
		outlet to north 128.35
		inlet from south 129.85
MH 16A92	145.66	140.26
MH 16QE1	127.90	Inlet RL126.34 Outlet RL125.06
MH 16EW1	134.16	133.41
MH 16EW2	135.73	133.93
MH in Lot 63	131.46	outlet 129.72

Stormwater Pit Reference Table

Pit No.	Top RL	Invert RL
Kerb Inlet Pit 1	128.15	127.01
Kerb Inlet Pit 2	128.14	126.18
Headwall 3	125.57	124.75
Humeceptor	130.42	129.06 insert 127.26 bottom

Ⓐ Easement For Sewerage Purposes Limited in Height & Depth (DP612269)
Ⓑ Right of Carriageway (DP1255349)
Ⓒ Easement For Overland Flow 5 Wide (DP1255349)
Ⓓ Easement to Drain Water (DP1255349)
Ⓔ Easement For Sewer Gravity Main (DP1060356)
Ⓕ Easement For Sewer Gravity Main (DP1255349)
Ⓖ Easement to Drain Water 2 Wide (DP715333)

MGA

Legend:
- Denotes Change of Grade
- Denotes Fence Line
- Denotes Sewer Line
- Denotes Sewer Manhole
- Denotes Edge of Trees
- Denotes Overhead Electricity
- Denotes Centre of Tree
- Denotes Communications Pit
- Denotes Electricity Pit
- Denotes Electricity Box
- Denotes Grated Pit
- Denotes Fire Hydrant
- Denotes Power Pole
- Denotes Stop Valve
- Denotes Kerb Inlet Pit

Issue	Description	Chk	Drw	Date	Appd
D	Extra detail on adjoining land	GH	GH	27.07.21	GH
C	Extra trees and detail located	GH	GH	15.07.21	GH
B	Extra Sewer located	GH	GH	4.09.19	GH
A	Detail & Contour Survey	GH	IM	4.01.18	IM

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CAUTION: The information shown on this plan may be insufficient for some types of detailed design. Heath & McPhail Surveying Pty Ltd should be consulted as to the suitability of the information shown herein prior to the commencement of any works based on this plan.

658 Ballina Road Pty. Ltd.

Plan Showing Detail & Contour Survey Lot 4 in DP 406893, known as No.658 Ballina Road, Goonellabah.

Scale: 1:700 at A2
Datum: AHD
Origin: SSM 90073 RL=131.85
Contour Int: 0.25m

Locality: Goonellabah
LGA: Lismore
Autocad File: HM17154
Civilcad File: HM17154-1.ccx

Heath & McPhail SURVEYING
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Glen Heath: 0417 677 689 Ian McPhail: 0407 289 192

Sheet No.	Checked By:	Approved By:	Date of Survey:
1 of 1	GH	Glen Heath	28.12.2017
			3.09.2019
			07.07.2021
			23.07.2021

Dwg. No.
HM17154-1 Issue **D**

10 5 0 10 20 30 40 50 60 70

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Disclaimer:
This Detail Survey is not a "survey" as defined by the Surveying Act, 2002.
This survey is not a full Detail & Contour Survey. The purpose of this survey is for design purposes only over the surveyed area of Lot 4 in DP 406893 by Heath & McPhail Surveying.
A Title Search has been carried however the Title Boundaries have not been marked as part of this survey.
If any construction is planned close to the boundaries it would be advisable to carry out further survey work to determine the boundary dimensions.
Only partial location of structures & retaining walls etc have been included as part of this survey.
Not all individual trees have been located within this surveyed area. The trees have been located to enable orientation & identification of features on site. Only trees with a trunk diameter (DBH) greater than 100mm have been located as shown on this survey. The overall spread of the trees shown are approximate only.
No "Dial Before You Dig" searches have been carried out as part of this survey.
There may be services on site that have not been located as part of this survey.
Prior to any demolition, excavation or construction on the site, the relevant authorities should be contacted for possible location of underground services and detailed locations of all services.
Council or the relevant authorities should be contacted regarding any future dealings within the land as to the location of all underground services to comply to the relevant setbacks from any of these services.
This plan may not be copied unless these notes are included.

Reference Table to correspond with Tree numbers shown in red on plan

Tree Number	Common Name	Scientific Name	Overall Spread
1	Pecan	*Carya illinoinensis*	10
2	Pecan	*Carya illinoinensis*	10
3	Poinciana	Delonix regia	20
4	Macadamia	*Macadamia Integrifilia*	4
5	Pecan	*Carya illinoinensis*	8
6	Pecan	*Carya illinoinensis*	10
7	Pecan	*Carya illinoinensis*	8
8	Pecan	*Carya illinoinensis*	6
9	Pecan	*Carya illinoinensis*	8
10	Pecan	*Carya illinoinensis*	10
11	Pecan	*Carya illinoinensis*	10
12	Pecan	*Carya illinoinensis*	8
13	Mango	*Mangifera indica*	10
14	Mango	*Mangifera indica*	10
15	Mango	*Mangifera indica*	8
16	Mango	*Mangifera indica*	10
17	Mango	*Mangifera indica*	10
18	Mango	*Mangifera indica*	10
19	Stone fruit		4
20	Mango	*Mangifera indica*	10
21	Mango	*Mangifera indica*	10
22	Mango	*Mangifera indica*	10
23	Pecan	*Carya illinoinensis*	6
24	Pecan	*Carya illinoinensis*	10
25	Mango	*Mangifera indica*	6
26	Pecan	*Carya illinoinensis*	8
27	Pecan	*Carya illinoinensis*	10
28	Pecan	*Carya illinoinensis*	6
29	Mango	*Mangifera indica*	8
30	Mango	*Mangifera indica*	8
31	Mango	*Mangifera indica*	8
32	Mango	*Mangifera indica*	6
33	Macadamia	*Macadamia Integrifilia*	4
34	Pecan	*Carya illinoinensis*	10
35	Mango	*Mangifera indica*	4
36	Mango	*Mangifera indica*	8
37	Mango	*Mangifera indica*	6
38	Mango	*Mangifera indica*	6
39	Mango	*Mangifera indica*	6
40	Mango	*Mangifera indica*	6
41	Mango	*Mangifera indica*	6
42	Mango	*Mangifera indica*	6
43	Mango	*Mangifera indica*	6
44	Mango	*Mangifera indica*	6
45	Mango	*Mangifera indica*	6
46	Eucalypt		4
47	Eucalypt		4
48	Mango	*Mangifera indica*	8
49	Mango	*Mangifera indica*	8
50	Mango	*Mangifera indica*	8
51	Mango	*Mangifera indica*	8
52	Mango	*Mangifera indica*	4
53	Pecan	*Carya illinoinensis*	8
54	Pecan	*Carya illinoinensis*	10
55	Macadamia	*Macadamia Integrifilia*	6
56	Macadamia	*Macadamia Integrifilia*	6
57	Eucalypt		4
58	Eucalypt		4
59	Eucalypt		4

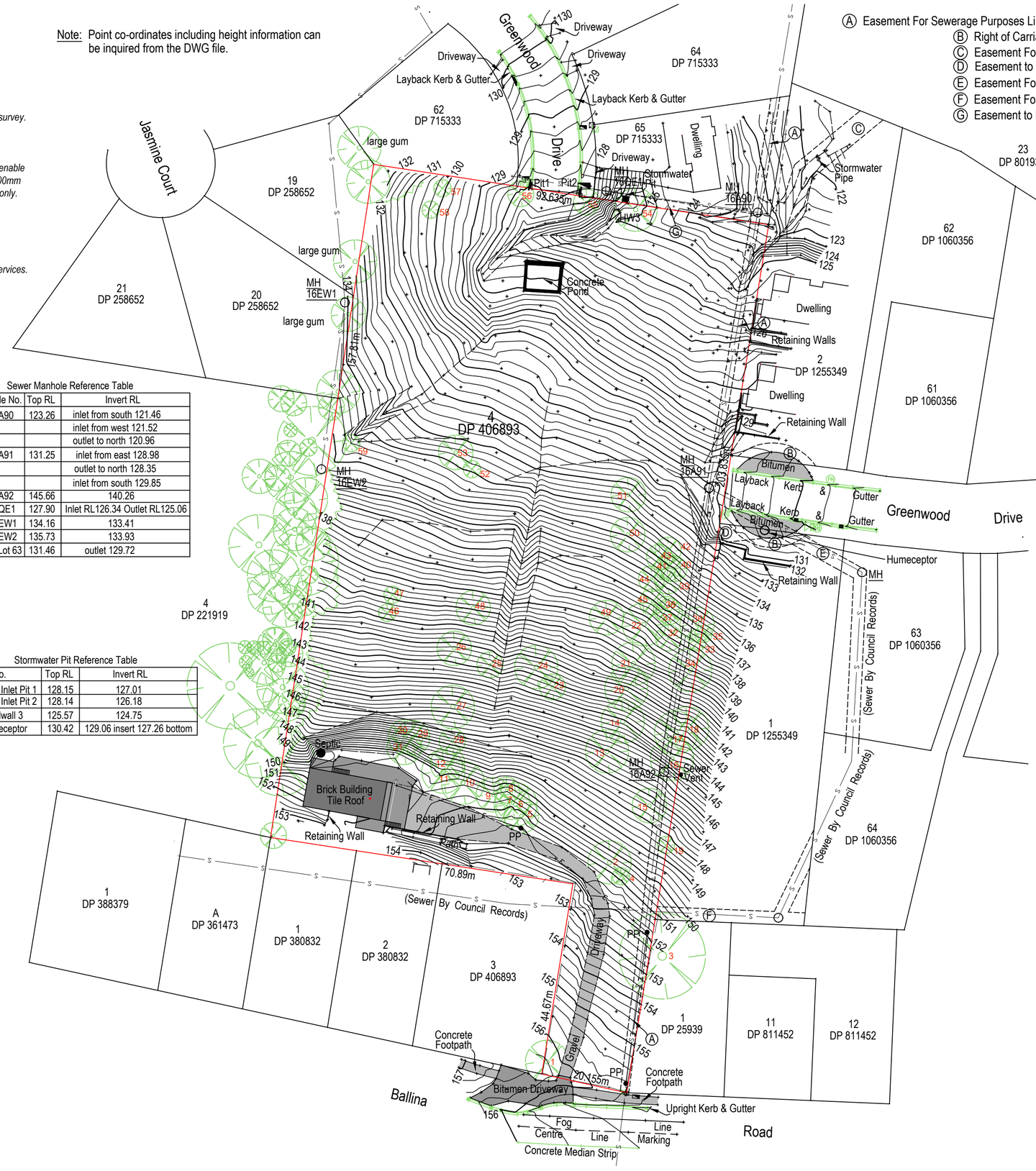
Note: Point co-ordinates including height information can be inquired from the DWG file.

Sewer Manhole Reference Table

Manhole No.	Top RL	Invert RL
MH 16A90	123.26	inlet from south 121.46
		inlet from west 121.52
		outlet to north 120.96
MH 16A91	131.25	inlet from east 128.98
		outlet to north 128.35
		inlet from south 129.85
MH 16A92	145.66	140.26
MH 16QE1	127.90	Inlet RL126.34 Outlet RL125.06
MH 16EW1	134.16	133.41
MH 16EW2	135.73	133.93
MH in Lot 63	131.46	outlet 129.72

Stormwater Pit Reference Table

Pit No.	Top RL	Invert RL
Kerb Inlet Pit 1	128.15	127.01
Kerb Inlet Pit 2	128.14	126.18
Headwall 3	125.57	124.75
Humeceptor	130.42	129.06 insert 127.26 bottom



Ⓐ Easement For Sewerage Purposes Limited in Height & Depth (DP612269)
Ⓑ Right of Carriageway (DP1255349)
Ⓒ Easement For Overland Flow 5 Wide (DP1255349)
Ⓓ Easement to Drain Water (DP1255349)
Ⓔ Easement For Sewer Gravity Main (DP1060356)
Ⓕ Easement For Sewer Gravity Main (DP1255349)
Ⓖ Easement to Drain Water 2 Wide (DP715333)

MGA

Legend:
- Denotes Change of Grade
- Denotes Fence Line
- Denotes Sewer Line
- Denotes Sewer Manhole
- Denotes Edge of Trees
- Denotes Overhead Electricity
- Denotes Centre of Tree
- Denotes Communications Pit
- Denotes Electricity Pit
- Denotes Electricity Box
- Denotes Grated Pit
- Denotes Fire Hydrant
- Denotes Power Pole
- Denotes Stop Valve
- Denotes Kerb Inlet Pit

Issue	Description	Chk	Drw	Date	Appd
D	Extra detail on adjoining land	GH	GH	27.07.21	GH
C	Extra trees and detail located	GH	GH	15.07.21	GH
B	Extra Sewer located	GH	GH	4.09.19	GH
A	Detail & Contour Survey	GH	IM	4.01.18	IM

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658 Ballina Road Pty. Ltd.

Plan Showing Detail & Contour Survey Lot 4 in DP 406893, known as No.658 Ballina Road, Goonellabah.

Scale: 1:700 at A2 — Locality: Goonellabah
Datum: AHD — LGA: Lismore
Origin: SSM 90073 RL=131.85 — Autocad File: HM17154
Contour Int: 0.25m — Civilcad File: HM17154-1.ccx

Heath & McPhail SURVEYING
Heath & McPhail Surveying Pty Ltd
60 Hillcrest Avenue
Goonellabah. NSW . 2480 . Australia
Office (02) 66 886181
Glen Heath: 0417 677 689 Ian McPhail: 0407 289 192

Sheet No.	Checked By:	Approved By:	Date of Survey:
1 of 1	GH	Glen Heath	28.12.2017 3.09.2019 07.07.2021 23.07.2021

Dwg. No.
HM17154-1 Issue **D**

Appendix B

MUSIC model input parameters

Source node details

RESIDENTIAL – Split Catchments (Catchments A, B and C)							
		Roof		Roads		ground	
Impervious fraction		100%		60%		20%	
impervious area properties							
rainfall threshold (mm/day)		1		1		1	
soil storage capacity (mm)		500		500		500	
initial storage (% OF CAPACITY)		10		10		10	
field capacity (mm)		200		200		200	
infiltration capacity coefficient - a		211		211		211	
infiltration capacity coefficient - b		50		50		50	
initial depth (mm)		5		5		5	
daily recharge rate (%)		28		28		28	
daily baseflow rate (%)		27		27		27	
daily deep seepage rate (%)		0		0		0	
pollutant concentrations							
		mean	st.dev.	mean	st.dev.	mean	st.dev.
TSS	base	N/A	N/A	1.00	0.34	1	0.34
	storm	1.3	0.39	2.43	0.39	2.18	0.39
TP	base	N/A	N/A	-0.97	0.31	-0.97	0.31
	storm	-0.89	0.31	-0.3	0.31	-0.47	0.31
TN	base	N/A	N/A	0.2	0. 2	0.2	0.2
	storm	0.26	0.23	0.26	0.23	0.26	0.23

RESIDENTIAL – Lumped Catchment (Catchment E)			
Impervious fraction (%)		40	
impervious area properties			
rainfall threshold (mm/day)		1	
soil storage capacity (mm)		500	
initial storage (% OF CAPACITY)		10	
field capacity (mm)		200	
infiltration capacity coefficient - a		211	
infiltration capacity coefficient - b		5	
initial depth (mm)		50	
daily recharge rate (%)		28	
daily baseflow rate (%)		27	
daily deep seepage rate (%)		0	
pollutant concentrations		mean	st.dev.
TSS	base	1.00	0.34
	storm	2.18	0.39
TP	base	-0.97	0.31
	storm	-0.47	0.32
TN	base	0.20	0.20
	storm	0.26	0.23

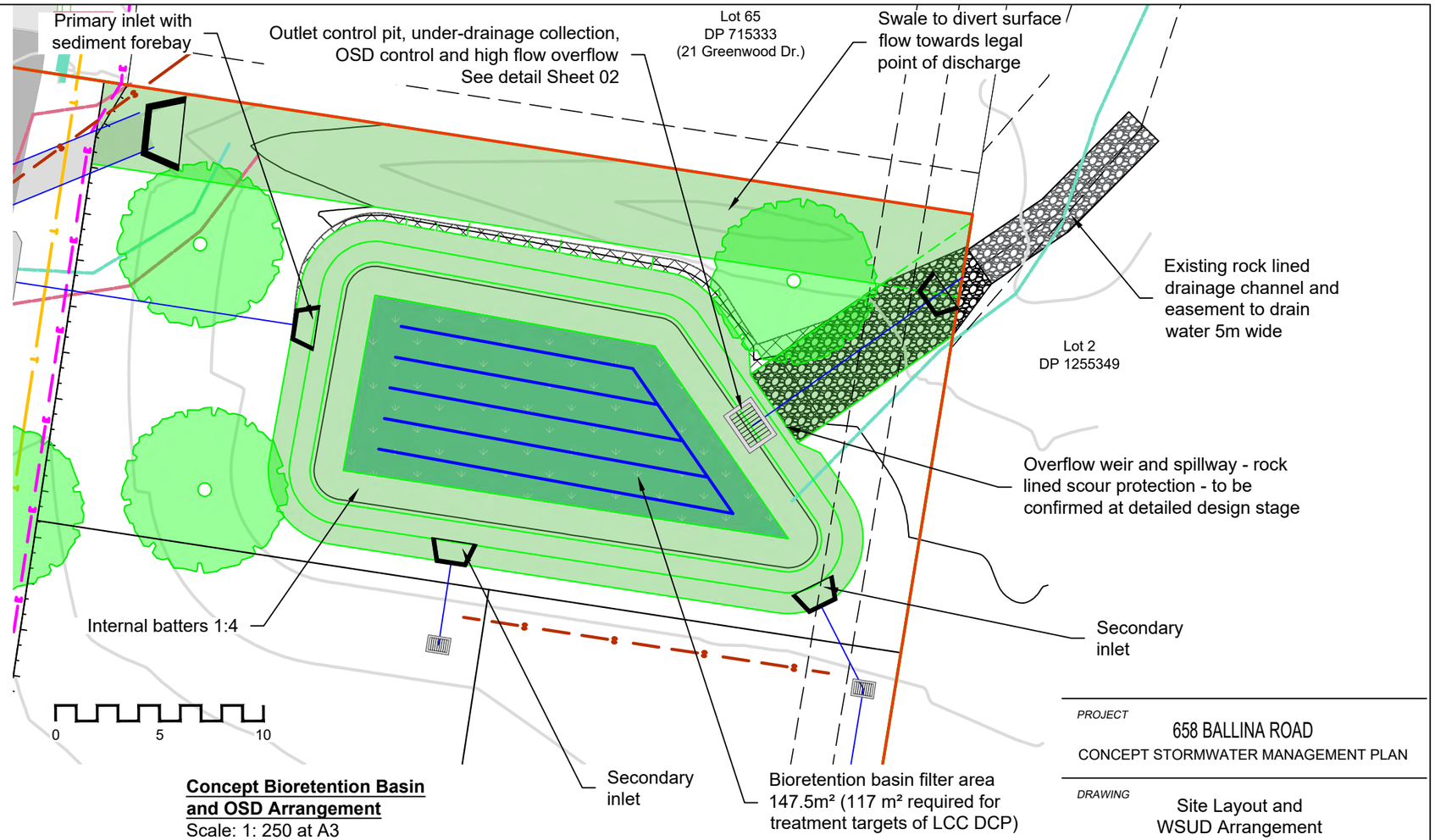
Treatment node details

Bioretention Basin	
Inlet Properties	
low flow by-pass (m^3/s)	0
high flow by-pass (m^3/s)	0.5
Storage Properties	
extended detention depth (m)	0.4
surface area (m^2)	135
Filter and Media Properties	
filter area (m^2)	135
unlined filter media perimeter (m)	0.01
saturated hydraulic conductivity (mm/hr)	200
filter depth (m)	0.5
TN content of filter media (mg.kg)	400
orthophosphate content of filter media (mg/kg)	5
Infiltration Properties	
Exfiltration rate (mm/hr)	0
Lining Properties	
is base lined? (yes/no)	yes
vegetation properties (tick)	
vegetated with effective nutrient removal plants	✓
vegetated with ineffective nutrient removal plants	X
unvegetated	X
Outlet Properties	
overflow weir width (m)	1.5
underdrain present (yes/no)	Y
submerged zone with carbon present/ (yes/no)	n

Appendix C

Concept Stormwater Management Plans (AWC, 2021)

Site Layout
Scale: 1: 1000 at A3



Concept Bioretention Basin and OSD Arrangement
Scale: 1: 250 at A3

Notes:

1. This Concept Stormwater Management Plan is intended for submission to Lismore City Council (LCC) at the Development Application (DA) stage of the proposal
   - 1.1. Detailed design (construction plans) will be undertaken as part of the Construction Certificate (CC) phase with documentation
   - 1.2. Stormwater treatment and On Site Detention (OSD) will be achieved in a dual-purpose basin discharging to the existing legal point of discharge to the north east; an existing 5m wide easement on Lot 2 DP 1255349 for overland flow
   - 1.3. Surface flow from the upslope areas to the west of the subject site will be conveyed along the western and northern boundary for discharge at the existing legal point of discharge
   - 1.4. These plan sheets shall be read in conjunction with the report (658 Ballina Road - Concept Stormwater Management Plan (AWC, 2022)(Revision C))

Treatment

2. Stormwater treatment will be achieved with the construction of a bioretention basin located on Lot 15 of the proposed development; details include:
   - 2.1. Refer Concept Details on Sheet 02
   - 2.2. Pollutant reduction in accordance with LCC DCP of 75 % TSS, 65 %TN, 40 % TP and 90 % gross pollutants
   - 2.3. Filter area of 147.5 m² (min. 117 m² to achieve pollutant reduction target)
   - 2.4. Filter depth of 0.5m
   - 2.5. Extended Detention Depth (EDD) depth of 0.4m (treatment storage)
   - 2.6. Internal batters of 1:4 grade
   - 2.7. Drainage layers and underdrainage pipe network
   - 2.8. Outlet control pit collecting underdrainage flow and over topping
   - 2.9. OSD volume and discharge control (refer below)
   - 2.10. Overflow weir and spillway rock lined for scour protection (size TBC)
   - 2.11. Landscaping and filter planting
   - 2.12. Maintenance access

On Site Detention

3. OSD will be achieved by two methods; lot based OSD tanks and an end of line dual-purpose basin:

Tanks

- 3.1. Each dwelling lot will have a 3000L rainwater tank that will collect rainwater from roof areas and constrict discharge - total of 39KL(m³) (TBC by Floodworks)
- 3.2. Each dwelling lot will have a positive restriction on the title
- 3.3. Details of the tank and orifice will need to be determined at the dwelling DA stage and be based on total roof area
- 3.4. Each site is likely to have a rainwater collection and usage requirement under the BASIX - these two systems can be achieved using the same tank

Basin

- 3.5. OSD volume to be determined (by Floodworks)
- 3.6. OSD storage and controlled discharge will be contained above the EDD of the bioretention treatment storage
- 3.7. The OSD storage will be above the EDD with the top being determined by the top pit level
- 3.8. The outlet pipe of the overflow/outlet pit will effect the controlled discharge (restricted discharge flow rate TBC - by Floodworks)

PROJECT
658 BALLINA ROAD
CONCEPT STORMWATER MANAGEMENT PLAN

DRAWING
Site Layout and WSUD Arrangement

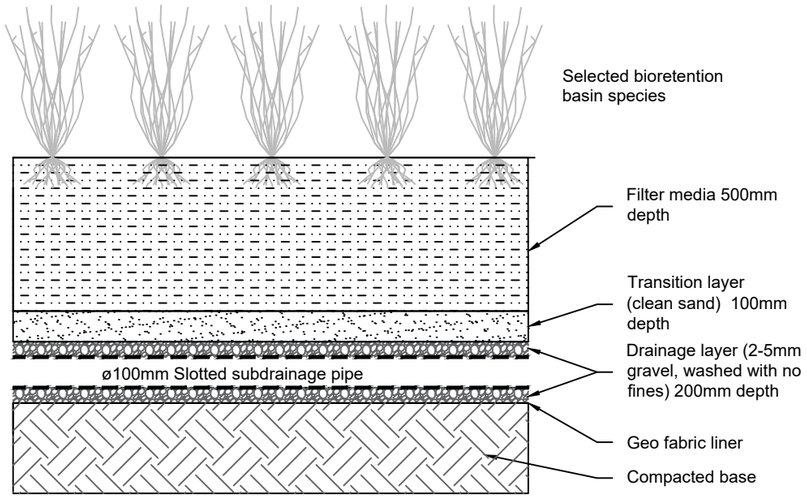
CLIENT
658 Ballina Rd Pty Ltd
c/o CA Construction Management

REV.	ISSUE / AMENDMENTS	DATE
A	Concept for DA	08/10/2021
B	Amended subdivision layout	08/03/2022

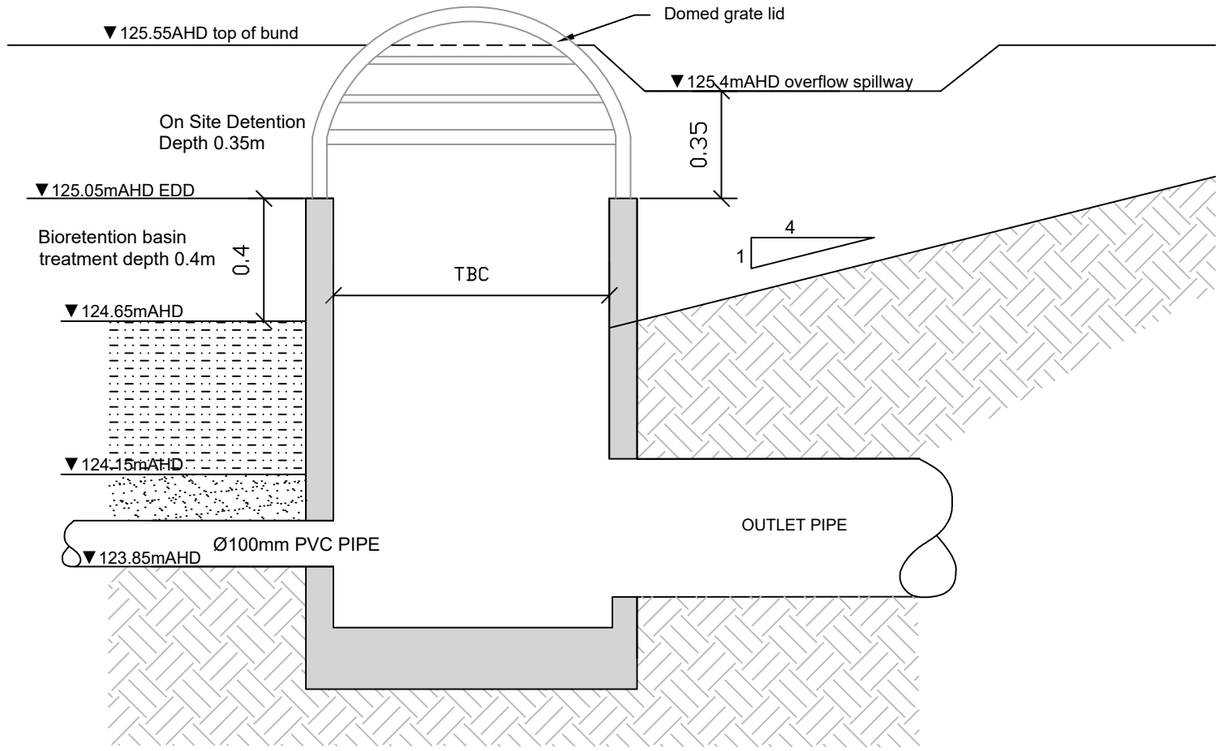
AWC
Australian Wetlands Consulting Pty Ltd
8 George St
Bangalow NSW 2479
P (02) 6687 1550
www.awconsult.com.au

SCALE	REV. B
DESIGNED JM	DWG No. 1-211472_BallinaRd_CD_01
DRAWN JM	CAD FILE No. 1-211472_BallinaRd.DWG
CHECKED KC	
DRAWING CREATED	01/10/2021

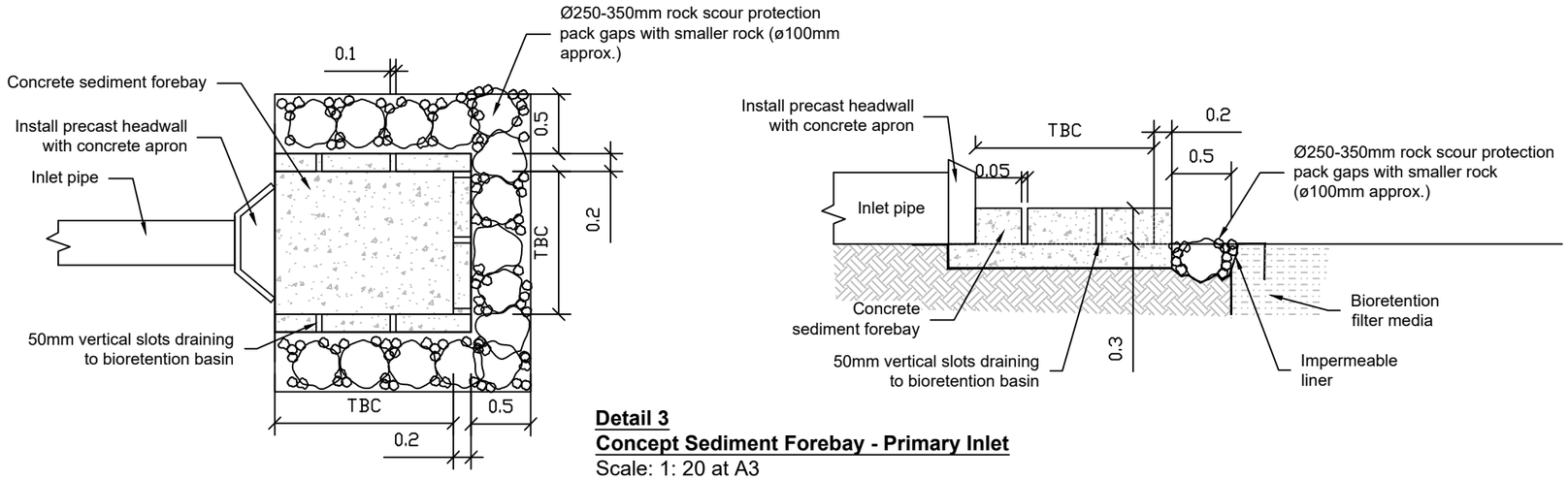
DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.



Detail 1
Filter Media Profile
Scale: 1: 20 at A3



Detail 2
Concept Outlet Control Pit Arrangement
Scale: 1: 20 at A3



Detail 3
Concept Sediment Forebay - Primary Inlet
Scale: 1: 20 at A3
Sizing to be confirmed

PROJECT
658 BALLINA ROAD
CONCEPT STORMWATER MANAGEMENT PLAN

DRAWING

CLIENT
658 Ballina Rd Pty Ltd
c/o CA Construction Management

REV.	ISSUE / AMENDMENTS	DATE
A	Concept for DA	08/10/2021
B	Amended subdivision layout	08/03/2022

AWC
Australian Wetlands Consulting Pty Ltd
8 George St
Bangalow NSW 2479
P (02) 6687 1550
www.awconsult.com.au

SCALE
REV. **B**

DESIGNED JM
DRAWN JM
CHECKED KC
DRAWING CREATED 01/10/2021
DWG No. 1-211472_BallinaRd_CD_01
CAD FILE No. 1-211472_BallinaRd.DWG

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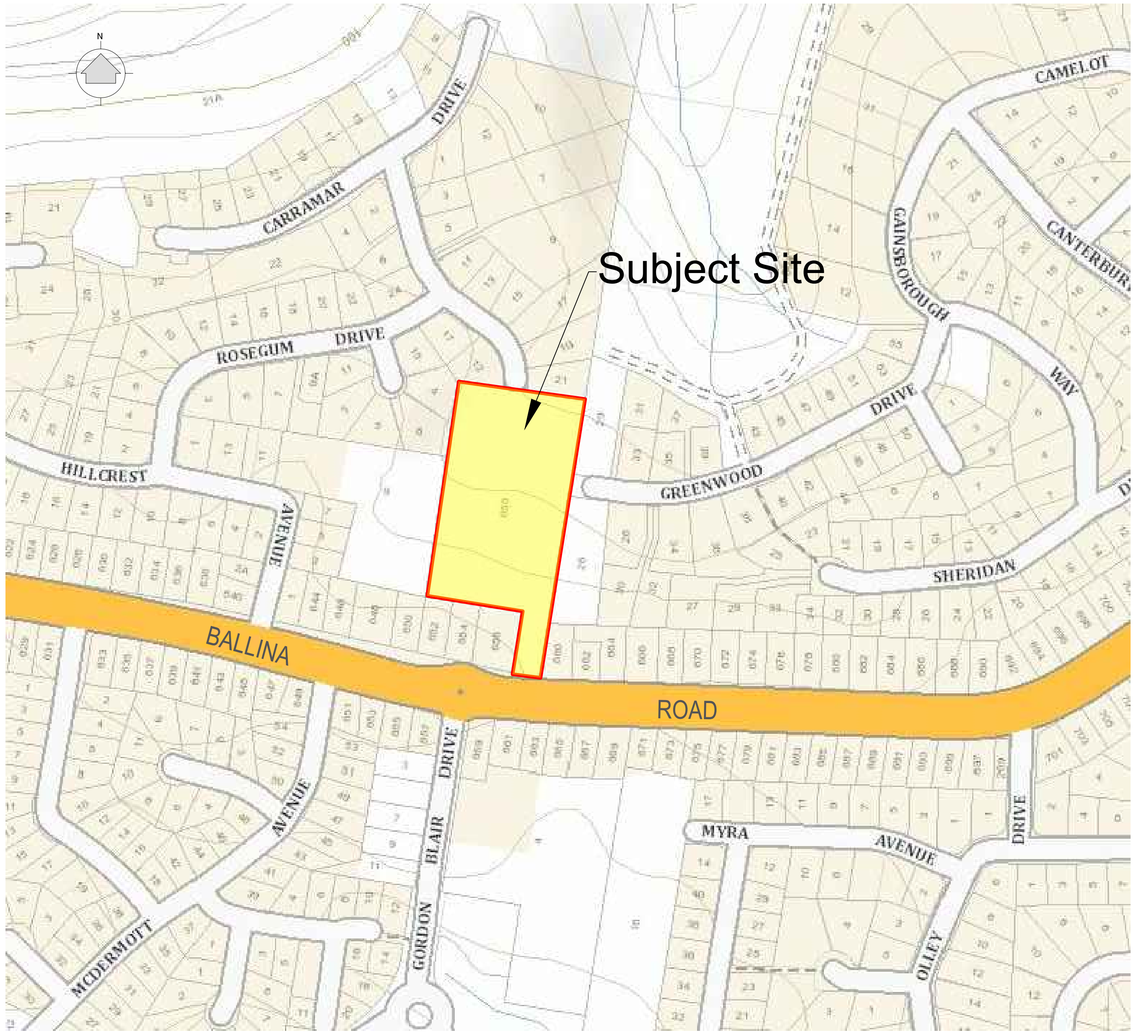
Appendix D

Development Application – Engineering Design Plans (RCS, 2022)

Drawing No: 21037-CIV-01 to 20, Revision No. 5, Date Issued: 17/03/22

Development Application - Engineering Design Plans

658 Ballina Road, Goonellabah , NSW
Subdivision of Lot 4 in DP406893



File Ref: 21037-26.dwg

Title	Sheet No.	Rev No.
Title Page	1	5
Site Layout Existing - Overview	2	5
Site Layout Proposed - Overview	3	5
Lot Layout	4	5
Greenwood Drive Layout	5	5
Greenwood Drive Longitudinal Section	6	5
Greenwood Drive Cross Sections	7 - 9	5
Shared Driveway Layout (Lots 2, 3 & 4)	10	5
Shared Driveway Longitudinal Section	11	5
Shared Driveway Cross Sections	12 - 13	5
Electricity and Telecom Layout Plan	14	5
Sewer and Water Reticulation Layout Plan	15	5
Stormwater Drainage Layout Plan	16	5
Stormwater Basin Layout	17	5
Stormwater Basin Sections	18	5
Asset Protection Zone Sections	19	5
Bulk Earthworks Plan	20	5

Issue #	Changes	Drawn	Approved	Date
5	Additional notation added	DF	ARR	17/03/22
4	Amended design to suit revised lot layout	DF	ARR	25/02/22
3	Further amendments to address respondents feedback	DF	ARR	5/11/21
2	Amendments to address respondents feedback	DF	ARR	28/10/21
1	Original	DF	ARR	5/10/21

RCS GROUP
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PO Box 4053 Goonellabah NSW 2480
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E: info@surveyor.com.au ABN 54 055 030 576

LEGEND

- Site Boundary
- Property Boundary
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Bank Change of Grade
- Top of Bank
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- Existing Sealed Road

RCS GROUP
SURVEY PLAN DESIGN MANAGE

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All areas and dimensions are subject to final Survey.
Boundary corners have not been marked by survey. Prior to undertaking any construction works in proximity to the boundaries of the land/s shown within this plan it is recommended that the boundaries be fully surveyed and marked accordingly.
The shape and size of survey point symbols shown on this plan are diagrammatic only.
Further disclaimers are noted on the plan.

Drawing Title
EXISTING LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		2 of 20

LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

PROPOSED LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

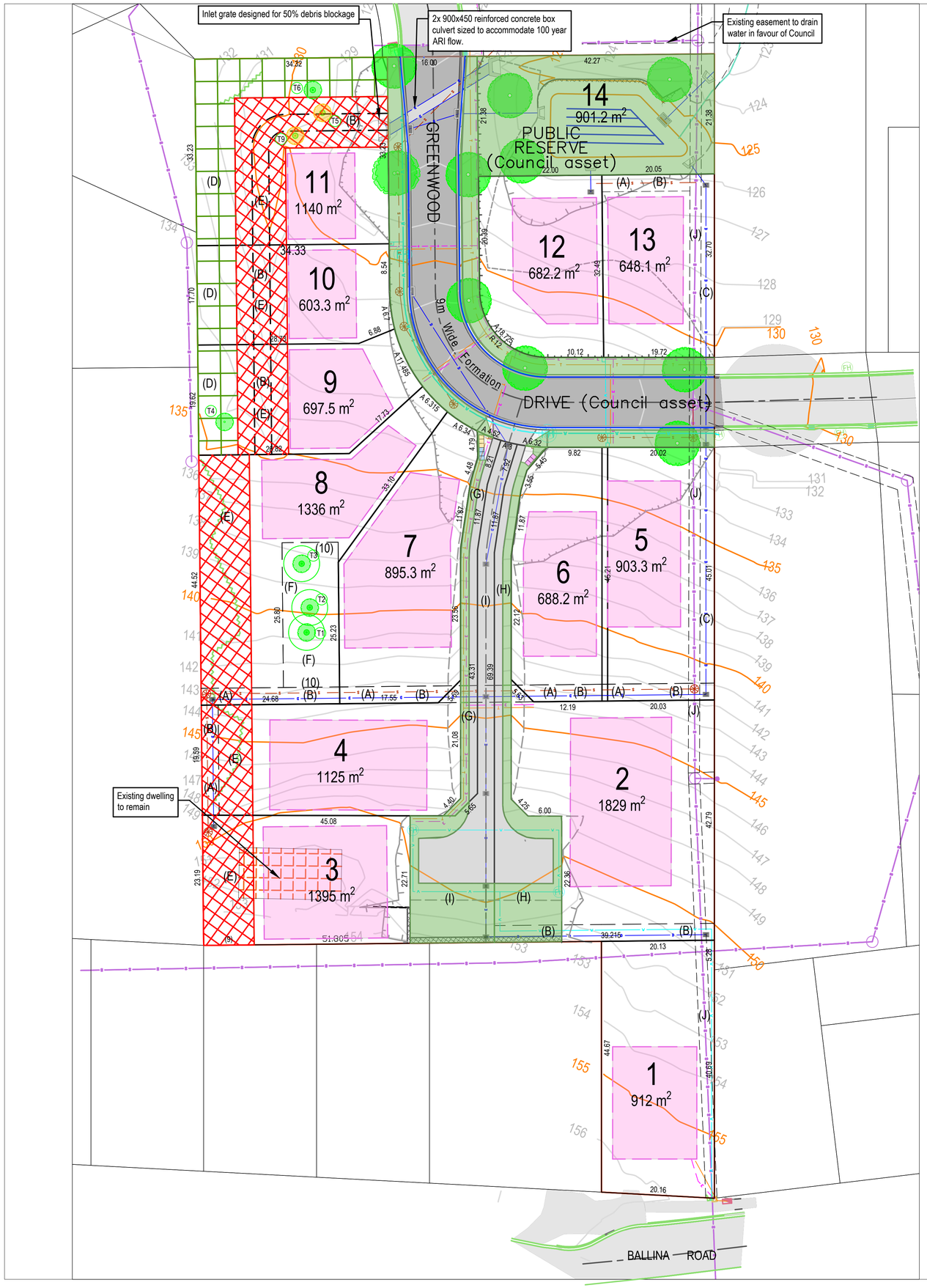
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

N
GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		3 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Tree to be retained
- Tree to be removed
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- New Hydrant
- Swale Bund (300mm freeboard)
- Swale Alignment
- Footpath
- Tree Identification Number
- New Koala Food Tree

Lot No	Lot Area m²	Available Building Area m²	Area in excess of minimum building envelope (12x15=180 m²)
1	912	300	120
2	1829	540	360
3	1395	440	260
4	1125	448	268
5	903.3	338	158
6	688.2	331	151
7	895.3	501	321
8	1336	326	146
9	697.5	268	88
10	603.3	188	8
11	1140	183	3
12	682.2	318	138
13	648.1	301	121
14	901.2	N/A	N/A

AVERAGE RESIDENTIAL LOT AREA : 989 m²
AVERAGE BUILDING ENVELOPE AREA : 345 m²

(A)	Easement to Drain Sewage 3 Wide
(B)	Easement to Drain Water 3 Wide
(C)	Easement to Drain Water Variable Width
(D)	Easement for Koala Corridor 7 Wide
(E)	Easement for Bushfire Protection (APZ) 9 Wide
(F)	Easment for Tree Protection 10 Wide
(G)	Easement for Access and Services 3 Wide and Variable
(H)	Easement for Access and Services 3 Wide and Variable
(I)	Easement for Access and Services 3 Wide and Variable
(J)	Easement for Sewerage Purposes Limited in Height & Depth - T249054 (DP 612269)

Koala Corridor 7m Wide

Bushfire Asset Protection Zone (APZ) 9m Wide

Available Building Area
6m setback from Road Frontages and 1m setback from Lot side boundaries and easements boundaries

Land to be dedicated to council:

Greenwood Drive (9 Wide)

Lot 14 - Public Reserve (901.2m²)

Assets to be dedicated to Council and timing of dedication

Greenwood Drive Extension – Subdivision works certification
Laneway – Subdivision works certification
Bio-Retention Basin – Subdivision works certification

RCS GROUP
SURVEY PLAN DESIGN MANAGE

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Consulting Surveyors NSW

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Drawing Title
LOT LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

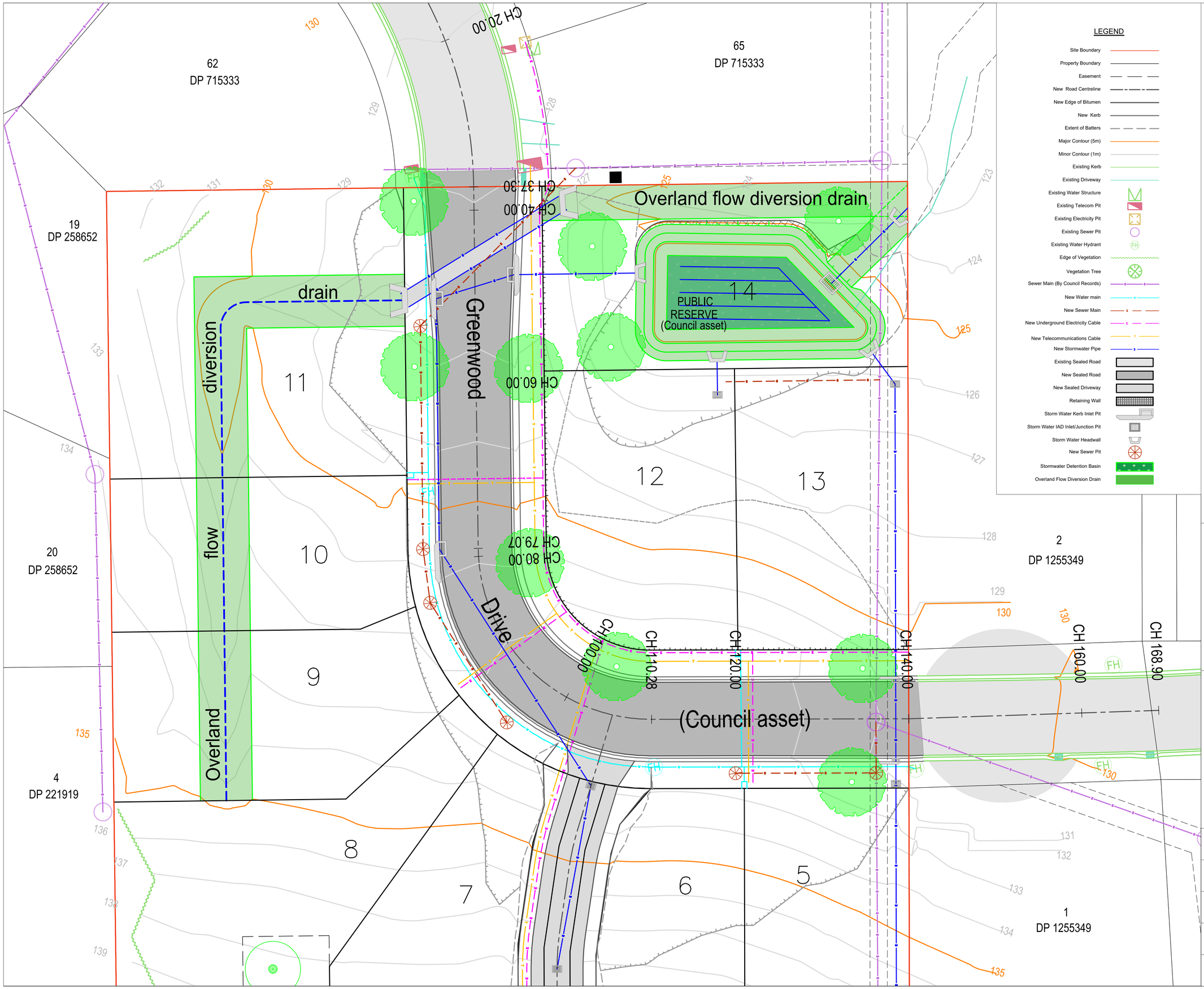
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn DF	*Date Surveyed* 23/07/21
Designed DF	*Approved* ARR	*Date Issued* 17/03/22
	Locality Goonellabah	*Drawing No* 21037-CIV
Parish Lismore	*County* Rous	*Revision No.* 5
Local Government Area Lismore		*Sheet No* 4 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title
GREENWOOD DRIVE LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

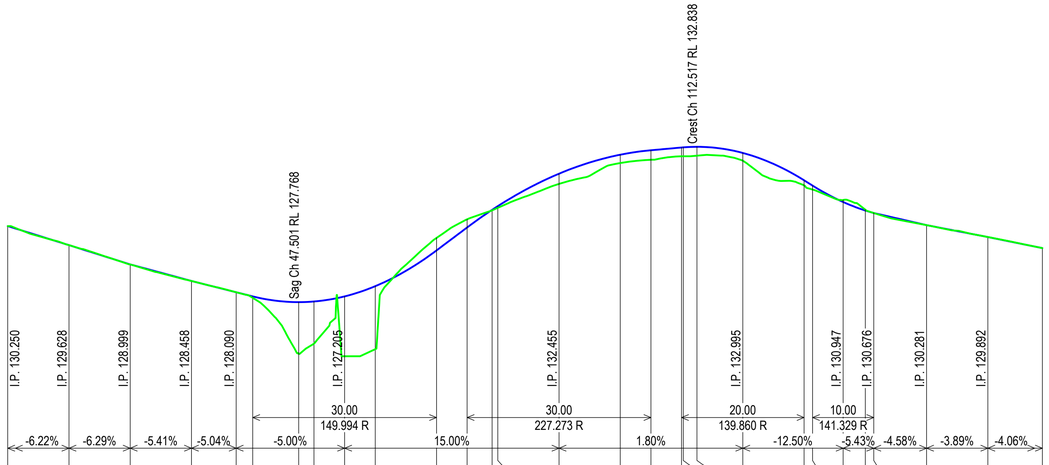
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**5** of **20**



R.L. 122.0

Cut / Fill	+0.00	+0.00	+0.00	+0.00	+0.00	+0.05	+1.69	+1.38	+1.96	+2.06	-0.40	-0.26	+0.02	+0.05	+0.33	+0.27	+0.32	+0.29	+0.29	+0.29	+0.26	+0.16	+0.13	-0.06	-0.02	+0.00	+0.00	+0.00	+0.00
Design	130.25	129.63	129.00	128.46	128.09	127.96	127.77	127.79	127.96	128.29	129.46	130.21	130.78	130.90	131.96	132.58	132.73	132.82	132.82	132.84	132.64	131.75	131.57	131.04	130.76	130.68	130.28	129.89	129.53
Existing	130.25	129.63	129.00	128.46	128.09	127.91	126.08	126.41	126.00	126.23	129.86	130.47	130.76	130.85	131.63	132.31	132.41	132.53	132.53	132.55	132.38	131.58	131.44	131.10	130.78	130.68	130.28	129.89	129.53
Chainage	0.00	10.00	20.00	30.00	37.30	40.00	47.50	50.00	55.00	60.00	70.00	75.00	79.07	80.00	90.00	100.00	105.00	110.00	110.28	112.52	120.00	130.00	131.38	136.38	140.00	141.38	150.00	160.00	168.90

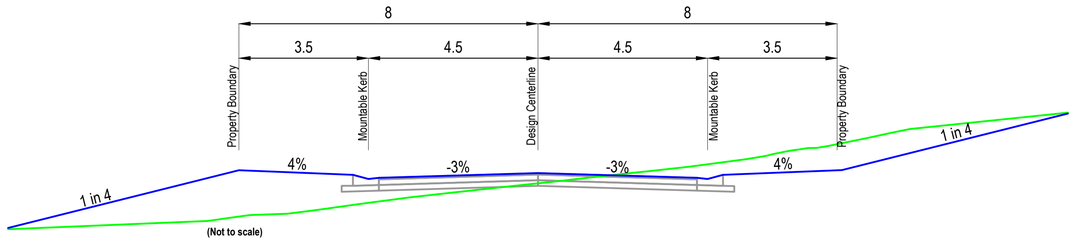
Horizontal Geometry

L=37.30 R=48.00 | L=41.77 B=188°42'00" | L=31.21 R=20.00 | L=29.72 B=99°17'03" | L=28.90 B=97°29'15"

H 1:500
V 1:100

Greenwood Drive - Ch.0.00 to Ch.168.90

Typical Section - Greenwood Drive (16 wide)



(Not to scale)

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Drawing Title
GREENWOOD DRIVE LONGITUDINAL SECTION

Project
Development Application
Subdivision of Lot 4 DP 406893

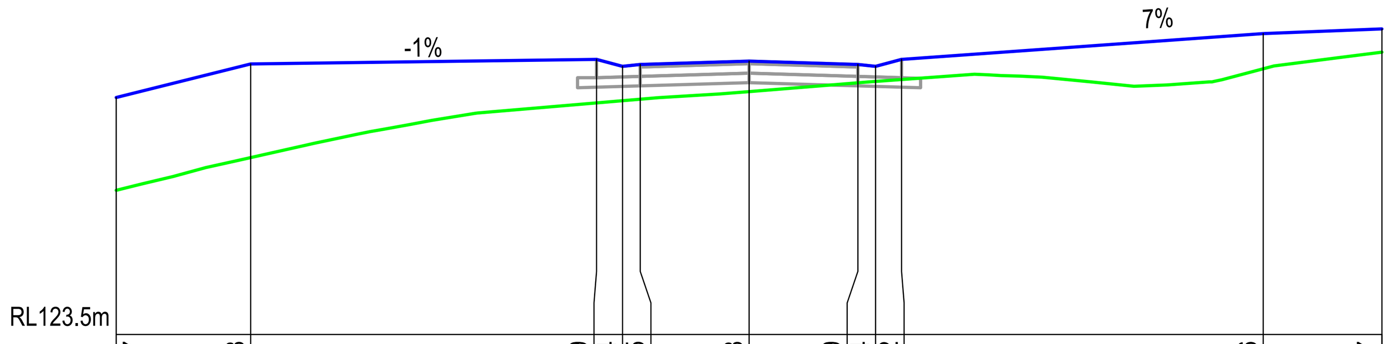
Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**6** of **20**



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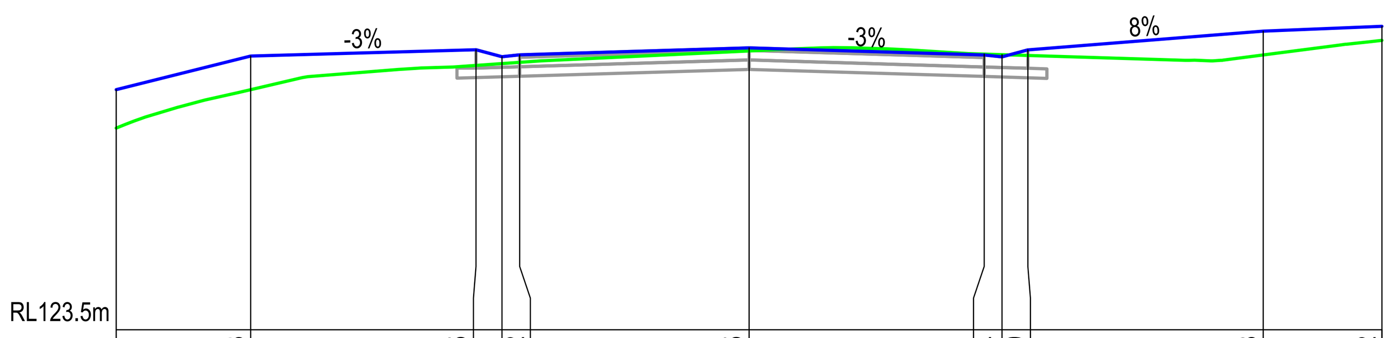
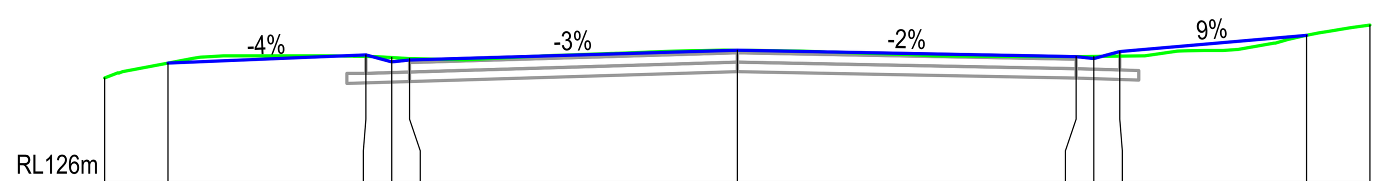
Ht Difference	1.47	1.48	0.69	0.54	0.55	0.48	0.29	0.24	0.32	0.56	0.37
DESIGN	127.251	127.782	127.855	127.745	127.775	127.826	127.775	127.745	127.855	128.262	128.337
EXISTING	125.783	126.300	127.166	127.201	127.225	127.345	127.485	127.507	127.537	127.705	127.968

Ch 43.30 m



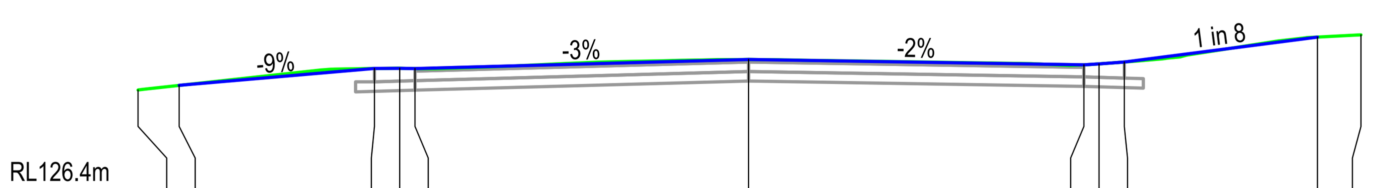
OFFSET	-10.00	-7.87	-4.32	-3.91	-3.63	0.00	3.72	4.00	4.41	8.13	10.00
Ht Difference	0.61	0.53	0.25	0.11	0.12	0.05	-0.01	-0.04	0.09	0.38	0.22
DESIGN	127.295	127.827	127.926	127.816	127.846	127.955	127.844	127.814	127.924	128.221	128.296
EXISTING	126.687	127.294	127.679	127.707	127.727	127.907	127.857	127.849	127.836	127.843	128.074

Ch 40.00 m



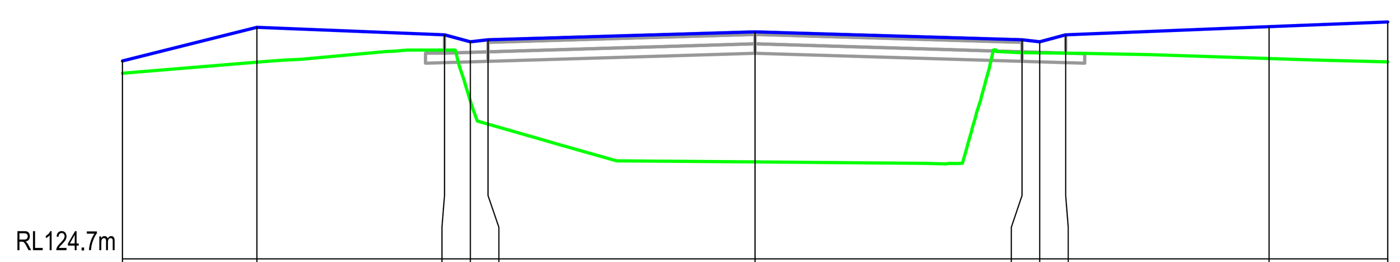
OFFSET	-10.00	-9.00	-5.87	-5.46	-5.18	0.00	5.36	5.64	6.05	9.00	10.00
Ht Difference		0.00	0.02	-0.07	-0.02	0.00	0.00	-0.03	0.07	0.00	
DESIGN		127.885	128.015	127.905	127.935	128.090	127.988	127.958	128.068	128.325	
EXISTING	127.652	127.885	127.991	127.974	127.958	128.090	127.988	127.991	127.995	128.325	128.487

Ch 37.30 m



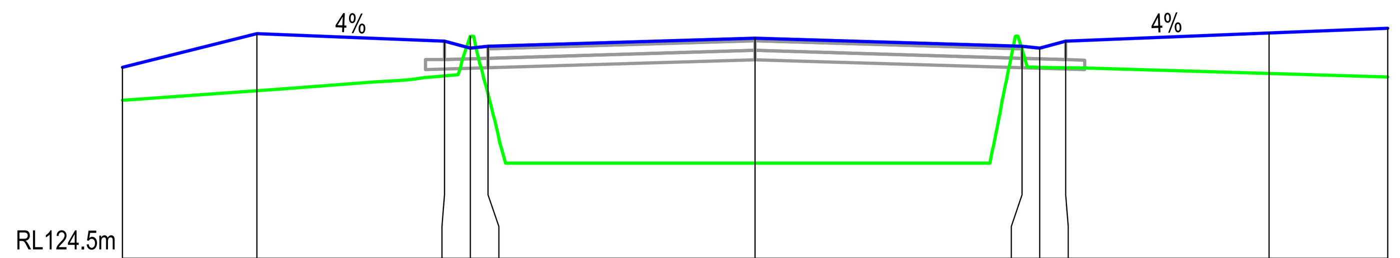
OFFSET	-10.00	-9.65	-9.00	-5.91	-5.51	-5.27	0.00	5.30	5.54	5.94	9.00	9.69	10.00
Ht Difference			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
DESIGN			128.050	128.316	128.320	128.314	128.458	128.374	128.389	128.418	128.812		
EXISTING		127.977	128.050	128.316	128.320	128.314	128.458	128.374	128.389	128.418	128.812	128.849	

Ch 30.00 m
Greenwood Drive



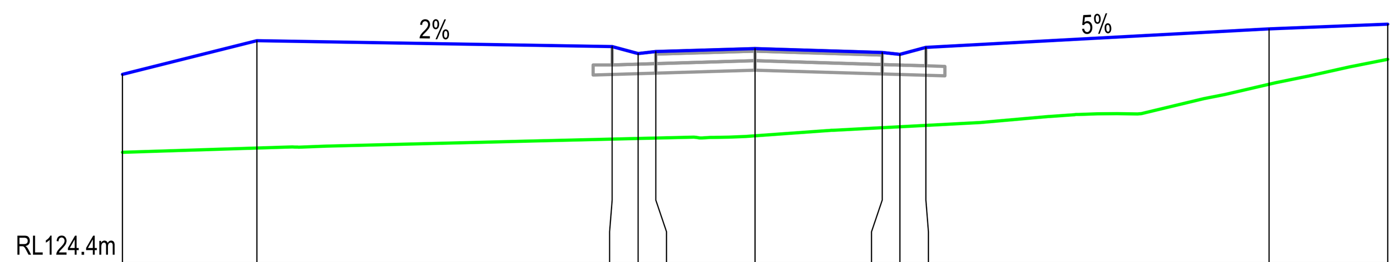
OFFSET	-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	10.00
Ht Difference	0.20	0.55	0.24	0.94	1.33	2.06	0.20	0.18	0.29	0.50	0.63
DESIGN	127.829	128.360	128.242	128.132	128.162	128.288	128.162	128.132	128.242	128.370	128.445
EXISTING	127.633	127.809	128.000	127.196	126.829	126.232	127.959	127.956	127.951	127.866	127.814

Ch 60.00 m



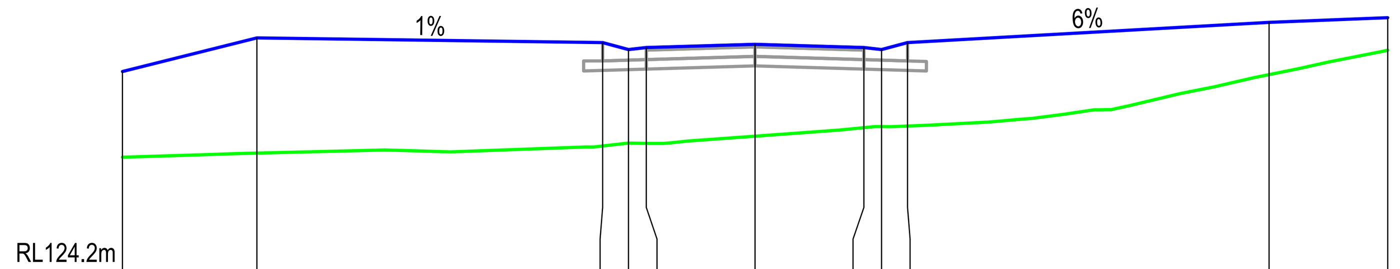
OFFSET	-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	10.00
Ht Difference	0.52	0.90	0.55	-0.19	0.76	1.97	0.05	0.30	0.42	0.64	0.77
DESIGN	127.511	128.042	127.924	127.814	127.844	127.970	127.844	127.814	127.924	128.052	128.127
EXISTING	126.992	127.143	127.376	128.000	127.084	126.000	127.792	127.510	127.504	127.415	127.360

Ch 55.30 m



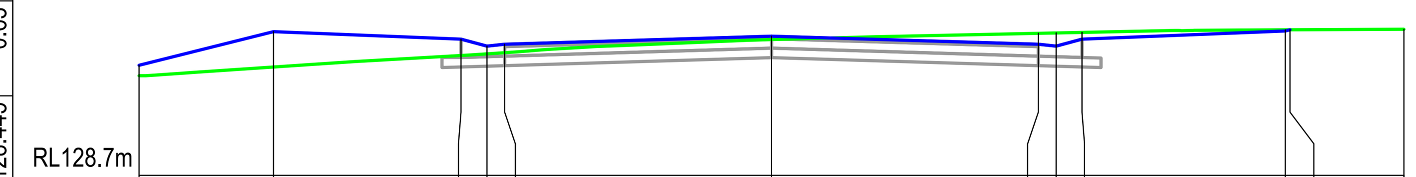
OFFSET	-10.00	-7.87	-2.26	-1.85	-1.57	0.00	2.01	2.29	2.70	8.13	10.00
Ht Difference	1.23	1.69	1.46	1.34	1.36	1.38	1.19	1.14	1.23	0.87	0.56
DESIGN	127.382	127.914	127.821	127.711	127.741	127.788	127.728	127.698	127.808	128.100	128.175
EXISTING	126.154	126.221	126.361	126.371	126.377	126.413	126.541	126.555	126.577	127.227	127.620

Ch 50.00 m



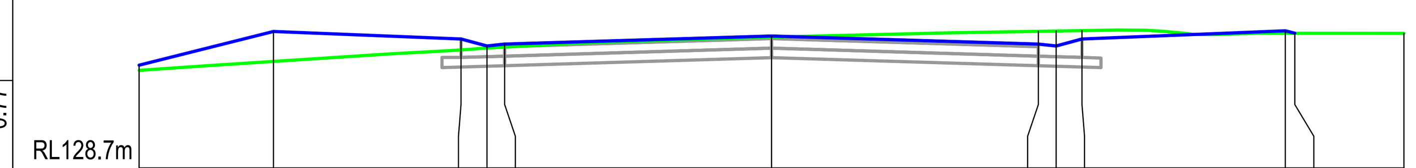
OFFSET	-10.00	-7.87	-2.41	-2.00	-1.72	0.00	1.72	2.00	2.41	8.13	10.00
Ht Difference	1.35	1.82	1.64	1.48	1.51	1.45	1.27	1.22	1.32	0.82	0.51
DESIGN	127.348	127.880	127.807	127.697	127.727	127.778	127.727	127.697	127.807	128.125	128.200
EXISTING	125.994	126.059	126.171	126.217	126.212	126.327	126.462	126.479	126.488	127.300	127.686

Ch 49.30 m



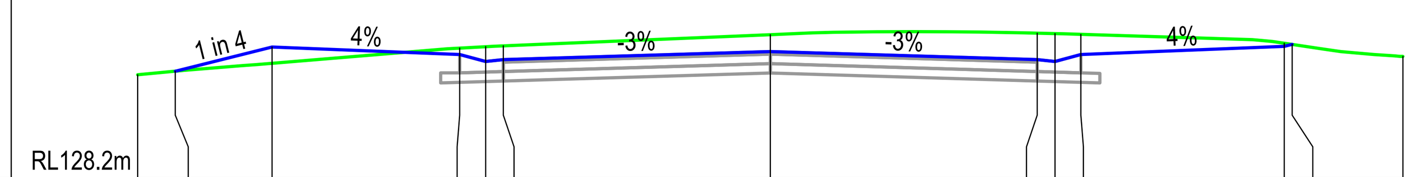
OFFSET	-10.00	-7.88	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.12	8.20	10.00
Ht Difference	0.17	0.56	0.26	0.12	0.13	0.05	-0.17	-0.21	-0.11	-0.02	0.00	
DESIGN	130.441	130.972	130.853	130.743	130.773	130.900	130.773	130.743	130.853	130.982	131.000	
EXISTING	130.274	130.413	130.594	130.620	130.639	130.846	130.946	130.952	130.960	131.000	131.000	131.010

Ch 80.00 m



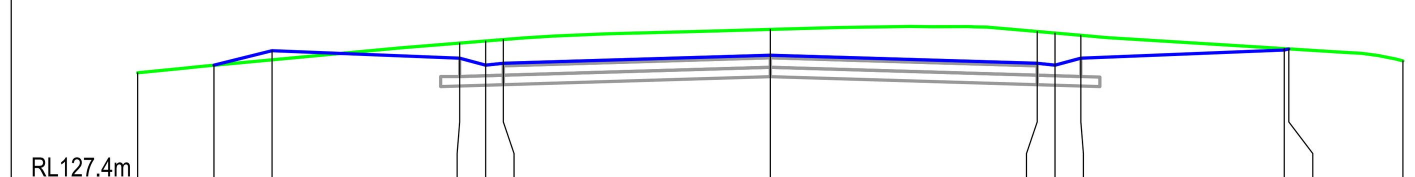
OFFSET	-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.27	10.00
Ht Difference	0.08	0.47	0.17	0.03	0.05	0.02	-0.20	-0.24	-0.13	0.04	0.00	
DESIGN	130.320	130.851	130.732	130.622	130.652	130.779	130.652	130.622	130.732	130.861	130.824	
EXISTING	130.236	130.379	130.561	130.590	130.605	130.762	130.853	130.858	130.865	130.824	130.824	130.822

Ch 79.07 m



OFFSET	-10.00	-9.41	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.25	10.00
Ht Difference		0.00	0.26	-0.10	-0.23	-0.22	-0.27	-0.42	-0.44	-0.32	-0.05	0.00	
DESIGN		129.894	130.277	130.158	130.048	130.078	130.205	130.078	130.048	130.158	130.287	130.318	
EXISTING	129.838	129.894	130.020	130.260	130.282	130.295	130.472	130.495	130.488	130.476	130.337	130.318	130.129

Ch 75.00 m



OFFSET	-10.00	-8.79	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.20	10.00
Ht Difference		0.00	0.14	-0.24	-0.38	-0.37	-0.41	-0.50	-0.51	-0.36	-0.02	0.00	
DESIGN		129.297	129.527	129.408	129.298	129.328	129.455	129.328	129.298	129.408	129.537	129.555	
EXISTING	129.177	129.297	129.383	129.647	129.679	129.702	129.864	129.829	129.805	129.769	129.559	129.555	129.366

Ch 70.00 m

RCS GROUP
SURVEY PLAN DESIGN MANAGE
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E: info@rcsgroup.com.au ABN 54 055 030 576

Consulting Surveyors NSW

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Drawing Title
GREENWOOD DRIVE CROSS SECTIONS (Sheet 1 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

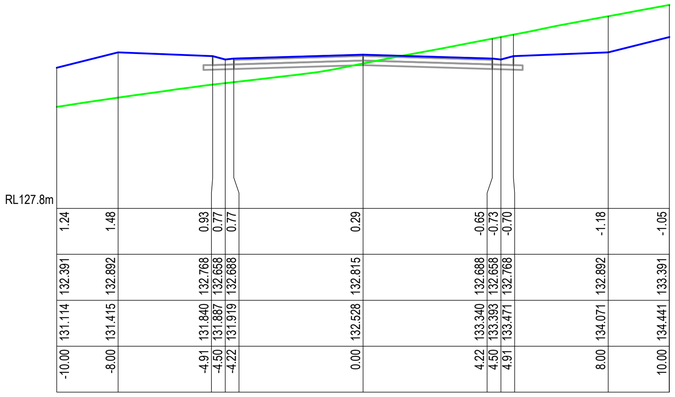
Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

Designed	*Drawn*	*Date Surveyed*
	DF	23/07/21
DF	ARR (*Approved*)	17/03/22 (*Date Issued*)

Locality	*Drawing No*
Goonellabah	21037-CIV

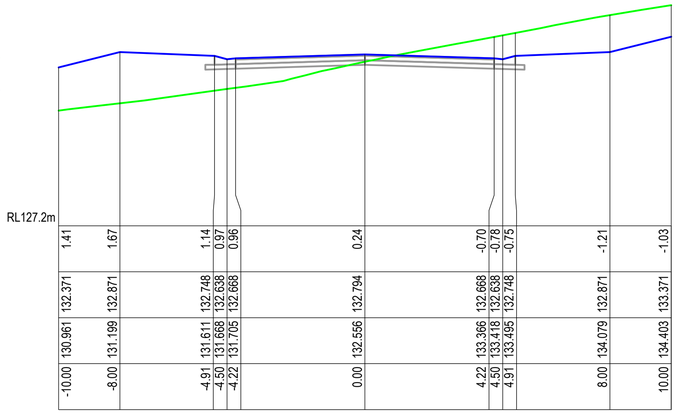
Parish	*County*	*Revision No.*
Lismore	Rous	5

Local Government Area	*Sheet No*
Lismore	7 of 20



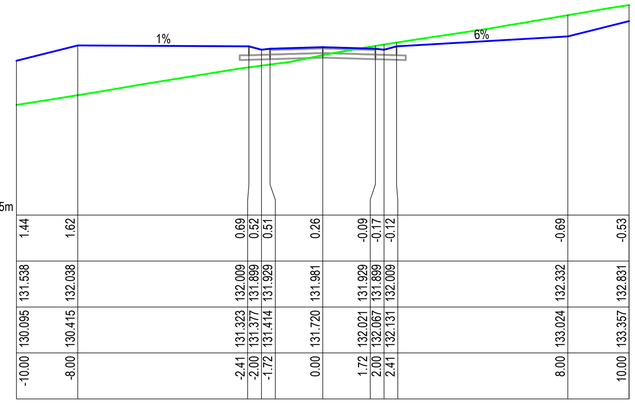
	1.24	1.48	0.93	0.77	0.77	0.29	-0.65	-0.73	-0.70	-1.18	-1.05
	132.391	132.892	132.768	132.658	132.688	132.815	132.688	132.658	132.768	132.892	133.391
	131.114	131.415	131.840	131.887	131.919	132.528	133.340	133.393	133.471	134.071	134.441
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 110.00 m



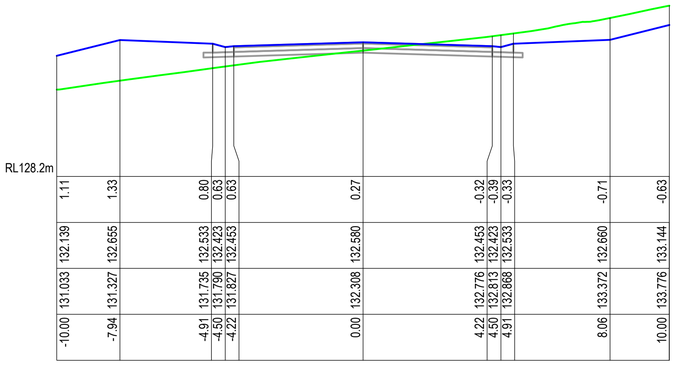
	1.41	1.67	1.14	0.97	0.96	0.24	-0.70	-0.76	-0.75	-1.21	-1.03
	132.371	132.871	132.748	132.638	132.668	132.794	132.668	132.638	132.748	132.871	133.371
	130.961	131.199	131.611	131.668	131.705	132.556	133.366	133.418	133.495	134.079	134.403
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 116.00 m



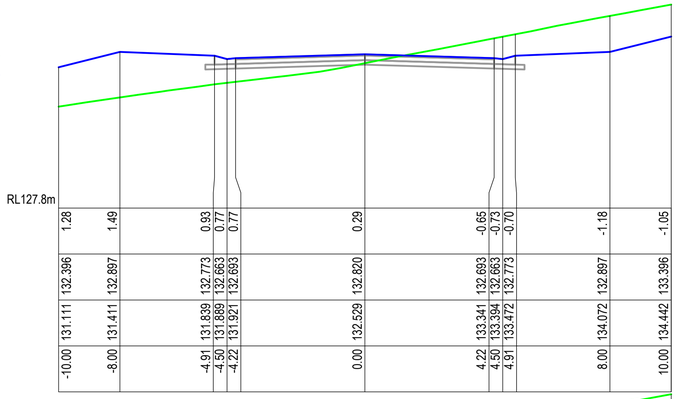
	1.44	1.62	0.69	0.52	0.51	0.26	-0.09	-0.17	-0.12	-0.69	-0.53
	131.538	132.038	132.009	131.899	131.929	131.981	131.929	131.869	132.009	132.332	132.831
	130.095	130.415	131.323	131.377	131.414	131.720	132.021	132.067	132.131	133.024	133.357
	-10.00	-8.00	-2.41	-2.00	-1.72	0.00	1.72	2.00	2.41	8.00	10.00

Ch 128.00 m



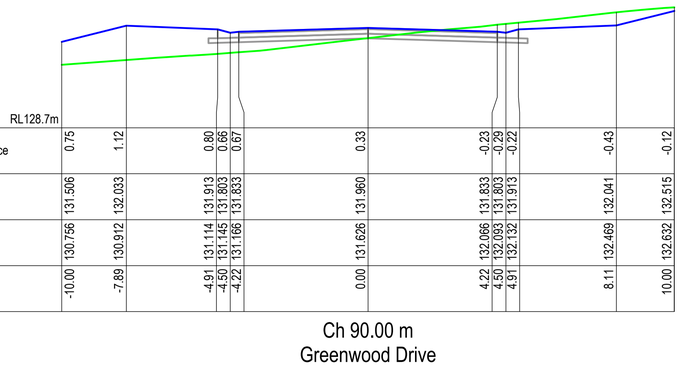
	1.11	1.33	0.80	0.63	0.63	0.27	-0.32	-0.39	-0.33	-0.71	-0.63
	132.139	132.655	132.533	132.423	132.453	132.580	132.453	132.423	132.533	132.660	133.144
	131.033	131.327	131.735	131.790	131.827	132.308	132.776	132.813	132.868	133.372	133.776
	-10.00	-7.94	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.06	10.00

Ch 100.00 m



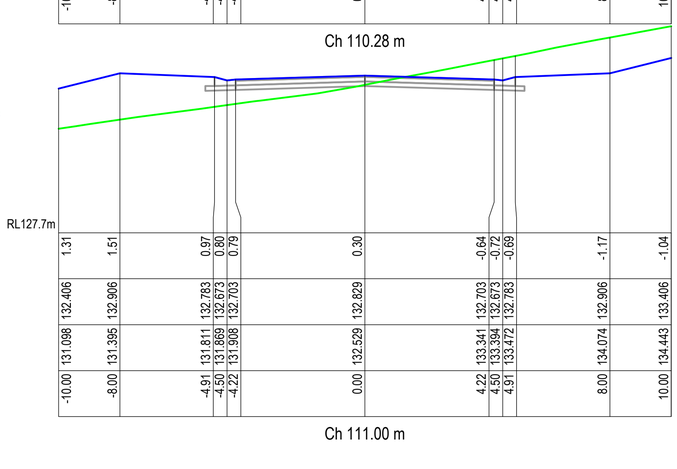
	1.28	1.49	0.93	0.77	0.77	0.29	-0.65	-0.73	-0.70	-1.18	-1.05
	132.396	132.897	132.773	132.663	132.693	132.820	132.693	132.663	132.773	132.897	133.396
	131.111	131.411	131.839	131.888	131.921	132.529	133.341	133.394	133.472	134.072	134.442
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 110.28 m



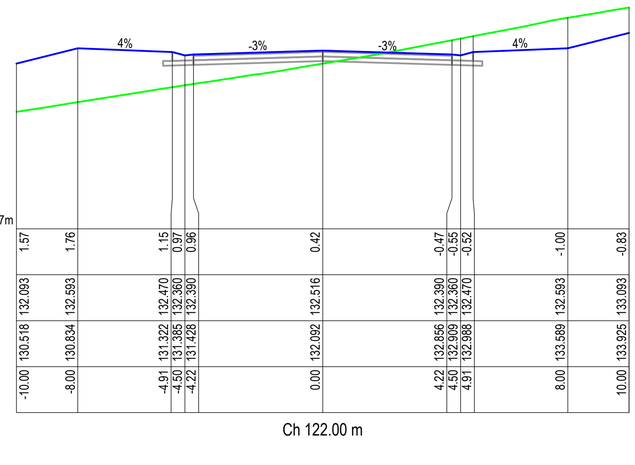
Ht Difference	0.75	1.12	0.80	0.66	0.67	0.33	-0.23	-0.29	-0.22	-0.43	-0.12
DESIGN	131.506	132.033	131.913	131.803	131.833	131.960	131.833	131.803	131.913	132.041	132.515
EXISTING	130.756	130.912	131.114	131.145	131.166	131.626	132.066	132.093	132.132	132.469	132.632
OFFSET	-10.00	-7.89	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.11	10.00

Ch 90.00 m
Greenwood Drive



	1.31	1.51	0.97	0.80	0.79	0.30	-0.64	-0.72	-0.69	-1.17	-1.04
	132.406	132.906	132.783	132.673	132.703	132.829	132.703	132.673	132.783	132.906	133.406
	131.098	131.395	131.811	131.869	131.908	132.529	133.341	133.394	133.472	134.074	134.443
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 111.00 m



	1.57	1.76	1.15	0.97	0.96	0.42	-0.47	-0.55	-0.52	-1.00	-0.83
	132.093	132.593	132.470	132.360	132.390	132.516	132.390	132.360	132.470	132.593	133.093
	130.518	130.834	131.322	131.385	131.428	132.092	132.866	132.909	132.988	133.589	133.925
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 122.00 m

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Consulting Surveyors NSW

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Drawing Title

GREENWOOD DRIVE CROSS SECTIONS (Sheet 2 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

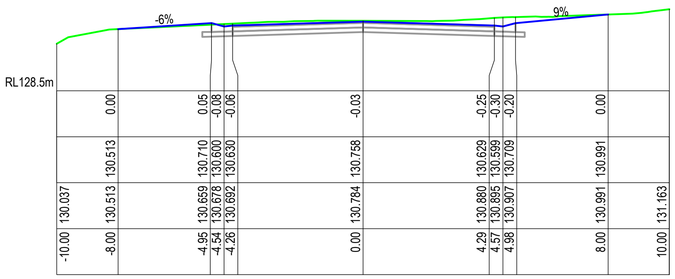
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

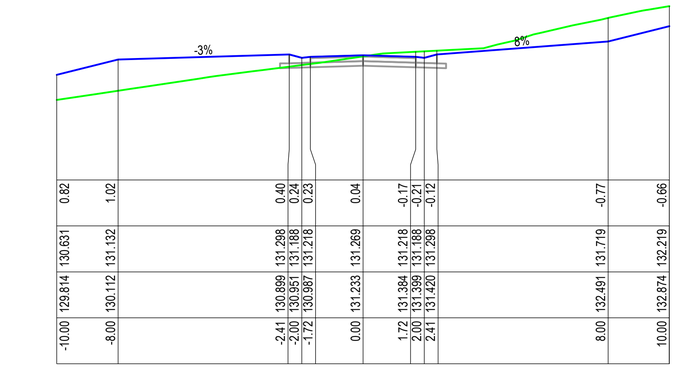
Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	8 of 20



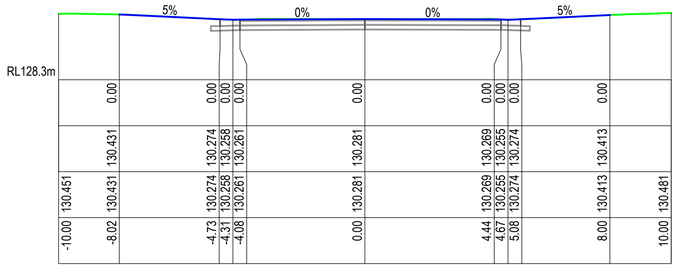
	0.00		0.05	-0.08	-0.06		-0.03		-0.25	-0.30	-0.20		0.00		
	130.513		130.710	130.600	130.630		130.758		130.629	130.599	130.709		130.991		
130.037	130.513		130.659	130.678	130.692		130.784		130.880	130.895	130.907		130.991		131.163
-10.00	-8.00		-4.95	-4.54	-4.26		0.00		4.29	4.57	4.98		8.00		10.00

Ch 140.00 m



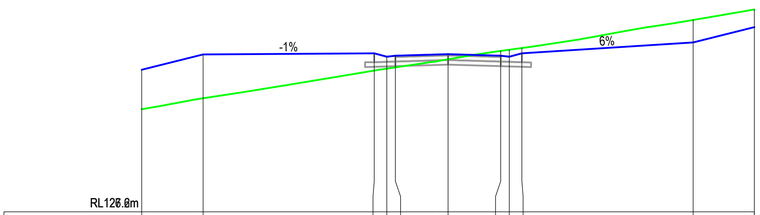
0.82	1.02		0.40	0.24	0.23		0.04		-0.17	-0.21	-0.12		-0.77		-0.66
130.631	131.132		131.298	131.188	131.218		131.269		131.218	131.188	131.298		131.719		132.219
129.814	130.112		130.898	130.965	130.987		131.233		131.394	131.399	131.420		132.491		132.874
-10.00	-8.00		-2.41	-2.00	-1.72		0.00		1.72	2.00	2.41		8.00		10.00

Ch 134.00 m



	0.00		0.00	0.00	0.00		0.00		0.00	0.00	0.00		0.00		
	130.431		130.274	130.258	130.261		130.281		130.269	130.255	130.274		130.413		
130.451	130.431		130.274	130.258	130.261		130.281		130.269	130.255	130.274		130.413		130.481
-10.00	-8.02		-4.73	-4.33	-4.08		0.00		4.44	4.67	5.08		8.00		10.00

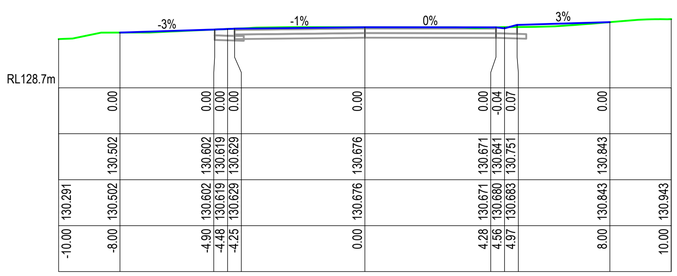
Ch 150.00 m



Ht Difference	1.29	1.43		0.56	0.39	0.38		0.17		-0.16	-0.23	-0.17		-0.73		-0.57
DESIGN	131.237	131.737		131.773	131.663	131.693		131.745		131.693	131.663	131.773		132.129		132.629
EXISTING	129.948	130.306		131.209	131.273	131.314		131.578		131.851	131.890	131.946		132.861		133.203
OFFSET	-10.00	-8.00		-2.41	-2.00	-1.72		0.00		1.72	2.00	2.41		8.00		10.00

Ch 130.00 m

Greenwood Drive



	0.00		0.00	0.00	0.00		0.00		0.00	-0.04	0.07		0.00		
	130.502		130.602	130.619	130.629		130.676		130.671	130.641	130.751		130.843		
130.291	130.502		130.602	130.619	130.629		130.676		130.671	130.680	130.683		130.843		130.943
-10.00	-8.00		-4.90	-4.48	-4.25		0.00		4.28	4.56	4.97		8.00		10.00

Ch 141.38 m

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Consulting Surveyors NSW

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Drawing Title

GREENWOOD DRIVE CROSS SECTIONS (Sheet 3 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

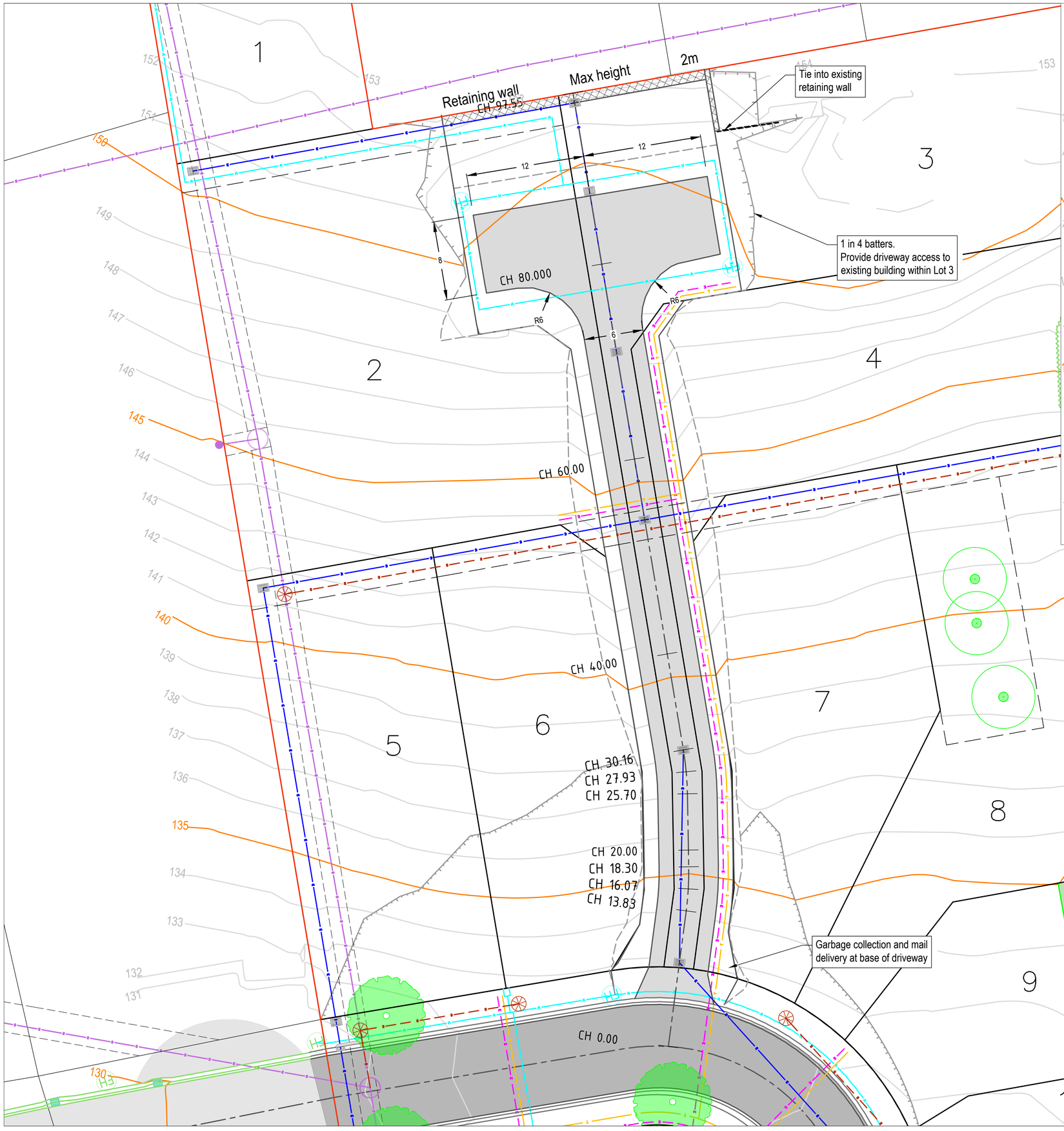
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	9 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Overland Flow Diversion Drain

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Drawing Title
SHARED DRIVEWAY LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

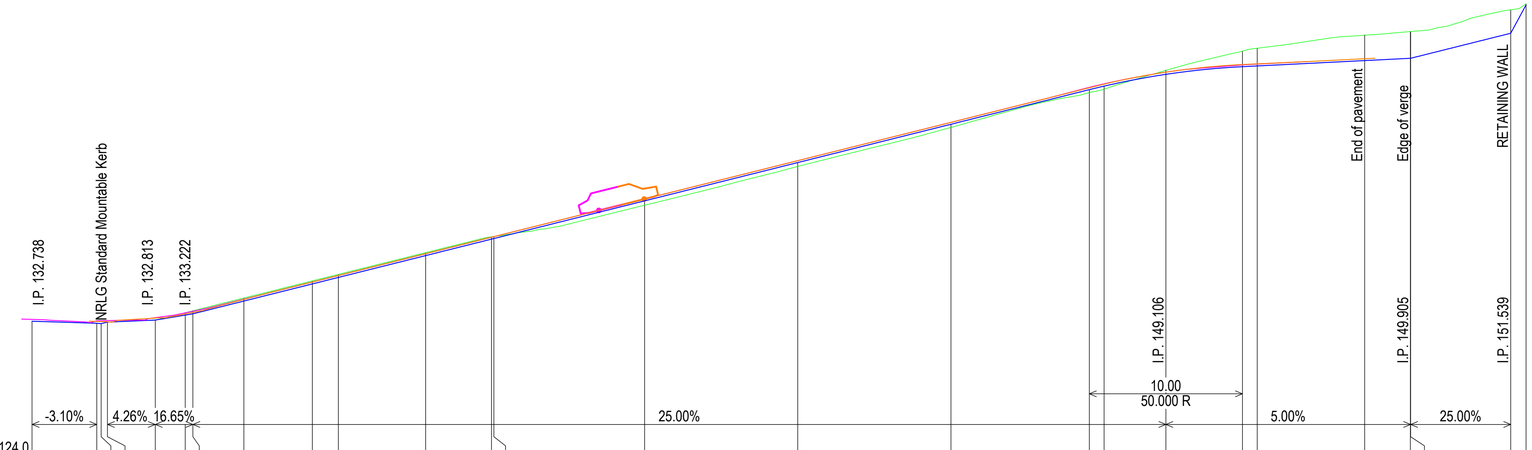
GRID NORTH
MGA 94 ZONE 56

	Drawn **DF**	*Date Surveyed* **23/07/21**
Designed **DF**	*Approved* **ARR**	*Date Issued* **17/03/22**
	Locality **Goonellabah**	*Drawing No* **21037-CIV**
Parish **Lismore**	*County* **Rous**	*Revision No.* **5**
Local Government Area **Lismore**		*Sheet No* **10** of **20**

B99 Standard Vehicle Clearance Test

Front Clearance

Rear Clearance



R.L. 124.0

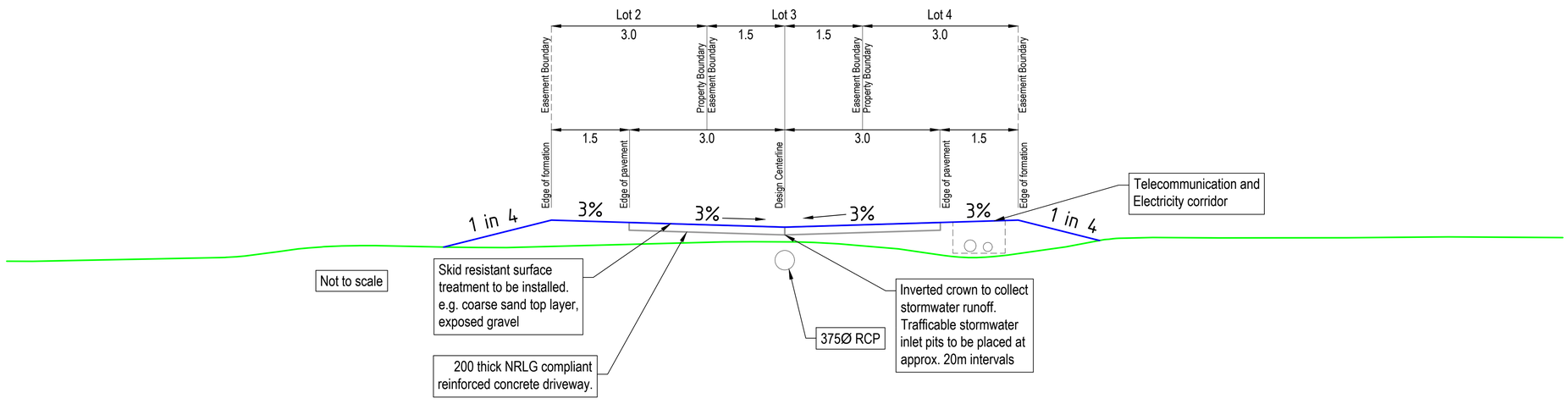
Cut / Fill	+0.00	+0.00	+0.00	-0.01	+0.00	-0.16	-0.20	-0.19	-0.20	-0.19	-0.20	-0.15	-0.13	+0.29	+0.26	+0.21	+0.19	+0.20	-0.26	-1.01	-1.16	-1.65	-1.75	-1.74	-1.53
Design	132.74	132.61	132.58	132.88	132.81	133.14	133.22	134.06	135.17	135.60	137.02	138.10	138.14	140.60	143.10	145.60	147.86	148.09	148.86	149.36	149.40	149.76	149.90	149.91	151.54	153.39
Existing	132.74	132.61	132.58	132.89	132.81	133.30	133.42	134.25	135.37	135.79	137.22	138.25	138.27	140.31	142.84	145.39	147.67	147.89	149.12	150.37	150.56	151.41	151.65	151.65	153.07	153.47
Chainage	0.00	4.23	4.51	4.92	8.04	10.00	10.50	13.83	18.30	20.00	25.70	30.00	30.16	40.00	50.00	60.00	69.04	70.00	74.04	79.04	80.00	87.02	90.00	90.02	96.55	97.55

Horizontal Geometry: L=13.83 B=206°20'22"; L=4.47 R=30.00; L=7.39 B=197°48'15"; L=4.46 R=30.00; L=67.39 B=189°17'03"

H 1:200
V 1:200

Shared Driveway - Lots 2, 3 & 4 - Ch.0.00 to Ch. 97.55

Typical Section - Shared Driveway - Lots 2, 3 & 4 (9 wide)



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Drawing Title
SHARED DRIVEWAY LONGITUDINAL SECTION

Project
Development Application
Subdivision of Lot 4 DP 406893

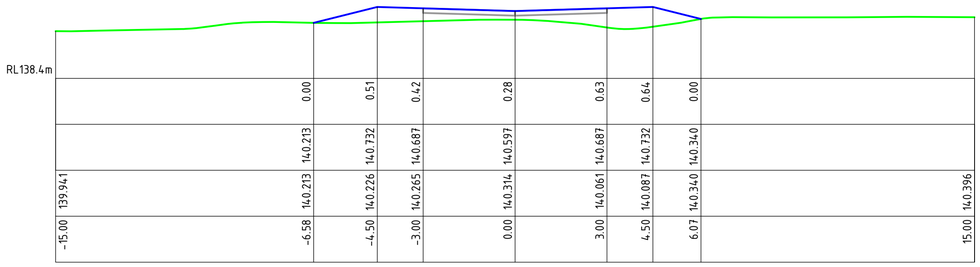
Client
Praedium Partnership

0 4 8 12 16

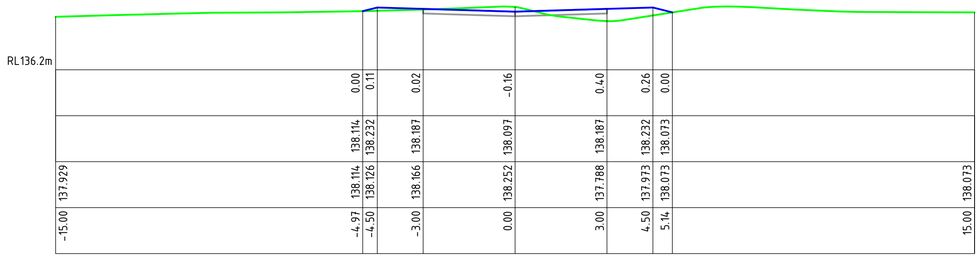
Reduction Ratio
1:200
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

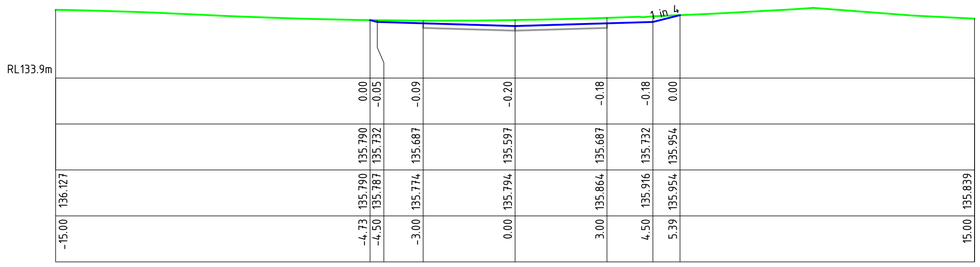
	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**11** of **20**



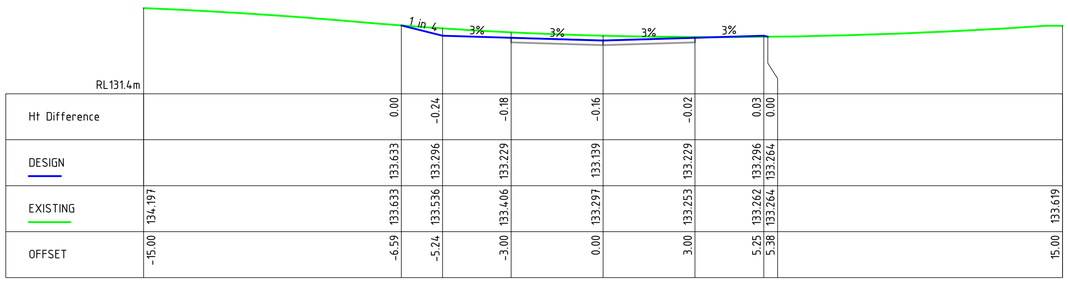
Ch 40.00 m



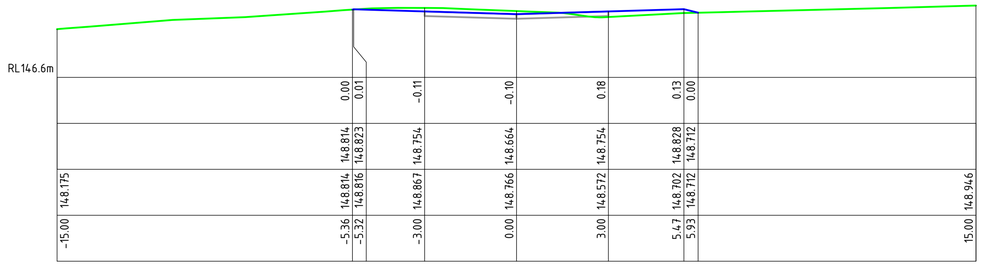
Ch 30.00 m



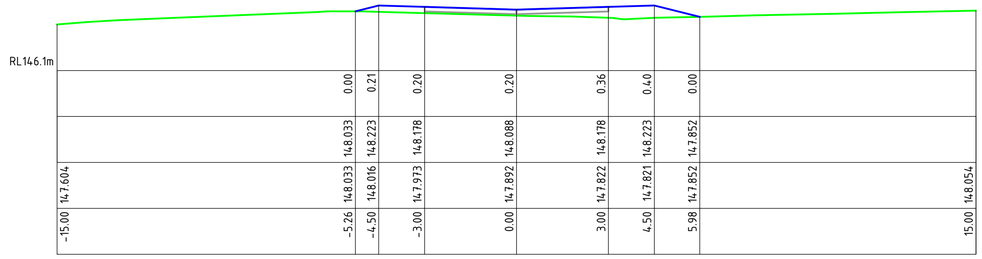
Ch 20.00 m



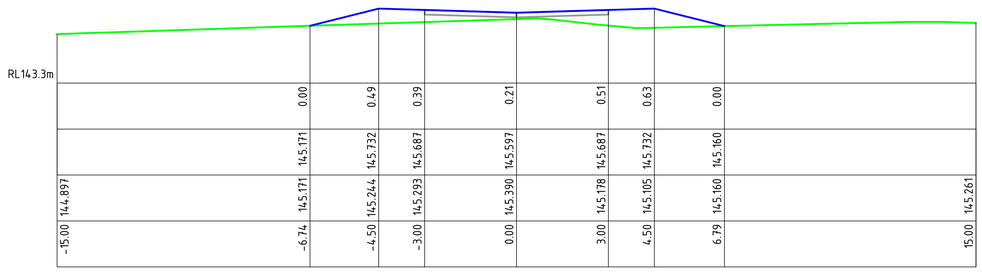
Ch 10.00 m
Shared Driveway



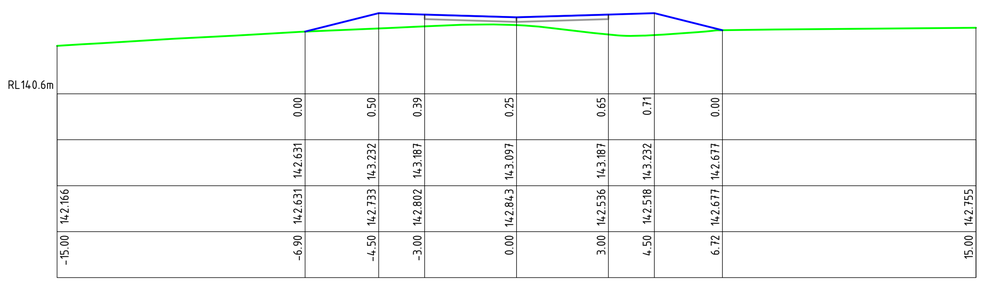
Ch 72.85 m



Ch 70.00 m



Ch 60.00 m



Ch 50.00 m

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Drawing Title

SHARED DRIVEWAY CROSS SECTIONS (Sheet 1 of 2)

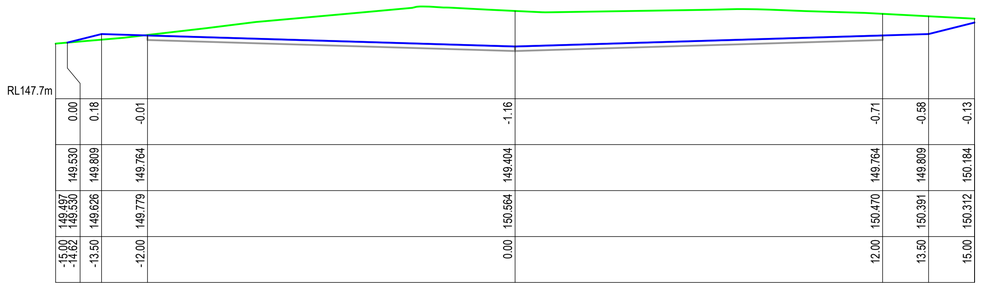
Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
Reduction Ratio
1:100
At A1 Size Sheet

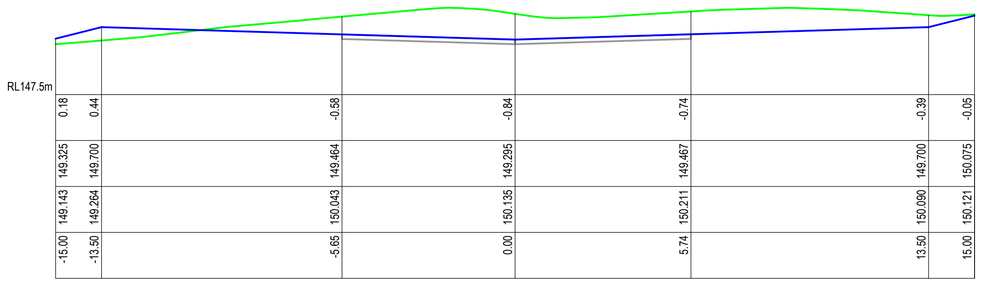
Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**12** of **20**



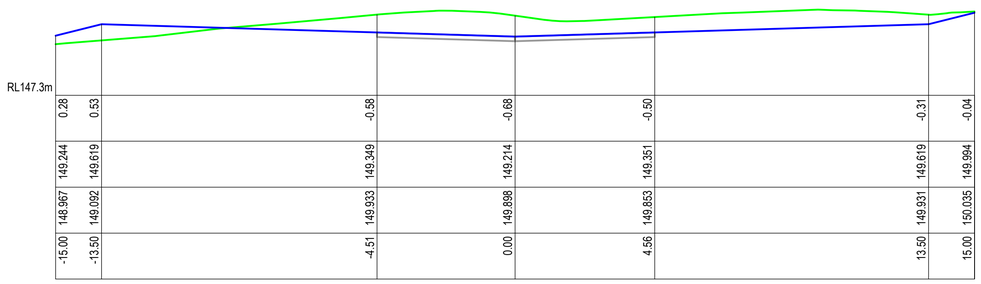
0.00	0.18	-0.01	-1.16	-0.71	-0.58	-0.13
149.530	149.809	149.764	149.404	149.764	149.809	150.184
149.497 149.530	149.626	149.779	150.564	150.470	150.391	150.312
-15.00 -14.62	-13.50	-12.00	0.00	12.00	13.50	15.00

Ch 80.00 m



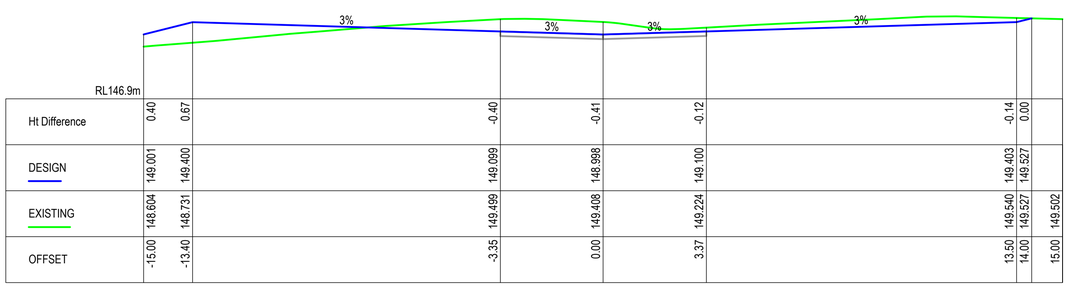
0.18	0.44	-0.58	-0.84	-0.74	-0.39	-0.05
149.325	149.700	149.464	149.295	149.467	149.700	150.075
149.143	149.264	150.043	150.135	150.211	150.090	150.121
-15.00	-13.50	-5.65	0.00	5.74	13.50	15.00

Ch 78.02 m



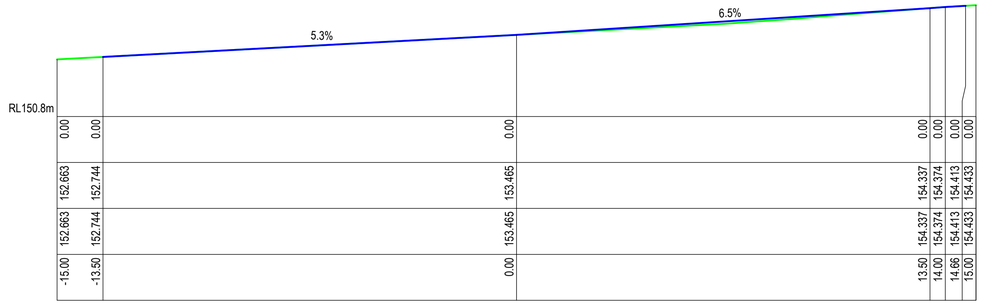
0.28	0.53	-0.58	-0.68	-0.50	-0.31	-0.04
149.244	149.619	149.349	149.214	149.351	149.619	149.994
148.967	149.092	149.933	149.898	149.853	149.931	150.035
-15.00	-13.50	-4.51	0.00	4.56	13.50	15.00

Ch 77.02 m



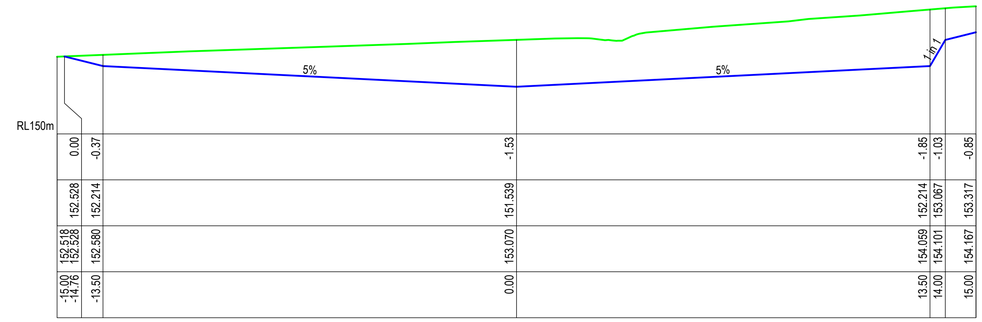
Ht Difference	0.40	0.67	-0.40	-0.41	-0.12	-0.14	0.00
DESIGN	149.001	149.400	149.099	148.998	149.100	149.403	149.527
EXISTING	148.604	148.731	149.499	149.408	149.224	149.540	149.527
OFFSET	-15.00	-13.40	-3.35	0.00	3.37	13.50 14.00	15.00

Ch 75.05 m
Shared Driveway



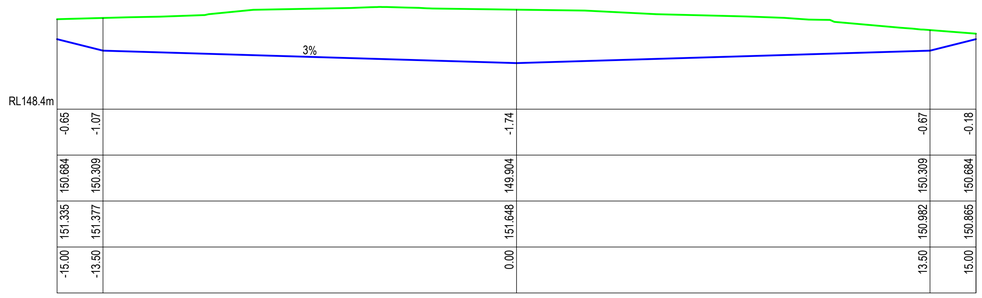
0.00	0.00	0.00	0.00	0.00	0.00	0.00
152.663	152.744	153.465	154.337	154.374	154.413	154.433
152.663	152.744	153.465	154.337	154.374	154.413	154.433
-15.00	-13.50	0.00	13.50	14.00	14.66	15.00

Ch 97.55 m



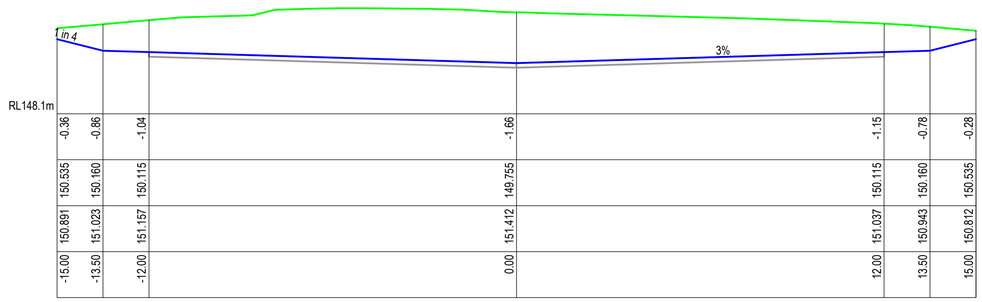
0.00	-0.37	-1.53	-1.85	-1.03	-0.85
152.528	152.214	151.539	152.214	153.067	153.317
152.518 152.528	152.580	153.070	154.099	154.101	154.167
-15.00 -14.76	-13.50	0.00	13.50	14.00	15.00

Ch 96.55 m



-0.65	-1.07	-1.74	-0.67	-0.18
150.684	150.309	149.904	150.309	150.684
151.335	151.377	151.648	150.982	150.865
-15.00	-13.50	0.00	13.50	15.00

Ch 90.00 m



-0.36	-0.86	-1.04	-1.66	-1.15	-0.78	-0.28
150.535	150.160	150.115	149.755	150.115	150.160	150.535
150.891	151.023	151.157	151.412	151.037	150.943	150.812
-15.00	-13.50	-12.00	0.00	12.00	13.50	15.00

Ch 87.02 m

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Drawing Title
SHARED DRIVEWAY CROSS SECTIONS (Sheet 2 of 2)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

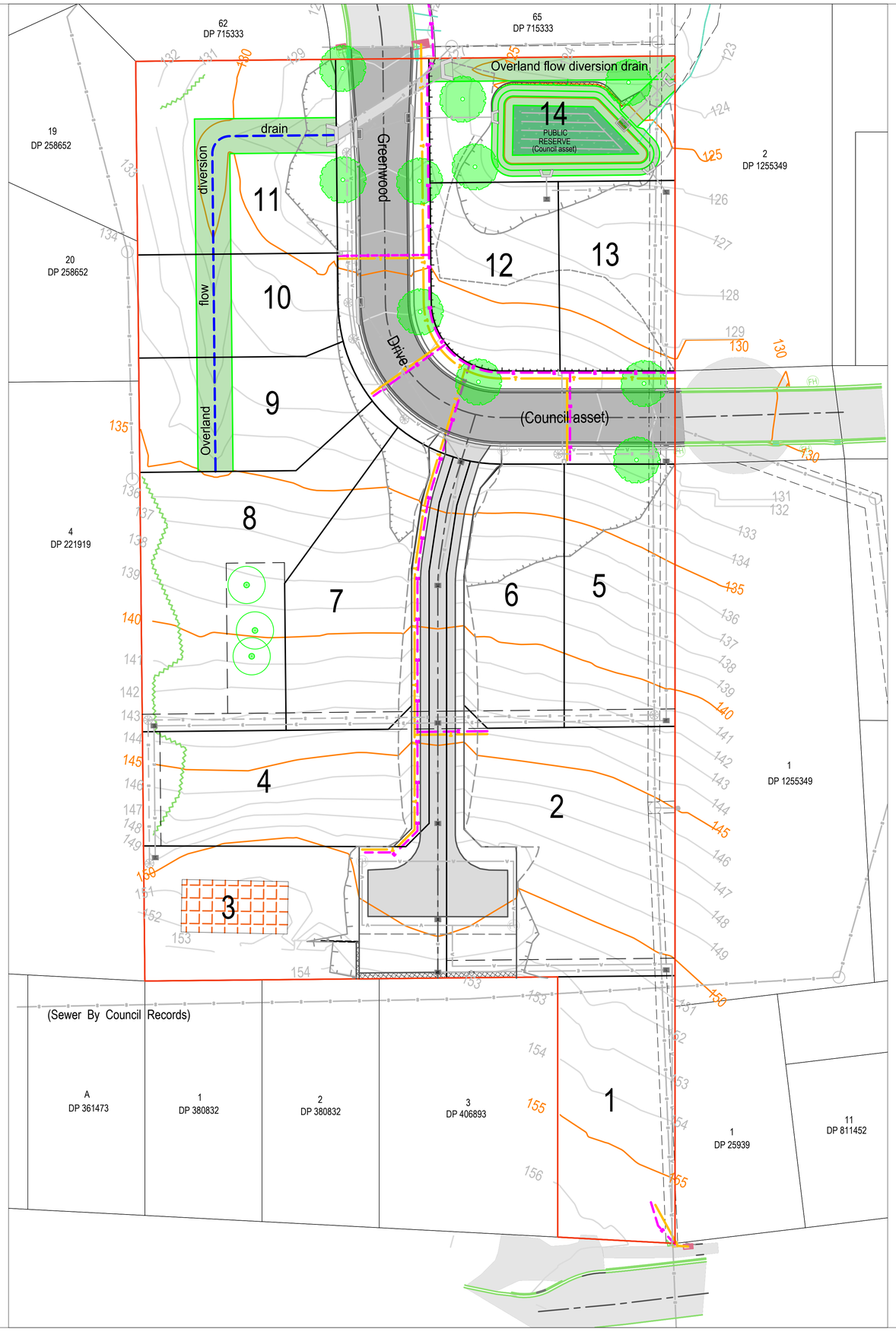
Drawn	*Date Surveyed*
DF	**23/07/21**

Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**

Locality	*Drawing No*
Goonellabah	**21037-CIV**

Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**

Local Government Area	*Sheet No*
Lismore	**13** of **20**



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

ELECTRICITY AND TELECOMMUNICATIONS LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

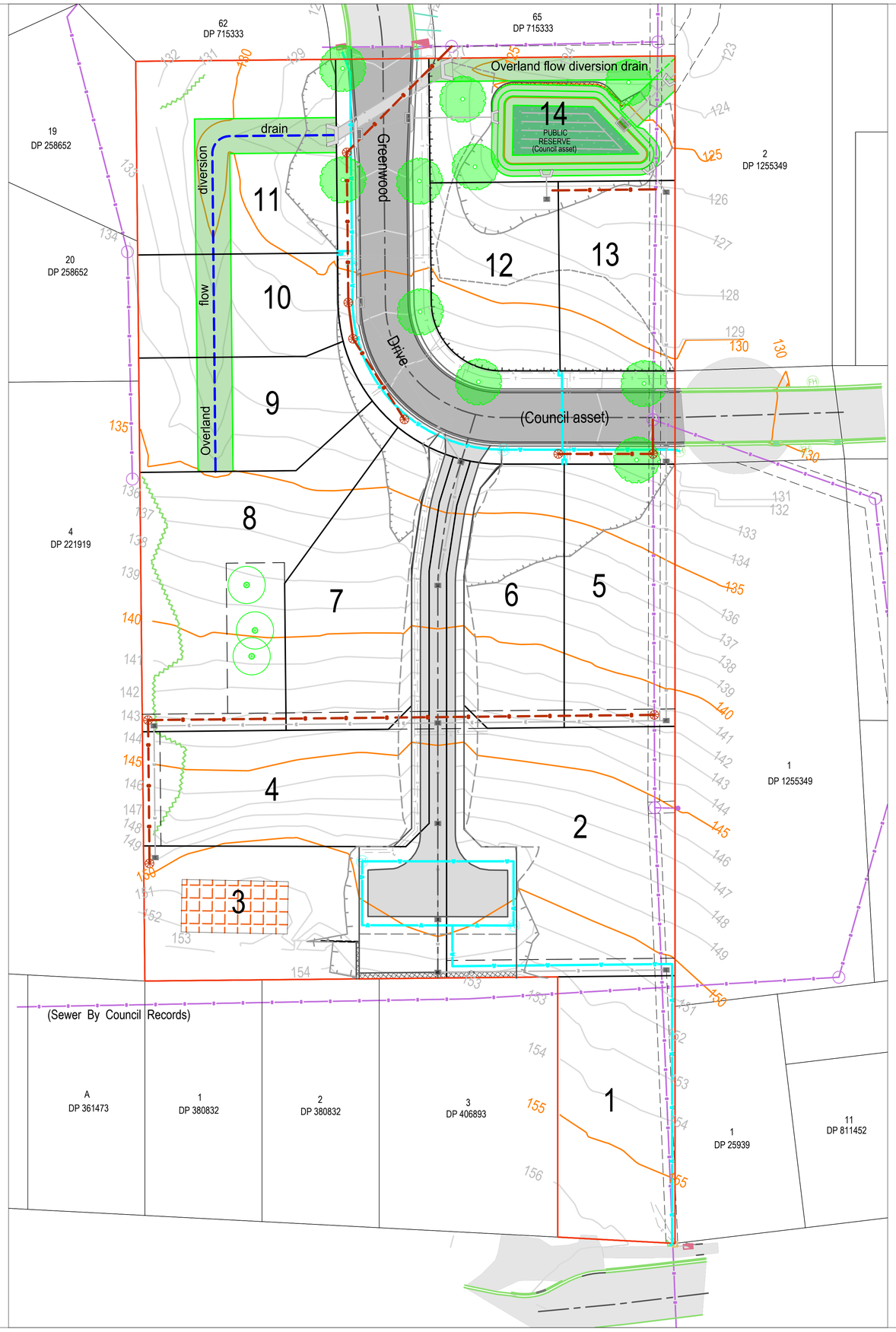
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		14 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

SEWER AND WATER RETICULATION LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

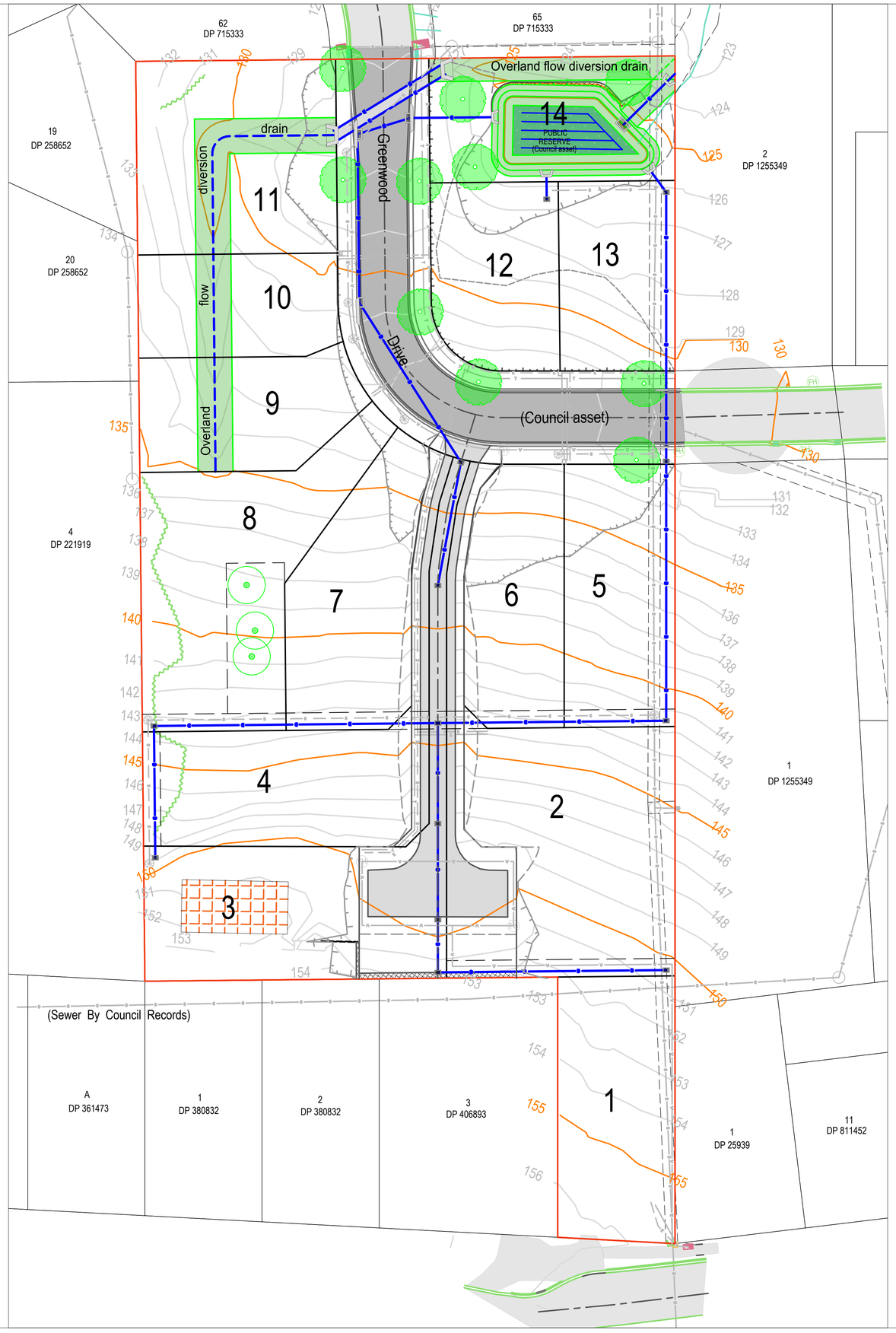
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		15 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

STORMWATER DRAINAGE LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

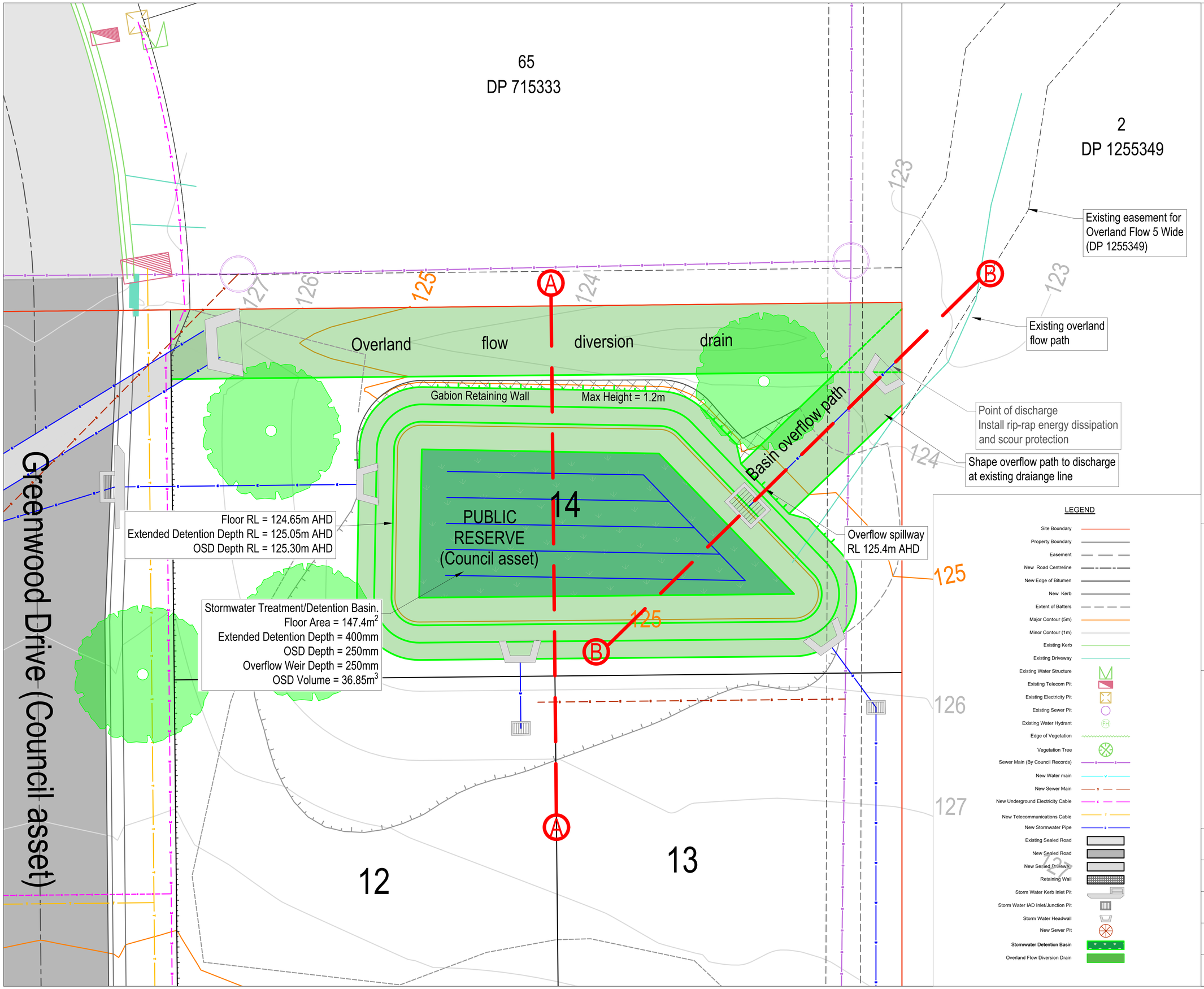
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		16 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- **Stormwater Detention Basin**
- Overland Flow Diversion Drain

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Drawing Title
STORMWATER BASIN LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
1:100
At A1 Size Sheet

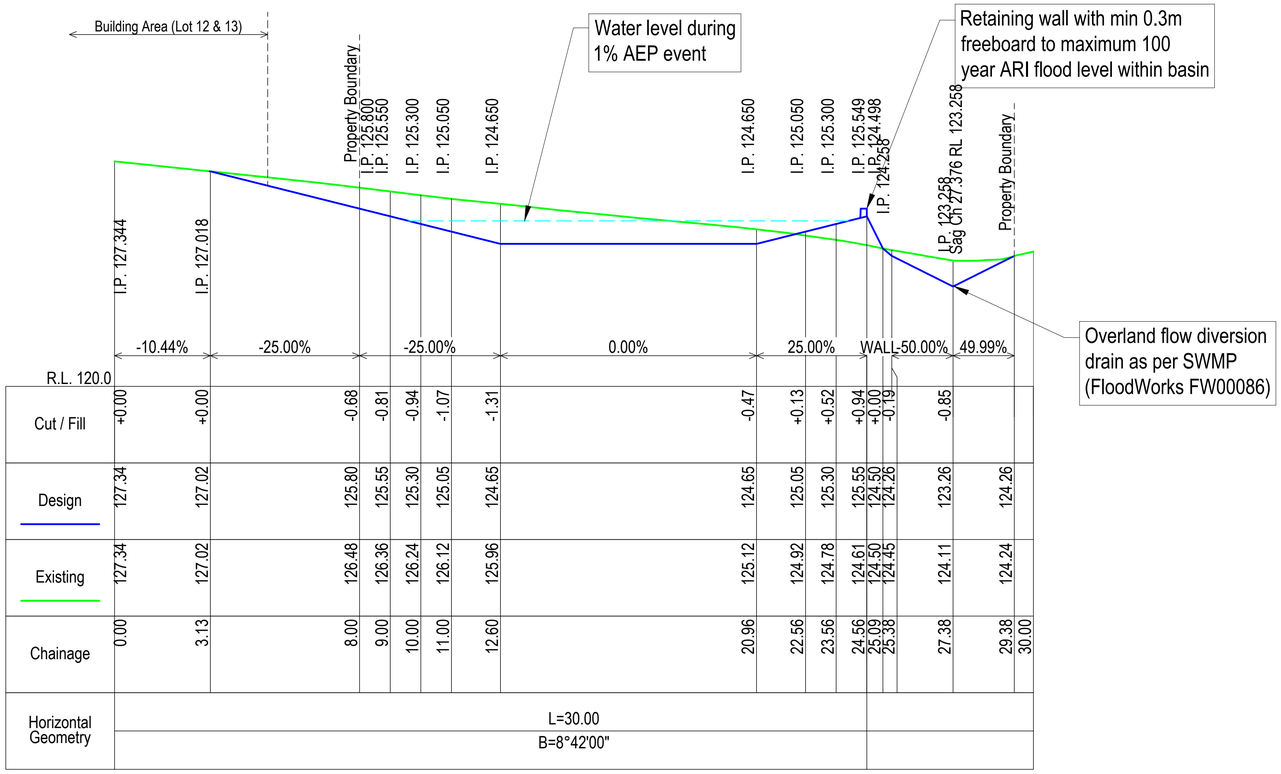
GRID NORTH
MGA 94 ZONE 56

Contour Interval
Major: 5m Minor: 1m

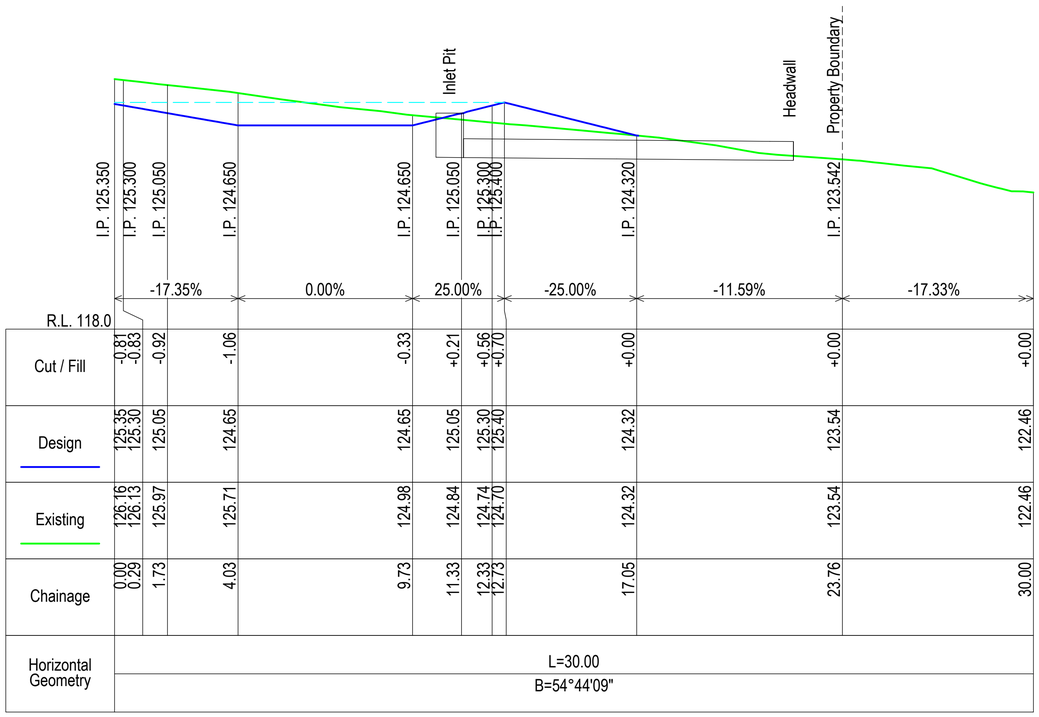
Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		17 of 20



Basin Section A - A



Basin Section B - B

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Drawing Title
STORMWATER BASIN
EXAMPLE SECTIONS

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

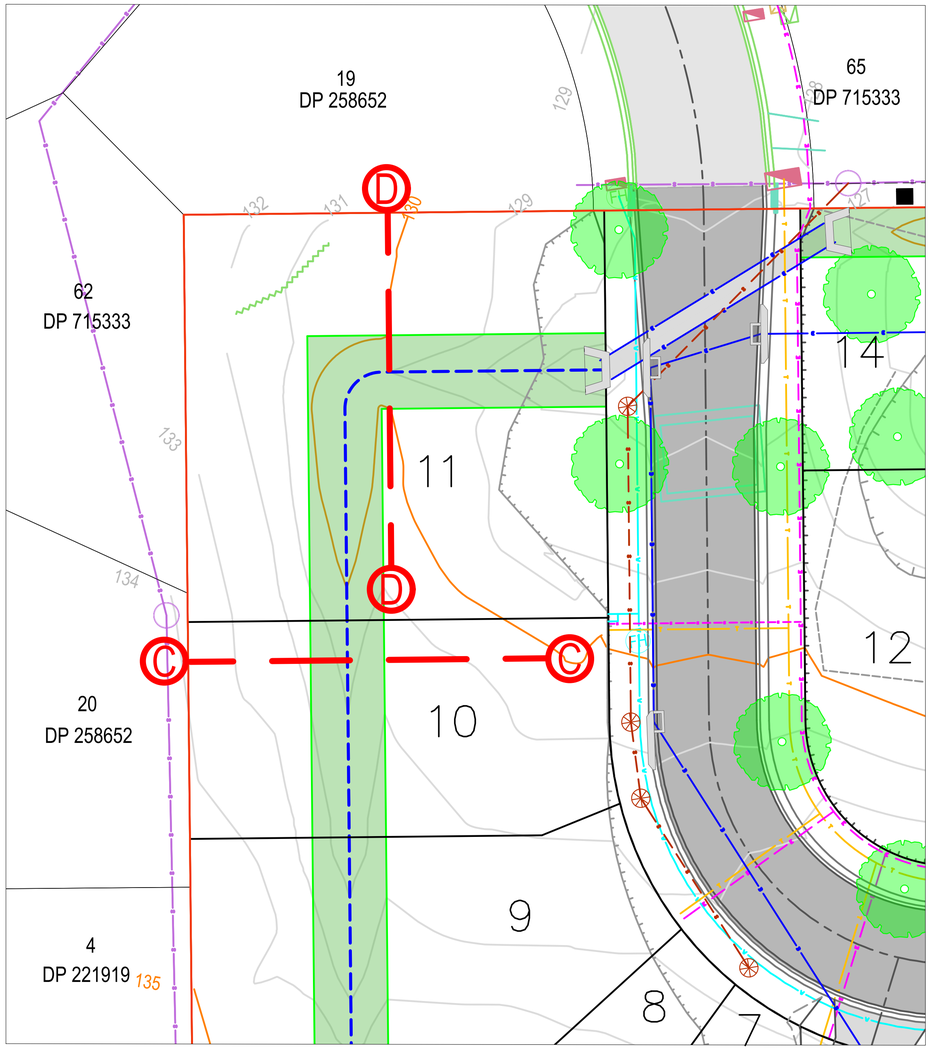
Drawn	Date Surveyed
DF	23/07/21

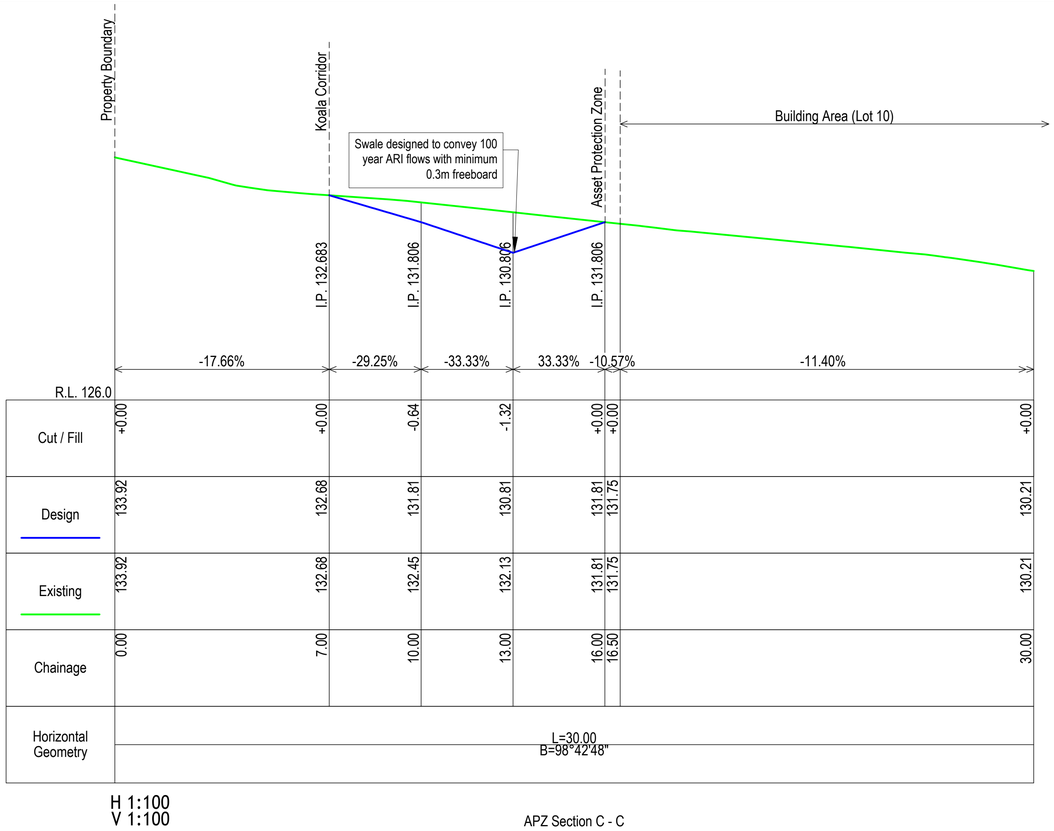
Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	18 of 20





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Existing	133.92	132.68	132.45	132.13	131.81	131.75	130.21
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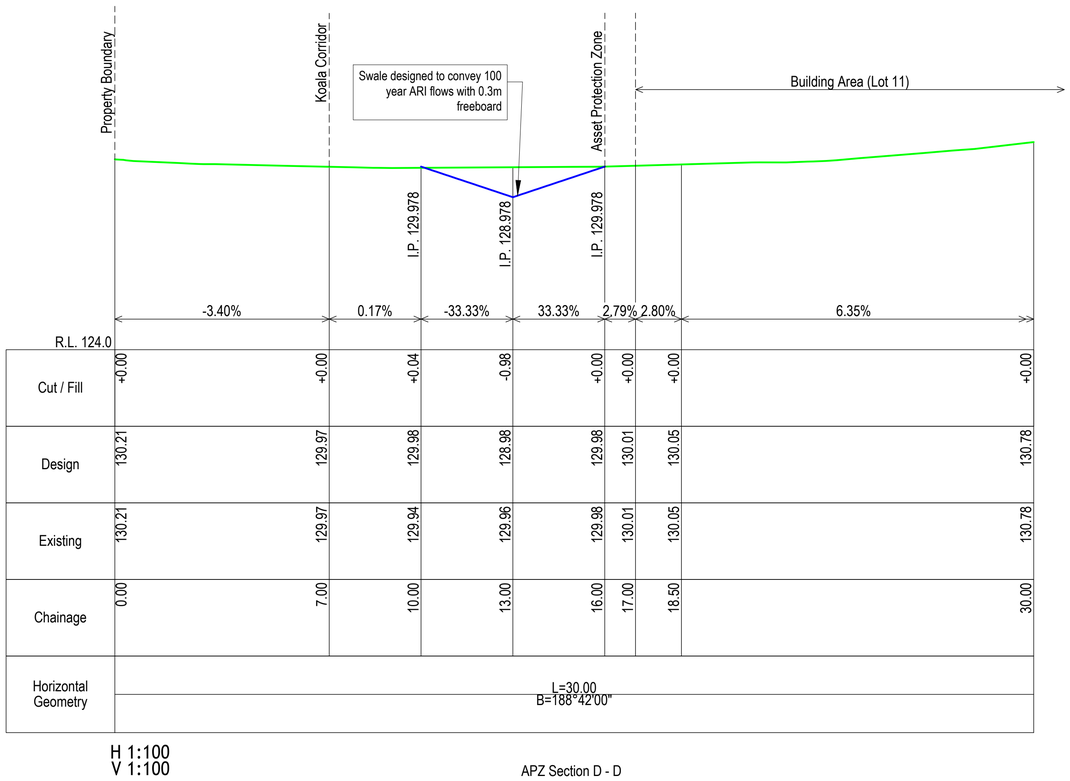
APZ Section C - C



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Design	130.21	129.97	129.98	128.98	129.98	130.01	130.05	130.78
Existing	130.21	129.97	129.94	129.96	129.98	130.01	130.05	130.78
Chainage	0.00	7.00	10.00	13.00	16.00	17.00	18.50	30.00

APZ Section D - D

LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Overland Flow Diversion Drain

RCS GROUP
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Drawing Title
ASSET PROTECTION ZONE
EXAMPLE SECTIONS

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 5 10 15 20
1:250
At A1 Size Sheet

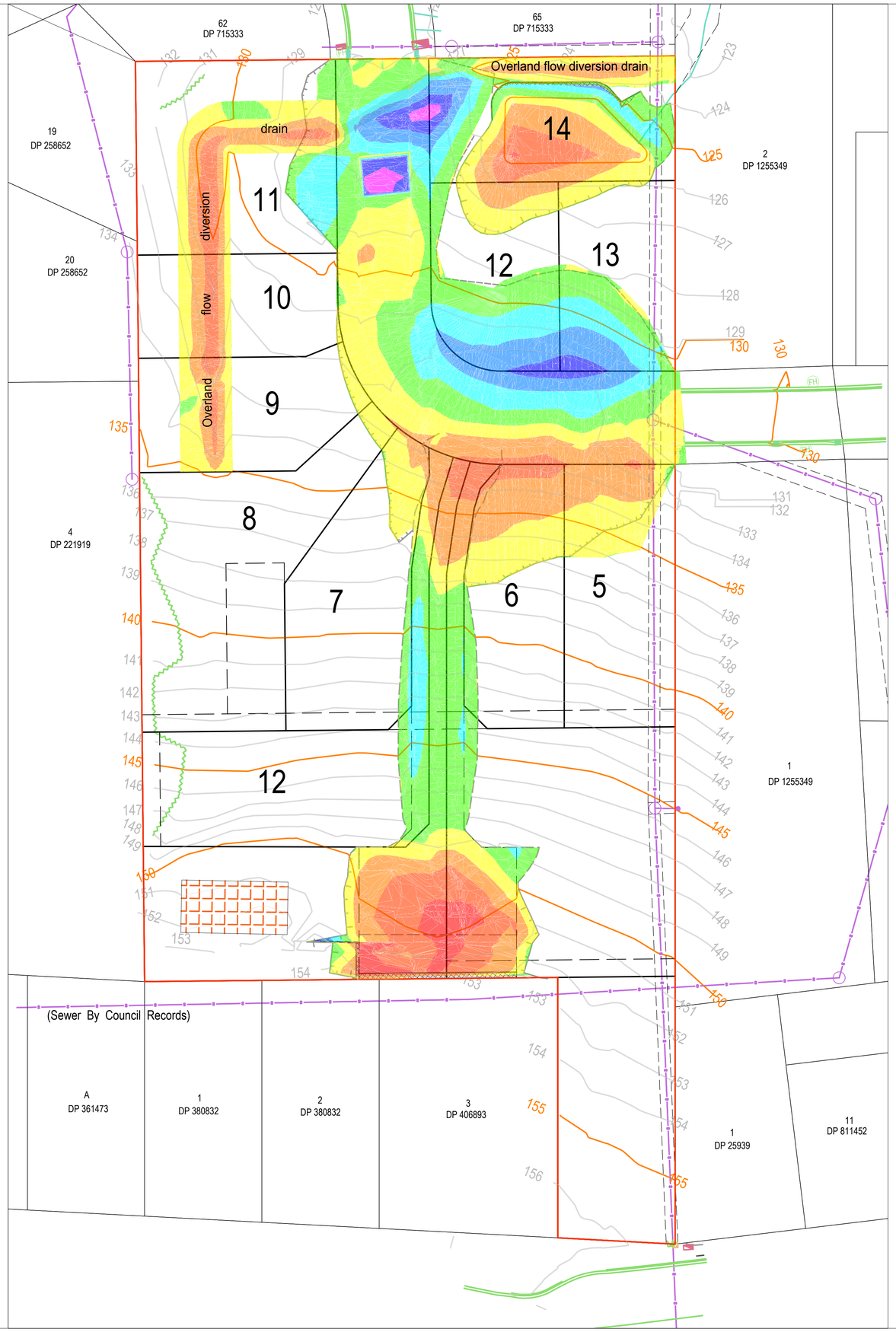
GRID NORTH
MGA 94 ZONE 56

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**19** of **20**



LEGEND

- Site Boundary
- Property Boundary
- Easement
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)

Levels Table

Min. Level	Max. Level	Colour
-2.500	-2.000	
-2.000	-1.500	
-1.500	-1.000	
-1.000	-0.500	
-0.500	0.000	
0.000	0.500	
0.500	1.000	
1.000	1.500	
1.500	2.000	
2.000	2.560	

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Drawing Title
EARTHWORKS PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		20 of 20

Bangalow

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Email: craig.adams@caconstructionmanagement.com.au

Project Number: PTP/00739
Letter Number: PTP/00739 – 0001 – Rev9
Project Name: 658 Ballina Road, Goonellabah

Slope Stability Assessment
Proposed Residential Subdivision
658 Ballina Road, Goonellabah

1. INTRODUCTION

This letter report presents the results of the additional geotechnical investigating (GI) and global stability analysis modelling undertaken for the proposed residential development to be located at 658 Ballina Road in Goonellabah.

Protest has previously provided a geotechnical landslide slope stability assessment report for this site and further information including modelling and analysis has been requested to satisfy Lismore City Council (LCC) Statement of Facts and Contentions. The primary purpose of this revised report is to include additional information to satisfy the following Statement of Facts and Contentions Part B Contentions:

- Geotechnical Engineering Section 4: To provide a clearer understanding of the ground engineering properties, groundwater and underlying geology formation; and
- Earthworks Section 5: To provide comment on the impact that the proposed earthworks will have on land stability and groundwater (if any).

Geotechnical Engineering Section 4 particulars state:

a) *The Applicant's Geotechnical Slope Stability Assessment Report prepared by Protest Engineering dated 12 June 2018 indicates that the site is made up of stiff reactive clay. In circumstances where such soils lend themselves to landslip, there has been insufficient testing within the area of proposed earthworks to demonstrate that the development as proposed can be undertaken without undue risks to life and property.*
b) *The Applicant's Geotechnical Slope Stability Assessment Report is inadequate and does not provide details of the slope stability analysis said to have been undertaken. Analysis and modelling must be provided in that regard.*
c) *No laboratory testing of soil engineering properties and reactivity has been reported or provided, which is inadequate.*
d) *No details of underlying geology information have been provided, including depths and strength of rock.*
e) *Insufficient data and reporting on groundwater conditions has been provided in order to enable a proper assessment of the proposed development.*

Earthworks Section 5 particulars state:

(c) *Insufficient information has been provided to demonstrate:*
   (vi) *That the proposed earthworks will not have an unacceptable impact on the environment, land stability and adjoining lot owners; and*
   (vii) *That the proposed earthworks will not have an unacceptable impact on groundwater systems and subsurface natural drainage patterns.*

In addition to addressing the primary purpose of the report the following LCC Development and Design Manual D6 Section D6.05 Special Treatment of Particular Areas has also been addressed:

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7. *Building areas containing natural ground slopes of an excessively steep nature, ie greater than 15% shall be brought to the attention of a Geotechnical Engineer for investigation of compatibility with dwelling types proposed. Specific requirements shall be noted on the design plans.*

It is noted that a 15% slope is equivalent to a gradient of approximately 1V:6.3H or 8.5 degrees.

The GI was undertaken to address the above items and included four boreholes with insitu strength testing, four Multi-Channel Analysis of Surface Waves (MASW) seismic survey lines and laboratory testing undertaken in general accordance with Protest's proposal PTT/02804/Rev1 dated 28 April 2021, 'AS1726:2017-Geotechnical Site Investigations' and 'AS1289-Methods of Testing for Engineering Purposes'.

It has also been requested that Protest make a comment regarding the proposed detention basin and the potential impact on groundwater.

This report includes results of the fieldwork and interpretive reporting on the following:

- 2D ground profile cross sections along geophysical survey lines;
- Global stability analysis to assess whether proposed civil engineering works will be affected by landslip or subsidence;
- Recommendations to ensure proposed civil engineering works will not be affected by landslip or subsidence (if required); and
- Comment on potential groundwater at the proposed basin location.

2. BACKGROUND INFORMATION

Protest initial report for the site '*Geotechnical Slope Stability Assessment Report, Proposed Residential Development, 658 Ballina Road, Goonellabah, Letter Number PTP/00739 - 0001 - Rev1*' dated 12 June 2018 was undertaken for this development. In summary, the investigation comprised five boreholes drilled across the site to 2.8 m depth and reported on regional geology and slope instability hazard rating.

Below is a summary of the report findings which assumed that all retaining structures would be designed in accordance with *'AS 4678-2002 Earth-retaining structures'*, earthworks would be undertaken in accordance with *'AS 3798-2007 Guidelines on earthworks for commercial and residential developments'* and the Australian Geomechanics publication *'Australian Geoguide LR8 (Construction Practice) hillside construction practice'*:

- Ground conditions at the borehole locations comprised stiff to very stiff silty clay;
- No groundwater was encountered at the borehole locations at the time of drilling;
- Regional geology mapping indicates that the site is underlain by Tertiary volcanics: basalt, rhyolite, trachyte, gabbro, syenite; and
- The site scored a relative susceptibility rating of between 0.2 and 0.6 and achieved a slope instability hazard rating of 'low' which should remain stable in the long-term conditions.

RCS Group drawing series 21037-CIV Revision 5 issued 17 March 2022 was provided to Protest in PDF file and earthwork cut and fill levels in CAD file. This information was used to map existing topography and proposed topography as shown on Drawings 101 and 102. Drawings 101 and 102 indicate:

- That the existing site slopes down towards the north with slopes generally less than 35% which is equivalent to a gradient of approximately 1V:2.9H or 19.5 degrees; and
- After the proposed earthworks the site will slope down towards the north with slopes generally less than 35%.

LiDAR data dated June 2010 was used to determine ground surface levels outside of the site boundary.

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3. REGIONAL GEOLOGY

Review of the New South Wales government MinView regional geology mapping indicates that the site is underlain by 'Lismore Basalt/Lamington Volcanic Complex//Lismore Basalt/ Cenozoic Igneous Province, Tweed Volcano, Basalt'. Drawing 103 shows regional geology mapping.

The geology identified on the MinView platform is considered consistent with the geology identified within Protest letter number PTP/00739 - 0001 - Rev1.

4. SITE DESCRIPTION

The site is located at 658 Ballina Road in Goonellabah, is rectangular in shape and had a grass ground cover with scattered trees. Drawings 104 to 111 include site photos showing typical site conditions taken at the time of the fieldwork. The aerial images on the attached drawings were taken from Nearmap showing site conditions on 15 January 2021.

5. FIELDWORK

The fieldwork scope for this additional investigation included four boreholes (nominated Boreholes 1 to 4), four MASW seismic survey lines and the installation of two standpipes. Attached to this report are the borehole log report sheets, site plan (Drawing 101) indicating the approximate test locations and results of the seismic survey (Drawings 104 to 111).

The northing and easting coordinates of the boreholes and seismic survey lines were picked using a Garmin Etrex 10 set to the UTM coordinate system.

5.1. BOREHOLES

The boreholes were drilled to depths of between 4 m and 6 m below the ground surface level using a 4WD utility mounted drilling rig fitted with 100 mm diameter solid flight augers. Disturbed samples of representative soil types were collected for soil description and classification purposes, and subsequent laboratory testing. The visual-tactile description and classification methods undertaken on disturbed samples, and shown on the attached logs, are described in accordance with AS1726:2017. The drilling was undertaken by an experienced geo-technician who logged the bores and collected samples under the instruction of a RPEQ geotechnical engineer.

Insitu testing comprised dynamic cone penetrometer (DCP), vane shear and pocket penetrometer (PP) testing undertaken at each borehole location. The results are presented on the respective borehole logs.

Silty clay strength consistency parameters described on the logs were inferred from the results of the insitu testing, tactile assessment and published correlations. Table 1 shows the inferred strength parameters from DCP data as taken from the Handbook of Geotechnical Investigations and Design Tables Second Edition, Burt G Look 2014. Silty clay strength descriptions on the borehole log report sheets may not be entirely consistent with Table 1 due to the strength parameters also being inferred from the results of the tactile assessment and PP testing.

Table 1: Clay Strength Parameters from DCP Data

Strength Consistency	DCP Blows/100 mm depth	Strength Cu
Very soft	0 – 1	0 – 12 kPa
Soft	0 – 1	12 – 25 kPa
Firm	1 – 2	25 – 50 kPa
Stiff	2 – 5	50 – 100 kPa
Very stiff	6 – 9	100 – 200 kPa
Hard	>10	>200 kPa

5.2. SEISMIC SURVEY

Four MASW seismic survey lines were undertaken using twenty-four 4.5 Hz geophones at 1.0 m spacings and recorded using the geometrics ES-3000. The seismic source adopted for acquisition was a 16 lb sledgehammer struck on a 50 mm thick polyethylene plate, with a 0 m and 5 m offsets from the first geophone were adopted depending on accessibility (i.e. fences, trees).

This setup records a frequency response at every geophone, which are then used to produce a shear velocity profile at 5 m spacings along the trajectory of the line. Twenty data points area created over a 18 m depth profile.

Tables 2 to 3 were used to infer ground conditions which generally comprised:

Table 2: Typical Shear Velocity (Vs) Ranges for Cohesive Soils (m/s)

Typical Shear Velocity (Vs) Ranges for Cohesive Soils (m/s)		
Strength Consistency	**Lower Vs Value**	**Upper Vs Value**
Very soft	0	80
Soft	80	120
Firm	120	160
Stiff	160	200
Very stiff	200	250
Hard	250	450

Table 3: Typical Shear Velocity (Vs) Ranges for basalt (m/s)

Typical Shear Velocity (Vs) Ranges for Non-Cohesive Soils (m/s)		
Strength	**Lower Vs Value**	**Upper Vs Value**
Very low	300	350
Low	350	400
Medium	400	500
High strength	500	600
Very high strength	>600	

Inferred ground conditions using the ranges in Tables 2 and 3 are shown on the attached Drawings. The percentage of each material type and strength/strength consistency in the soil mantle as a function of area recorded along each of the seismic line are also provided for information purposes.

5.3. STANDPIPES

Two groundwater monitoring wells (nominated MW1 and MW2) were installed on 6 October 2021 at the locations shown on Drawing 101. MW1 was installed at the southern part of the site and MW2 was installed at the northern part of the site. The target depth of the groundwater monitoring wells was 10 m however MW2

at the northern part of the site encountered refusal at 2 m depth during installation on a possible boulder or shallow rock. Details of the standpipe installation are attached.

After the groundwater monitoring wells were installed the drilling fluids were washed out using clean water. The wells were not purged of the water used to flush the groundwater monitoring wells at the time of installation.

Four site visits have been undertaken to record groundwater levels since the installation of the groundwater monitoring wells. Fresh/clean water which was considered to be groundwater was recorded in MW2 and those measurements are shown in Table 4.

Table 4: Summary Groundwater Monitoring

Date	Mud/Groundwater Recorded Below Surface Level (m)	
	MW1	MW2
11 October 2021	-	1.36
13 October 2021	-	1.38
15 October 2021	-	1.39
18 October 2021	-	1.78

No fresh/clean groundwater was recorded in MW1 during any of the site visits however mud was observed at the base of MW1 during the measurements. Considering the wells were full of water at the time of installation it is considered that the observed mud is remnant of the water used to flush out the drilling fluids and would not be indicative of the permanent ground water level. Drawing 115 is a photo showing the mud that was observed at the base of MW1.

6. LABORATORY TESTING

NATA accredited laboratory testing was undertaken on selected representative soil samples recovered from the boreholes in accordance with 'AS1289-Methods of Testing for Engineering Purposes'. The purpose of the laboratory testing was to determine typical soil behaviour characteristics for engineering assessment.

Laboratory testing included five quality tests (i.e. Atterberg limits, linear shrinkage and particle size distribution tests). The laboratory test result reports are attached and summarised in Table 5.

Table 5: Summary of Quality Test Results

Bore	Material	Depth (m)	W_L, %	W_P, %	I_p, %	LS, %	Passing 0.75µm, %
1	Silty clay	0.5-0.8	63	49	14	10	96
2	Silty clay	0.6-0.9	63	44	19	13.5	93
2	Silty clay	3.0-3.3	77	42	35	21	97
3	Silty clay	1.0-1.2	70	47	23	17.5	91
4	Silty clay	3.0-3.2	86	54	32	17.5	97

Note: W_L = Liquid limit; I_p = Plasticity index; LS = Linear shrinkage, - = Not tested.

Results of the Atterberg laboratory testing indicates that the samples tested have high plasticity fines.

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7. FIELDWORK RESULTS

7.1. GROUND MODEL

In summary, the soil profile encountered within the boreholes generally comprised stiff to hard clay to the borehole termination depths. Bore hole 2 encountered weathered basalt at 3.6 m depth and auger refusal on low strength of stronger basalt at 4 m depth. The strength consistency of the clay in the boreholes generally varied between each of the borehole locations however generally showed increasing strength with depth. No soft and firm clays were encountered in the boreholes.

In summary, the ground conditions inferred from the seismic survey indicate the ground conditions typically comprised a variable strength profile (consistent variable strength with the boreholes) of localised soft and firm clays within a stiff to hard clay soil mantle up to approximately 14 m thick with possibly boulders 'floating' within the clay underlain by weathered very low to high strength basalt. There are also some apparent strength inversions indicating totally weathered zones below a rock shelf or the possibly boundary of a different geological unit. The attached drawings show the percentage of each strength consistency inferred in the soil mantle along the seismic lines.

Table 6 below provides a further summary of the ground conditions inferred along each of the seismic lines.

Table 6: Inferred Ground Profile Along Seismic Lines

Line	Inferred Ground Profile
A	4 m to 9 m thick clay soil mantle comprising 3% firm, 16% stiff, 35% very stiff and 46% hard.
B	4 m to 10 m thick clay soil mantle comprising <1% soft, 9% firm, 21% stiff, 37% very stiff and 33% hard.
C	4 m to 14 m thick clay soil mantle comprising 5% soft, 9% firm, 20% stiff, 30% very stiff and 36% hard.
D	2 m to 7 m thick clay soil mantle comprising 3% soft, 14% firm, 20% stiff, 29% very stiff and 34% hard.

Note: The percentages indicated are based on the area of the inferred soil mantle, excluding the areas of inferred rock

Comparison between the borehole logs and seismic lines indicate general agreement, with the boreholes mostly indicating a slightly stronger soil profile. Due to the direct testing methods employed and tactile assessment the strength consistency shown on the borehole logs take precedence over the strength consistently inferred on the seismic lines. Based on this observation it is likely that the inferred strength consistency inferred along the seismic lines is lower than what will actually be encountered on site (i.e. there will be stronger soils on site when compared to the seismic lines).

7.2. GROUNDWATER

Groundwater was not encountered within 4 m to 6 m depth from the existing surface level at the borehole locations at the time of drilling. No permanent groundwater was measured in MW1 and groundwater was measured in MW2 between 1.36 m and 1.78 m depth.

It should be noted that groundwater levels can be perched and fluctuate seasonally and during and after heavy rainfall events. Given this natural variability, it is prudent to assume that water levels could potentially fluctuate.

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8. COMMENTS

8.1. LANDSLIDE RISK ASSESSMENT

Site observations and review of aerial and survey data indicate that that there have been no previous landslides that have occurred over the site which indicate that the existing slope and ground conditions have in the past been inherently stable.

Based on the results of the additional information gathered during this GI fieldwork and the previous geotechnical landslide slope stability assessment report it is still considered that a slope instability hazard rating of *'low'* could be assigned to the proposed development which indicate that the proposed development should remain stable in the long-term conditions, would not create undue risks to life and property and will not have an unacceptable impact on land stability for this site and the adjoining lot owners.

8.2. SLOPE STABILITY MODELLING AND ANALYSIS

To assess global stability of the proposed residential development a global slope stability model and analysis was undertaken on the two profiles shown on Drawing 101 (blue and green lines labelled as Section 1 and 2) using the commercially available Plaxis 2D software. The sections analysed are from site boundary to site boundary.

Initially one section was modelled (Section 1) for this report to assess the impact that the proposed earthworks will have on the landslide risk. Section 1 was selected based on the areas of the site that would be cut and filled. It is noted that Council Expert commented that Section 1 was not the '*steepest part of the site'* and that additional analysis should be undertaken to assess global stability on other parts of the site. Review of Drawings 102 does show a localised steeper area at the south western corner of the site and this could be the part of the site that Council Expert referred to as the '*steepest part of the site'.* This local steeper slope runs in an east-west direction across the southern parts of Lots 2 and 3. A second section (Section 2) across the site was subsequently modelled capturing this local steeper area. No earthworks are proposed along Section 2. It is noted that detailed assessment and design of all localised slopes will be required as part of the detailed design stage.

The following information was used to build the Plaxis 2D model:

- Existing and proposed ground surface profile within the site boundary from the RCS Group drawing series 21037-CIV Revision 5 digital data;
- Section 1:
  - The subsoil material profile along Seismic Line B. It was requested that the soil regions identified along the seismic line be modelled as close as practical; and
  - The subsoil material profile outside of Seismic Line B were extrapolated using extracts from the Line B profile.
- Section 2:
  - The subsoil material profile for this section adopts a simplified ground model comprising firm clay to 0.5 m depth, stiff clay to 3 m depth, very stiff clay to 6 m depth, hard clay to 9 m depth then low strength basalt.

Two groundwater cases were modelled, one case assuming that there is no permanent groundwater level to assess the long-term groundwater conditions and the other case assuming a perched groundwater level located approximately 1.5 m below the existing ground surface level.

The most likely permanent groundwater level at the higher parts of the site would be near the soil/rock interface during and after periods of prolonged heavy rain. Due to concerns that have been raised of the effect that a

temporary higher groundwater level would have on global stability a perched groundwater level approximately 1.5 m depth below the existing surface level was also included in the modelling. It is however noted that due to the sloping site topography and inferred very low permeability of the encountered clay it is highly impractical that the permanent groundwater could ever reach this level at the higher parts of the site and would actually be present near soil/rock interface greater than 5 m depth as indicated above.

The material parameters adopted for the stability analysis are summarised in Table 7 below from Table D3 and D4 of AS4678. Based on the CLA consultant's CAD file fill will need to be imported to raise site levels and the material parameters for controlled fill have assumed a 'worst case' clay fill.

Table 7: Inferred Material Parameters

Material	Unit Weight (t/m3)	Friction Angle (°)	Drained Cohesion (kPa)
Soft silty clay	15	20	1
Firm silty clay	16	22	3
Stiff silty clay	18	26	5
Very stiff silty clay	19	26	7
Hard silty clay	20	26	9
Very low strength basalt	21	32	10
Low strength basalt	22	35	12
Medium strength basalt	23	38	15
High strength basalt	24	40	20

Drawings 112 and 113 attached shows the existing and proposed Plaxis 2D models adopted for the analysis.

The results of the long-term global stability modelling and analysis for existing and proposed topography and ground conditions are summarised in Table 8 and shown in Figures 112 and 113. A Factor of safety (FoS) greater than 1.5 is considered suitable for long-term stability.

Table 8: Summary of Global Stability Analysis Results

Drawing	Profile	Groundwater	FoS	Comment
112	Section 1 - Existing	-	2.24	FoS>1.5 - Suitable for long-term stability
112	Section 1 - Existing	Approx. 1.5 m BGL	1.73	FoS>1.5 - Suitable for long-term stability
113	Section 1 - Proposed	-	2.24	FoS>1.5 - Suitable for long-term stability
113	Section 1 - Proposed	Approx. 1.5 m BGL	1.72	FoS>1.5 - Suitable for long-term stability
114	Section 2 - Existing	-	1.92	FoS>1.5 - Suitable for long-term stability
114	Section 2 - Existing	Approx. 1.5 m BGL	1.75	FoS>1.5 - Suitable for long-term stability

Note: BGL = Below existing ground level

The results of the Plaxis 2D modelling and analysis indicate that the proposed development would achieve a long-term global stability FoS greater than 1.5 and should remain stable in the long-term conditions, would not create undue risks to life and property, and will not have an unacceptable impact on land stability for this site and the adjoining lot owners.

8.3. PLAXIS FACTOR OF SAFETY ANALYSIS EXPLANATION

Reference should be made to the Plaxis manuals for detailed description of the safety analysis used by the program. Below is an extract from the Plaxis manual to provide the reader with the method used by Plaxis to calculate the FoS.

'In the Safety approach the shear strength parameters tan φ and c of the soil as well as the tensile strength are successively reduced until failure occurs. In the Safety approach the shear strength parameters tan φ and c of the soil as well as the tensile strength are successively reduced until failure of the structure occurs.

The total multiplier ΣMsf is used to define the value of the soil strength parameters at a given stage in the analysis:

$$\Sigma Msf = \frac{\tan \varphi_{input}}{\tan \varphi_{reduced}} = \frac{c_{input}}{c_{reduced}} = \frac{s_{u,input}}{s_{u,reduced}} = \frac{\text{Tensile strength}_{input}}{\text{Tensile strength}_{reduced}} \qquad Eq.\ [83]$$

where the strength parameters with the subscript 'input' refer to the properties entered in the material sets and parameters with the subscript 'reduced' refer to the reduced values used in the analysis.

The strength parameters are successively reduced automatically until all Additional steps have been performed. The factor of safety is given by:

$$SF = \frac{\text{available stregth}}{\text{stregth at failure}} = \text{value of } \Sigma\text{Msf at failure} \qquad Eq.\ [84]$$

8.5. LANDSLIDE ASSESSMENT SUMMARY, RECOMMENDATIONS AND CONCLUSION

Ground conditions and ground water summary:

- Ground conditions are expected to comprise a stiff to hard clay mantle up to approximately 10 m thick with possibly boulders 'floating' within the clay underlain by weathered very low to high strength basalt;
- Groundwater was encountered within MW2 between depths 1.36 m and 1.78 m;
- No permeant groundwater was encountered during drilling of the boreholes or within MW1; and
- Groundwater could potentially be encountered at higher parts of the site at the soil/rock interface after prolonged heavy rain.

Recommendations:

- All retaining structures should be designed in accordance with 'AS 4678-2002 Earth-retaining structures' and achieve a long-term global stability FoS greater than 1.5;
- Earthworks should be undertaken in accordance with *'AS 3798-2007 Guidelines on earthworks for commercial and residential developments'*;
- Previously it was recommended The Australian Geomechanics publication *'Australian Geoguide LR8 (Construction Practice) hillside construction practice'* be followed however, based on the modelling and analysis undertaken as part of this report it is now considered that the future residential buildings are unlikely to require piles socketed into rock; and
- Long-term unsupported permanent batter slopes are generally designed to be 2H:1V or flatter.

Conclusions:

- The proposed earthworks will not have an unacceptable impact on land stability at this site or to adjoining lot owners;
- The proposed earthworks will not have an unacceptable impact on the groundwater (if any);
- A relative susceptibility rating of between 0.2 and 0.6 suggests a slope instability hazard rating of '*low*' indicating that the site would remain stable in the long-term conditions and suitable for the proposed residential development and would not create undue risks to life and property;
- Results of the global stability modelling and analysis indicates that the proposed development would achieve a suitable long-term global stability FoS greater than 1.5 and would not create undue risks to life and property;

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- It is considered that the proposed development and site conditions do not lend themselves to landslide; and
- The natural ground slopes greater than 35% (approximately 1V:2.9H or 19.5 degrees) are considered compatible with the residential dwelling type proposed.

9. ADDITIONAL GROUNDWATER COMMENTS

Considering that groundwater was recorded at MW2, the question has been raised regarding how the permeant groundwater level could be affect due construction of the proposed basin within Lot 15.

The ground surface level at MW2 determined using the survey data provided is approximately RL 131.1 m and groundwater was measured at depths between 1.36 m (RL 129.7 m) and 1.78 m (RL 129.3 m).

The current ground level of the basin area located within Lot 15 is between approximately RL 124 m and RL 126 m. The basin will be formed by building up the northern side (low side) and excavating the southern side between 1 m and 1.5 m depth to approximately RL 124.65 m. It is also noted that the north eastern corner of the site is at approximately RL 123.5 m.

Based on the groundwater level measured at MW2 and the proposed basin level it does seem plausible that groundwater seepage could potentially intercept the basin. Based on existing ground levels any potential groundwater seepage into the basin is expected to be minimal.

We would recommend that during the detailed design stage standpipes be installed and monitored at the basin location to measure groundwater levels. If the results of the monitoring indicates that groundwater seepage is likely to intercept the basin then this will need to be addressed during the detailed design stage and suitably managed during the life cycle of the basin.

It is our opinion that management of any groundwater seepage that intercepts the basin can be satisfactory addressed.

We trust this information is satisfactory for your current needs. Should you have any questions, please feel free to contact the undersigned.

Regards,

Protest Engineering

Ryan Kemp
Principal Geotechnical Engineer - CPEng RPEQ NER

Attachments: *Borehole logs*
Drawings 101 to 114
standpipe installation drawings
Drawing 114 – Photo of mud at the base of the groundwater monitoring wells
Laboratory Test Results

BOREHOLE BH1

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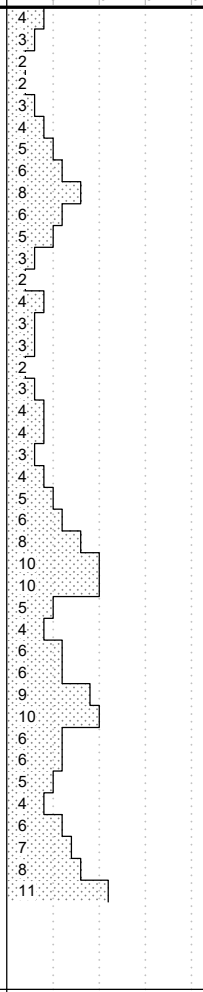
CLIENT: -
PROJECT: Proposed Commerical Development
LOCATION: 658 Ballina Road, Goonellabah
PROJECT NUMBER: PTP/00739
DRILLER: Protest Engineering **RIG:** 4WD Drill Rig

DATE: 20/05/2021
EASTING: 532075 m
NORTHING: 6812210 m
SURFACE ELEV:
LOGGED: JS **CHECKED:** MR

RL (m)	Depth (m)	Drilling Method	Graphic Log	Layer Depths	Material Description	Water	Strength (Consistency, Relative Density, Rock Strength)	Sampling & Testing: Type	Sampling & Testing: Results & Comments	Dynamic Penetrometer Test (blows per 100 mm)
				0	TOPSOIL/GRASS					
				0.1	CH silty CLAY trace sand, red/brown, stiff, high plasticity clay, low plasticity silt, fine to coarse sand, moist					
								0.5	V=78 kPa	
	1						Stiff			
								1.5	PP=175 kPa	
	2							2	PP=150 kPa	
				2.2	- very stiff		Very Stiff			
				2.4	- hard		Hard	2.5	PP=200 kPa	
				2.6	- stiff		Stiff			
				2.8	- very stiff					
	3			3	- grey mottled red/brown			3	PP=125 kPa	
							Very Stiff	3.5	PP=250 kPa	
	4			3.9	- hard		Hard			
					Bore terminated at 4.5 m. Target depth achieved.					
	5									
	6									
	7									



BOREHOLE BH2

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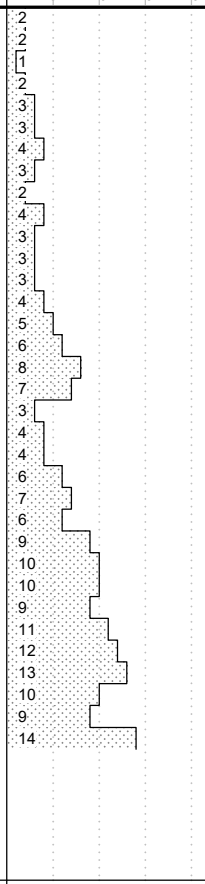
CLIENT: -
PROJECT: Proposed Commerical Development
LOCATION: 658 Ballina Road, Goonellabah
PROJECT NUMBER: PTP/00739
DRILLER: Protest Engineering **RIG:** 4WD Drill Rig

DATE: 20/05/2021
EASTING: 532113 m
NORTHING: 6012254 m
SURFACE ELEV:
LOGGED: JS **CHECKED:** MR

RL (m)	Depth (m)	Drilling Method	Graphic Log	Layer Depths	Material Description	Water	Strength (Consistency, Relative Density, Rock Strength)	Sampling & Testing: Type	Sampling & Testing: Results & Comments	Dynamic Penetrometer Test (blows per 100 mm)
				0	TOPSOIL/GRASS					
				0.1	CH silty CLAY trace sand, red/brown, firm, high plasticity clay, low plasticity silt, fine to coarse sand, moist		Firm			
				0.4	- stiff			0.5	PP=100 kPa V=70 kPa	
	1							1	PP=125 kPa V=86 kPa	
							Stiff	1.5	PP=75 kPa V=92 kPa	
	2							2	PP=100 kPa V=68 kPa	
				2.1	- very stiff		Very Stiff			
				2.5	- hard			2.5	PP=225 kPa	
				2.8	- grey					
	3						Hard			
				3.6	GP sandy GRAVEL, grey, very dense (inferred), fine to medium gravel, fine to coarse sand, dry; very low strength, highly weathered sandstone		Very Dense			
	4									
					Bore terminated at 4 m. 4WD Drill Rig refusal on very low strength sandstone.					
	5									
	6									
	7									



BOREHOLE BH3

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CLIENT: -
PROJECT: Proposed Commerical Development
LOCATION: 658 Ballina Road, Goonellabah
PROJECT NUMBER: PTP/00739
DRILLER: Protest Engineering **RIG:** 4WD Drill Rig

DATE: 20/05/2021
EASTING: 532152 m
NORTHING: 6812187 m
SURFACE ELEV:
LOGGED: JS **CHECKED:** MR

RL (m)	Depth (m)	Drilling Method	Graphic Log	Layer Depths	Material Description	Water	Strength (Consistency, Relative Density, Rock Strength)	Sampling & Testing: Type	Sampling & Testing: Results & Comments	Dynamic Penetrometer Test (blows per 100 mm)
				0	TOPSOIL/GRASS					
				0.1	CH silty CLAY trace sand, red/brown, stiff, high plasticity clay, low plasticity silt, fine to coarse sand, moist		Stiff	0.5	PP=200 kPa V=98 kPa	2, 4, 3, 6, 6, 5, 4
	1						Very Stiff	1	PP=275 kPa V=112 kPa	7, 6, 9, 10, 10
				1.2	- stiff		Stiff	1.5	PP=150 kPa V=86 kPa	6, 5, 4, 3
				1.6	- very stiff					7, 6, 6
	2						Very Stiff	2	PP=225 kPa	8, 7, 9, 9
				2.3	- hard			2.5	PP=250 kPa V=122 kPa	10, 11, 12, 13
	3							3	PP=200 kPa	
				3.3	- red/brown mottled grey		Hard	3.5	PP=200 kPa	
	4									
					Bore terminated at 4.5 m. Target depth achieved.					
	5									
	6									
	7									

Dynamic Penetrometer Test (blows per 100 mm): 5 10 15 20

BOREHOLE BH4

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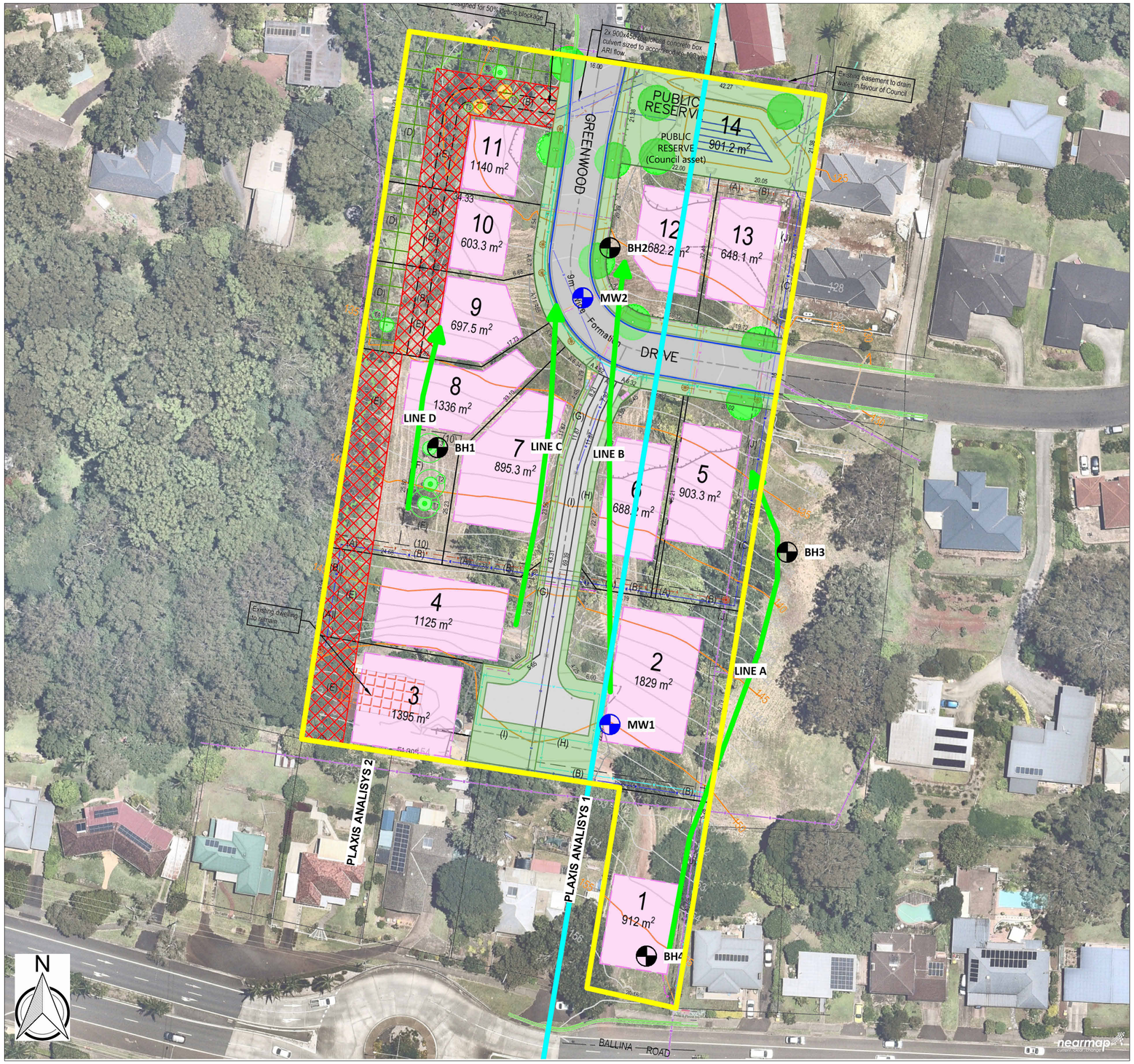
CLIENT: -
PROJECT: Proposed Commerical Development
LOCATION: 658 Ballina Road, Goonellabah
PROJECT NUMBER: PTP/00739
DRILLER: Protest Engineering **RIG:** 4WD Drill Rig

DATE: 20/05/2021
EASTING: 532121 m
NORTHING: 6812098 m
SURFACE ELEV:
LOGGED: JS **CHECKED:** MR

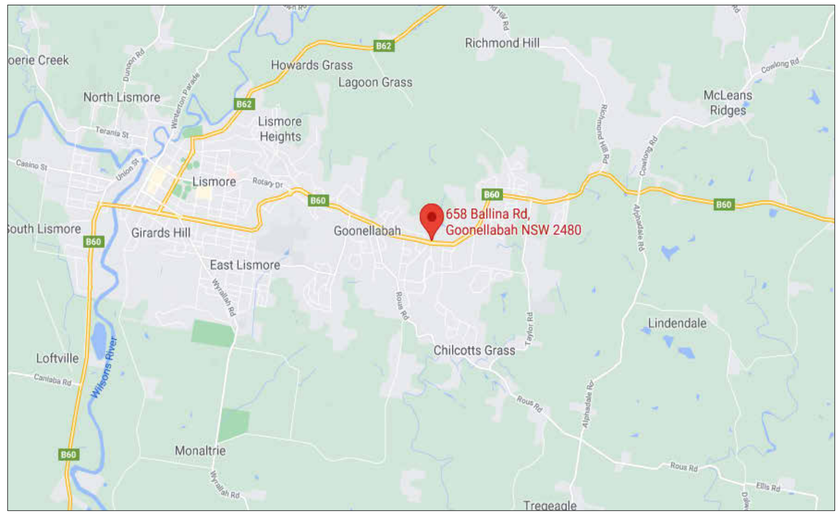
RL (m)	Depth (m)	Drilling Method	Graphic Log	Layer Depths	Material Description	Water	Strength (Consistency, Relative Density, Rock Strength)	Sampling & Testing: Type	Sampling & Testing: Results & Comments	Dynamic Penetrometer Test (blows per 100 mm)
				0	TOPSOIL/GRASS					
				0.1	CH silty CLAY trace sand, red/brown, stiff, high plasticity clay, low plasticity silt, fine to coarse sand, moist		Stiff			3, 2, 4, 6, 8, 11, 9, 16
				0.3	- very stiff		Very Stiff	0.5	PP=300 kPa	
				0.7	- hard					
	1							1	PP=300 kPa	3, 9, 12, 20/ 30 mm
	2							2	PP=300 kPa	6, 9, 12, 19
	3							3	PP=300 kPa	4, 6, 20/ 20 mm
							Hard			
	4							4	PP=300 kPa	6, 19
	5									
	6				Bore terminated at 6 m. Target depth achieved.					
	7									

Dynamic Penetrometer Test (blows per 100 mm): 5 10 15 20

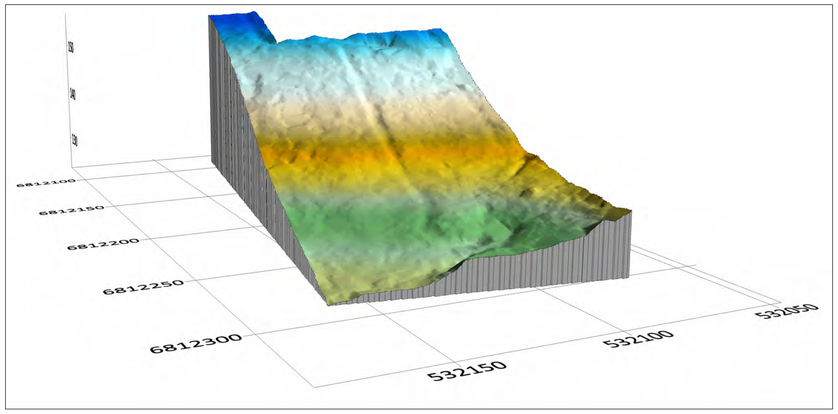
658 BALLINA ROAD, GOONELLABAH: TEST LOCATION PLAN



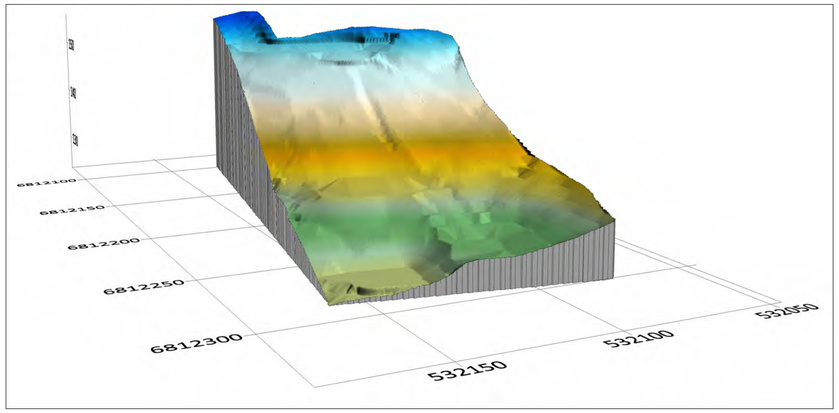
SITE LOCALITY



EXISTING SITE TOPOGRAPHY



SITE TOPOGRAPHY POST DEVELOPMENT



Legend

TEST LOCATION

SEISMIC LINE LOCATION AND DIRECTION

Regional Locality

Client

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Consultant

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Drawing Title

TEST LOCATION PLAN

Drawn	Date	Scale	
BW	14/10/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	101	2

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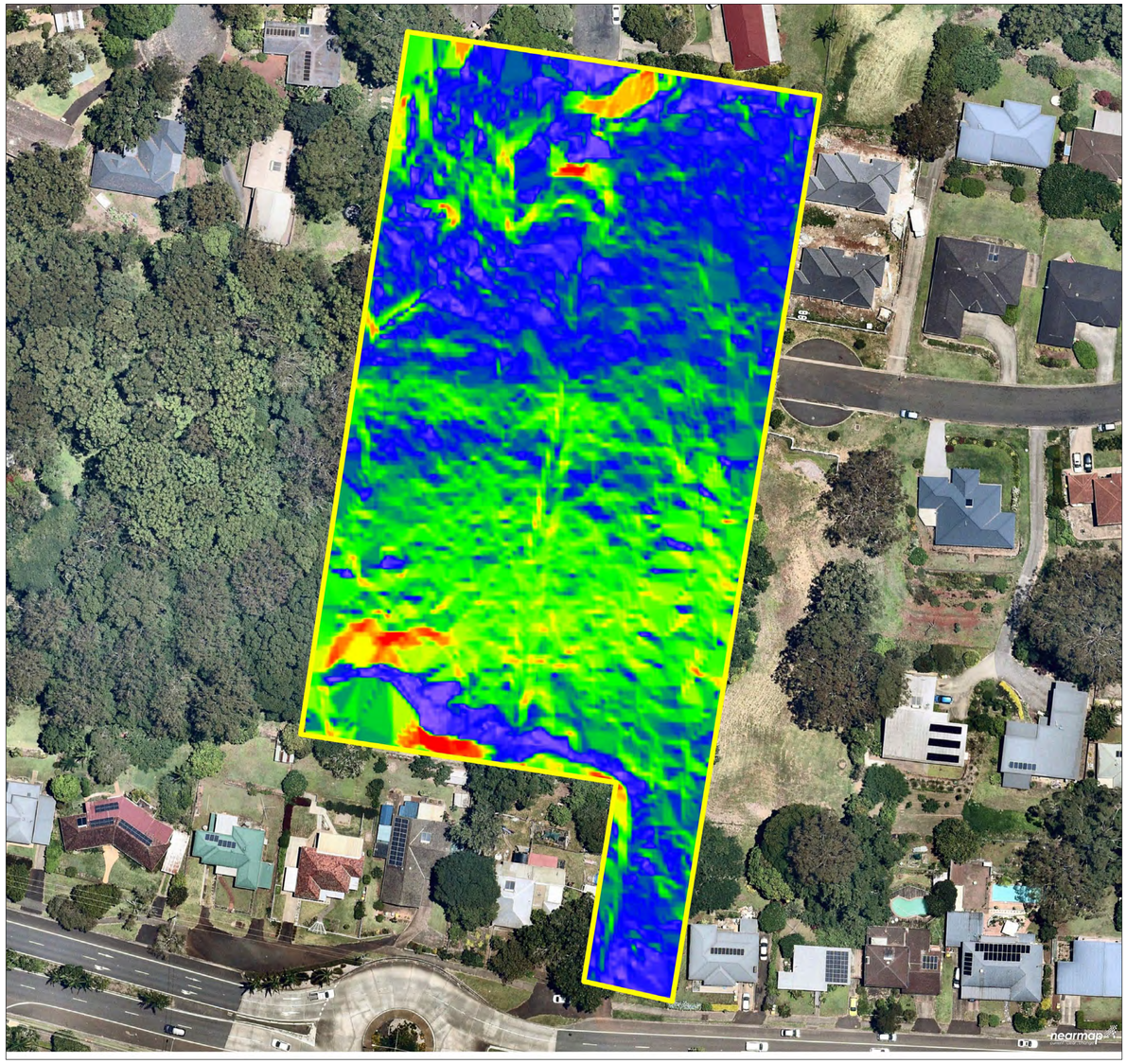
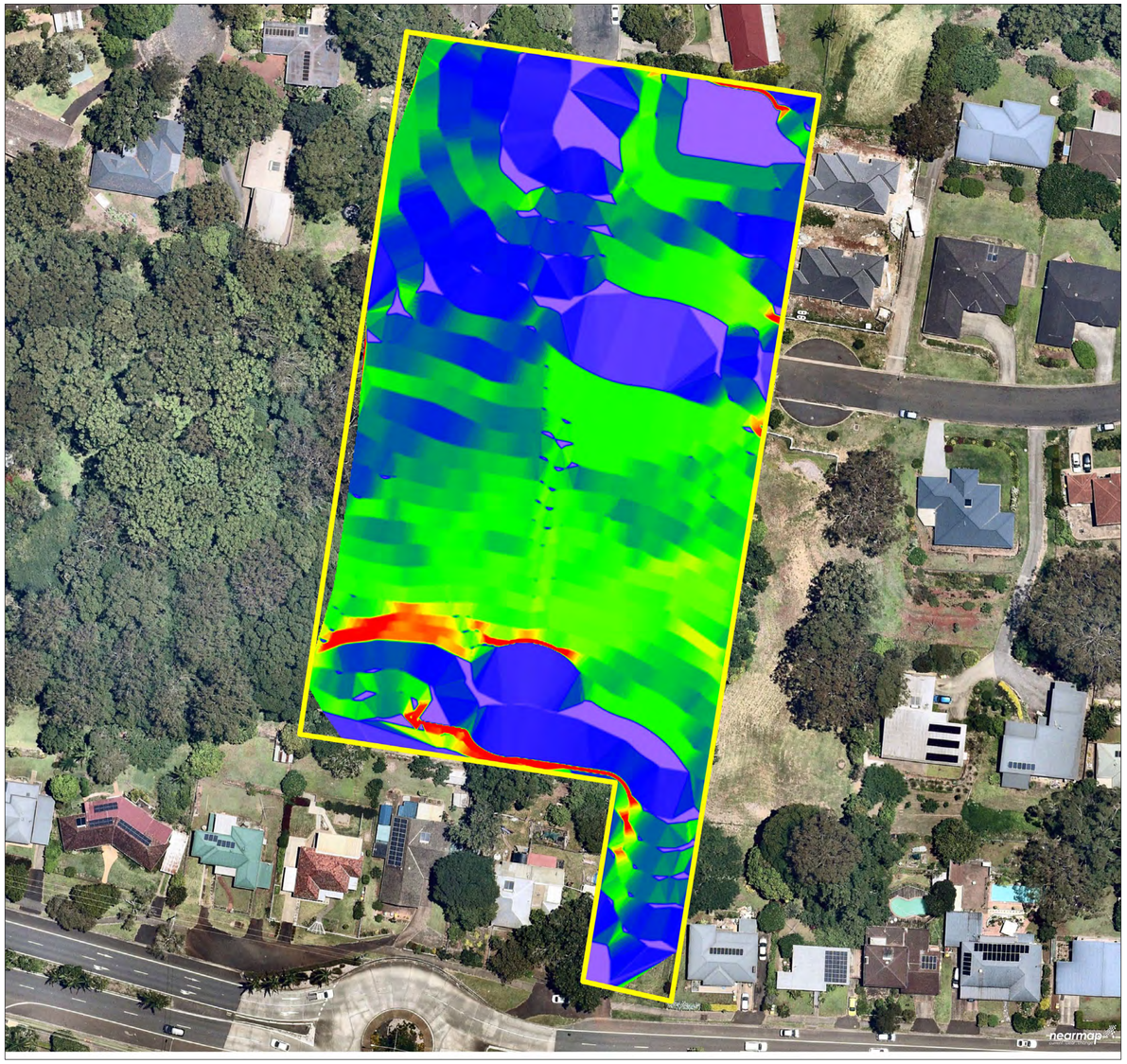
658 BALLINA ROAD, GOONELLABAH: SLOPE MAPS

EXISTING SITE SLOPES (%)



PROPOSED SITE SLOPES (%)



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Legend

SLOPE (%)

0 5 10 15 20 25 30 35 40 45 50 55 60

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Drawing Title

SLOPE MAP

Drawn	Date	Scale	A1	
BW	04/02/2020			
Designed	Project No.		Dwg No.	Issue
RK	PTP/00739		102	2

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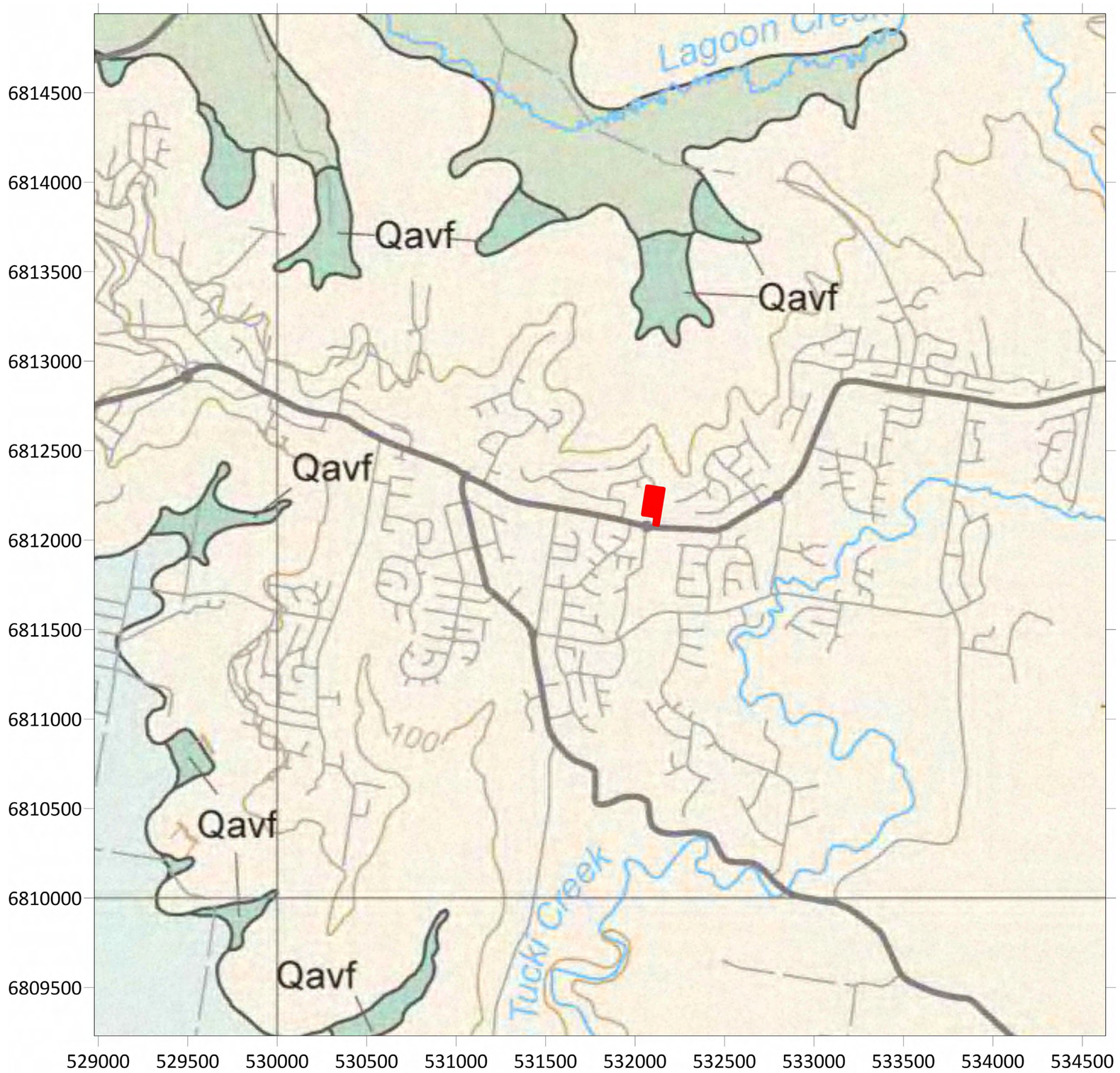
658 BALLINA ROAD, GOONELLABAH: REGIONAL GEOLOGY



Legend

SITE LOCATION

TERTIARY VOLCANIC ROCKS - BASALT, RHYOLITE, GABBRO

Regional Locality

Client

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Drawing Title

REGIONAL GEOLOGY

Drawn	Date	Scale	
BW	14/10/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	103	2

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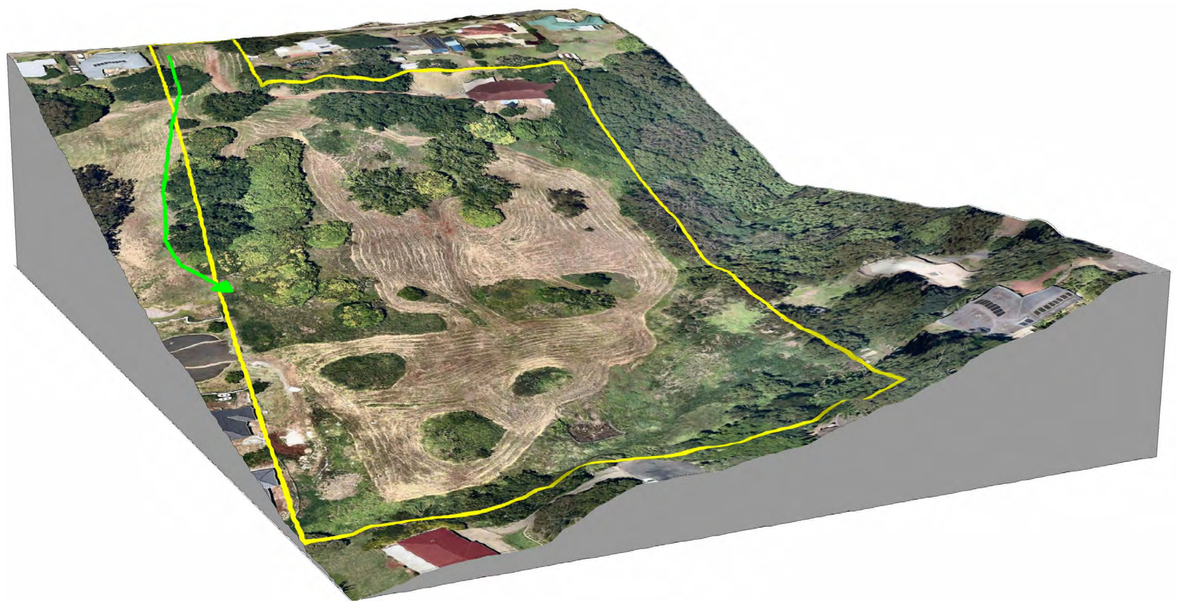
658 BALLINA ROAD, GOONELLABAH: LINE A SEISMIC SECTION

LINE A LOCATION AND DIRECTION



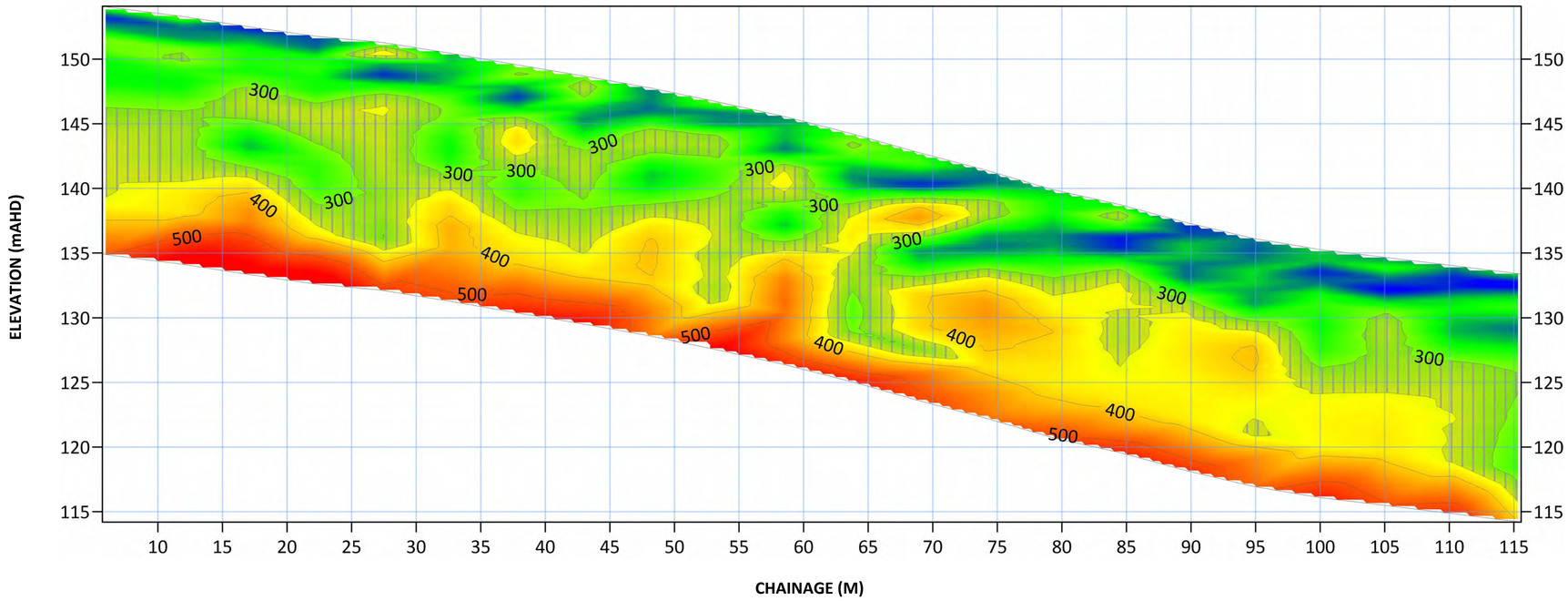
SHEAR VELOCITY SCALES

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY SOFT SOILS	0	80	
SOFT SOILS	80	120	
FIRM SOILS	120	160	
STIFF SOILS	160	200	
VERY STIFF SOILS	200	250	
HARD SOILS	250	400	

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR ROCK (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY LOW STRENGTH ROCK	300	350	
LOW STRENGTH ROCK	350	400	
MEDIUM STRENGTH ROCK	400	500	
HIGH STRENGTH ROCK	500	600	

LINE A SITE IMAGE

LINE A SEISMIC (Vs) PROFILE



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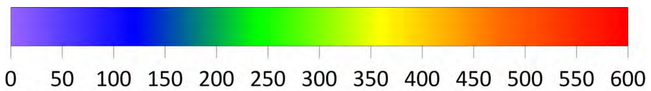

Regional Locality

Client

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Consultant

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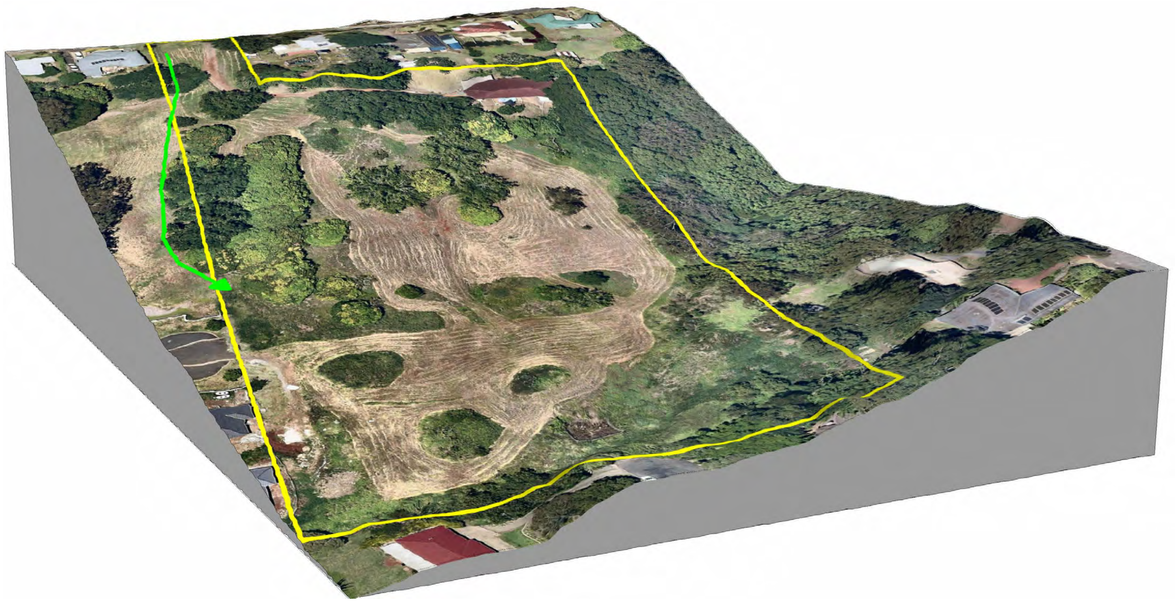
Drawing Title

658 BALLINA ROAD, GOONELLABAH - LINE A SEISMIC SECTIONS

Drawn	Date	Scale	
BW	26/11/2020	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	104	2

658 BALLINA ROAD, GOONELLABAH: LINE A INFERRED MATERIALS

LINE A LOCATION AND DIRECTION

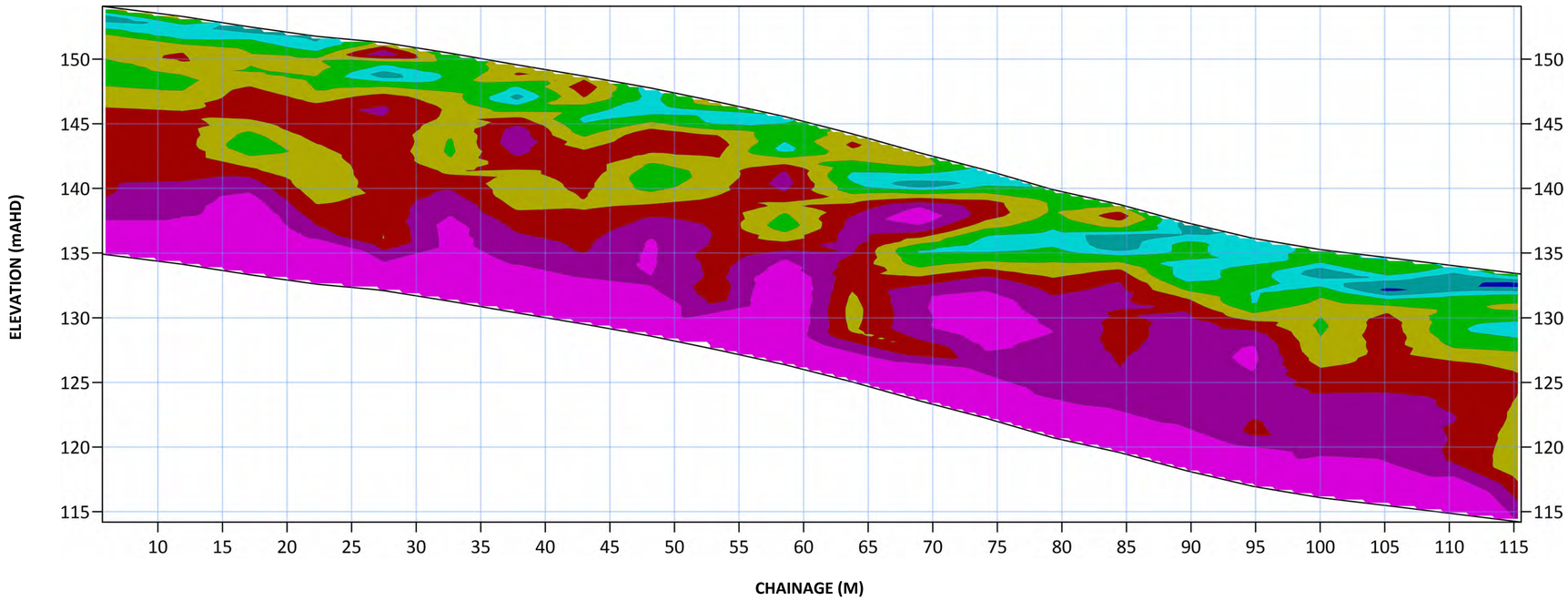


SHEAR VELOCITY COMPOSITIONS

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)				
STRENGH	LOWER VS VALUE	UPPER VS VALUE	COMPOSTION OF GROUND PROFILE	COMPOSITION OF SOIL MANTLE
VERY SOFT SOILS	0	80	0%	0%
SOFT SOILS	80	120	0%	0%
FIRM SOILS	120	160	1%	3%
STIFF SOILS	160	200	6%	16%
VERY STIFF SOILS	200	250	13%	35%
HARD SOILS	250	300	17%	46%
VERY LOW STRENGTH ROCK	300	350	22%	-
LOW STRENGTH ROCK	350	400	21%	-
MEDIUM STRENGTH OR STRONGER ROCK	400	+	20%	-

LINE A SITE IMAGE

LINE A SEISMIC (Vs) PROFILE



Legend

Soft Firm Stiff VStiff Hard VLS LS MS

80 120 160 200 250 300 350 400 +

Regional Locality

Client

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Consultant

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Project

658 BALLINA ROAD, GOONELLABAH

Drawing Title

658 BALLINA ROAD, GOONELLABAH - LINE A INFERRED MATERIALS

Drawn	Date	Scale	
BW	26/11/2020	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	105	2

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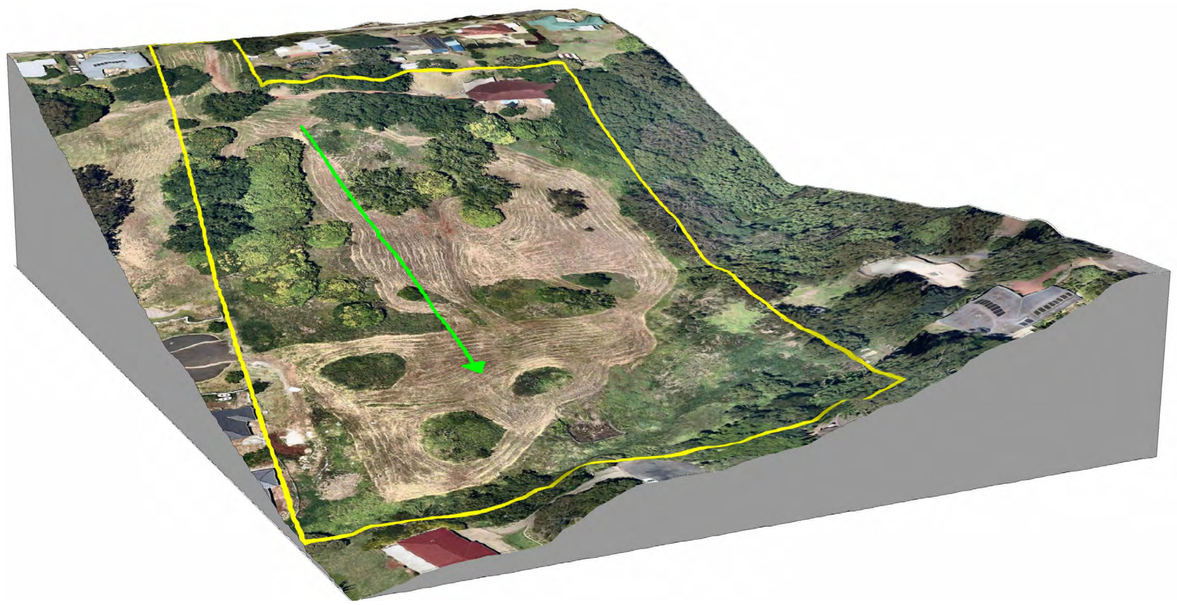
658 BALLINA ROAD, GOONELLABAH: LINE B SEISMIC SECTION

LINE B LOCATION AND DIRECTION



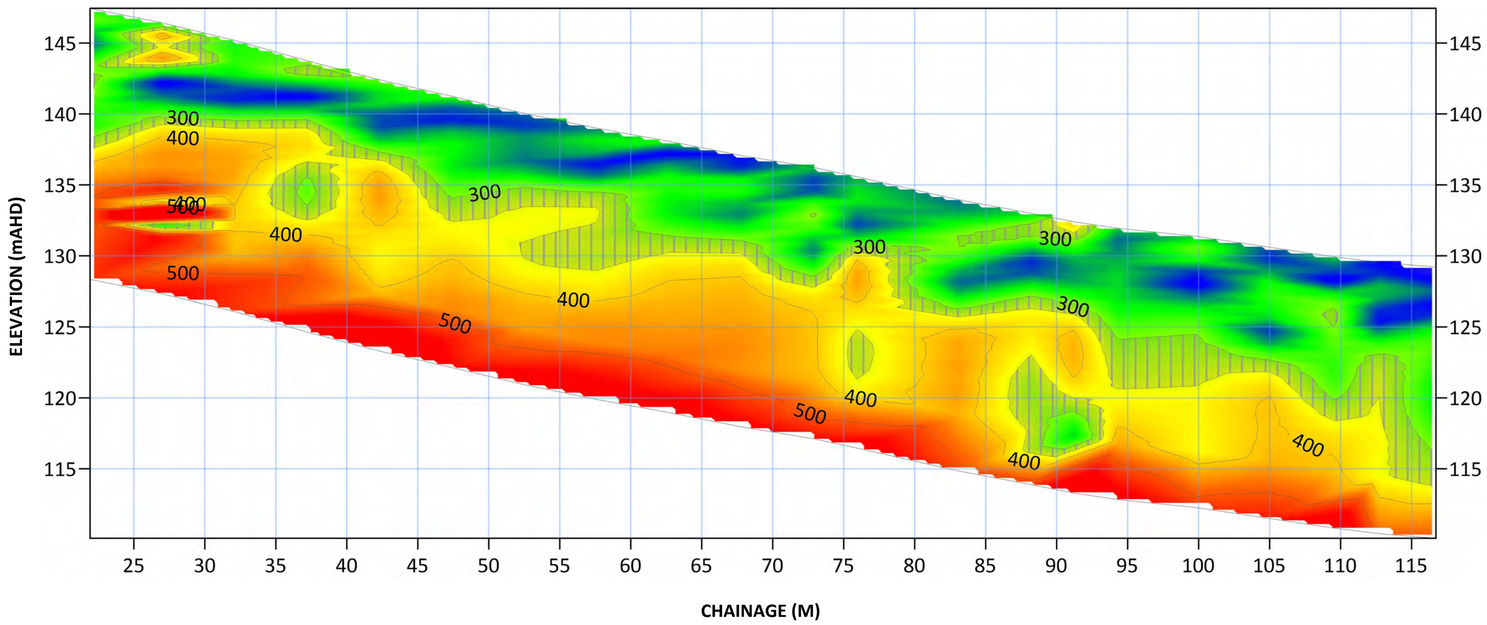
SHEAR VELOCITY SCALES

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY SOFT SOILS	0	80	
SOFT SOILS	80	120	
FIRM SOILS	120	160	
STIFF SOILS	160	200	
VERY STIFF SOILS	200	250	
HARD SOILS	250	400	

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR ROCK (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY LOW STRENGTH ROCK	300	350	
LOW STRENGTH ROCK	350	400	
MEDIUM STRENGTH ROCK	400	500	
HIGH STRENGTH ROCK	500	600	

LINE B SITE IMAGE

LINE B SEISMIC (Vs) PROFILE



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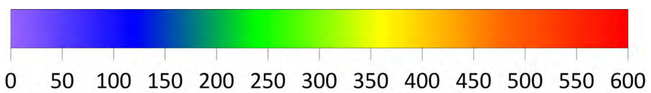

Regional Locality

Client

658 BALLINA ROAD PTY LTD

Consultant

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3. Verify all dimensions on site.

Project

658 BALLINA ROAD, GOONELLABAH

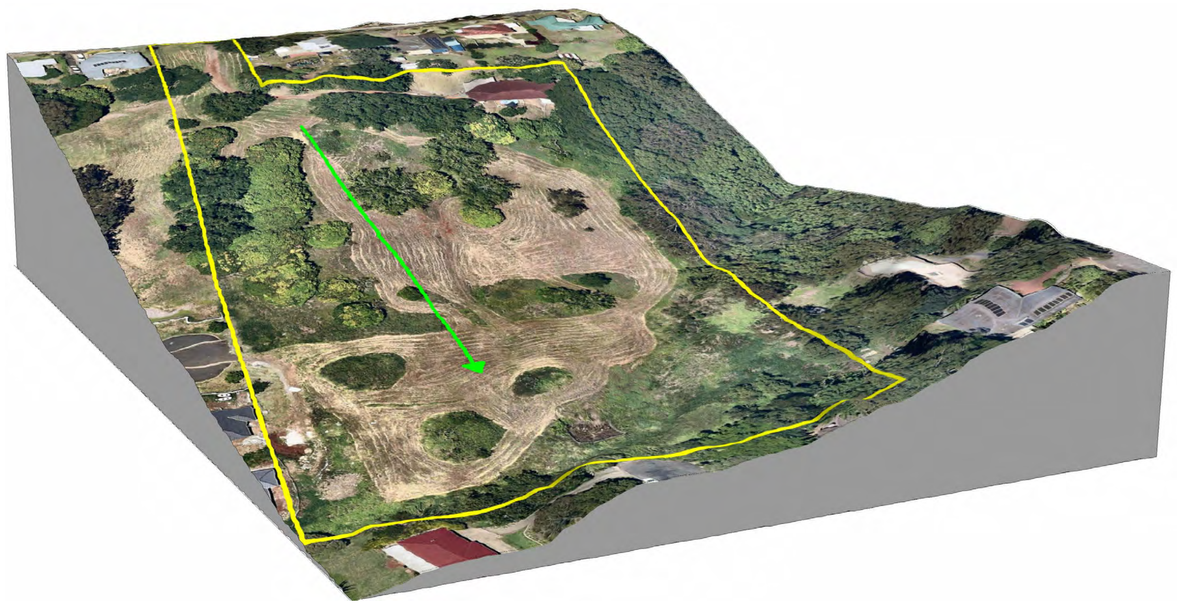
Drawing Title

658 BALLINA ROAD, GOONELLABAH - LINE B SEISMIC SECTIONS

Drawn	Date	Scale	
BW	28/05/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	106	2

658 BALLINA ROAD, GOONELLABAH: LINE B INFERRED MATERIALS

LINE B LOCATION AND DIRECTION

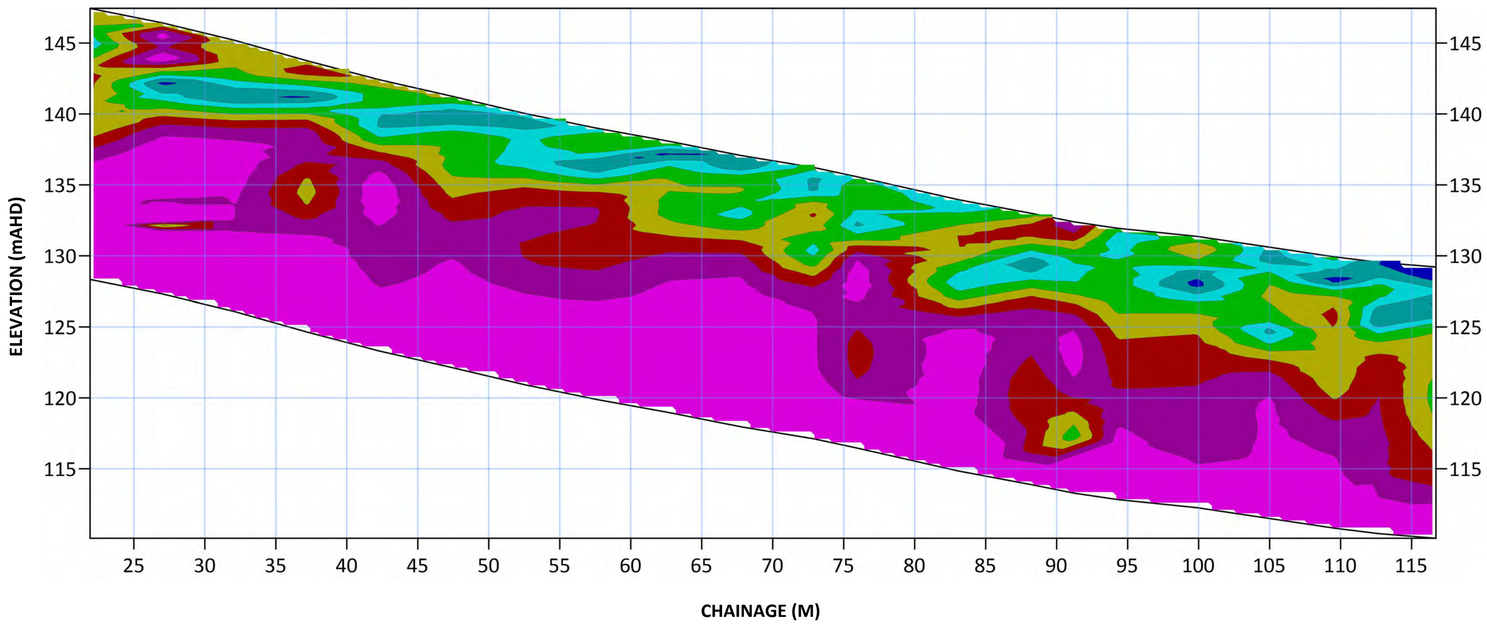


SHEAR VELOCITY COMPOSITIONS

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)				
STRENGH	LOWER VS VALUE	UPPER VS VALUE	COMPOSTION OF GROUND PROFILE	COMPOSITION OF SOIL MANTLE
VERY SOFT SOILS	0	80	0%	0%
SOFT SOILS	80	120	0%	0%
FIRM SOILS	120	160	3%	9%
STIFF SOILS	160	200	7%	21%
VERY STIFF SOILS	200	250	12%	37%
HARD SOILS	250	300	11%	33%
VERY LOW STRENGTH ROCK	300	350	13%	-
LOW STRENGTH ROCK	350	400	21%	-
MEDIUM STRENGTH OR STRONGER ROCK	400	+	34%	-

LINE B SITE IMAGE

LINE B SEISMIC (Vs) PROFILE



Legend

Regional Locality

Client

658 BALLINA ROAD PTY LTD

Consultant

PROTEST ENGINEERING

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2. Figured dimension take precedence over scale.
3. Verify all dimensions on site.

Project

658 BALLINA ROAD, GOONELLABAH

Drawing Title

658 BALLINA ROAD, GOONELLABAH - LINE B INFERRED MATERIALS

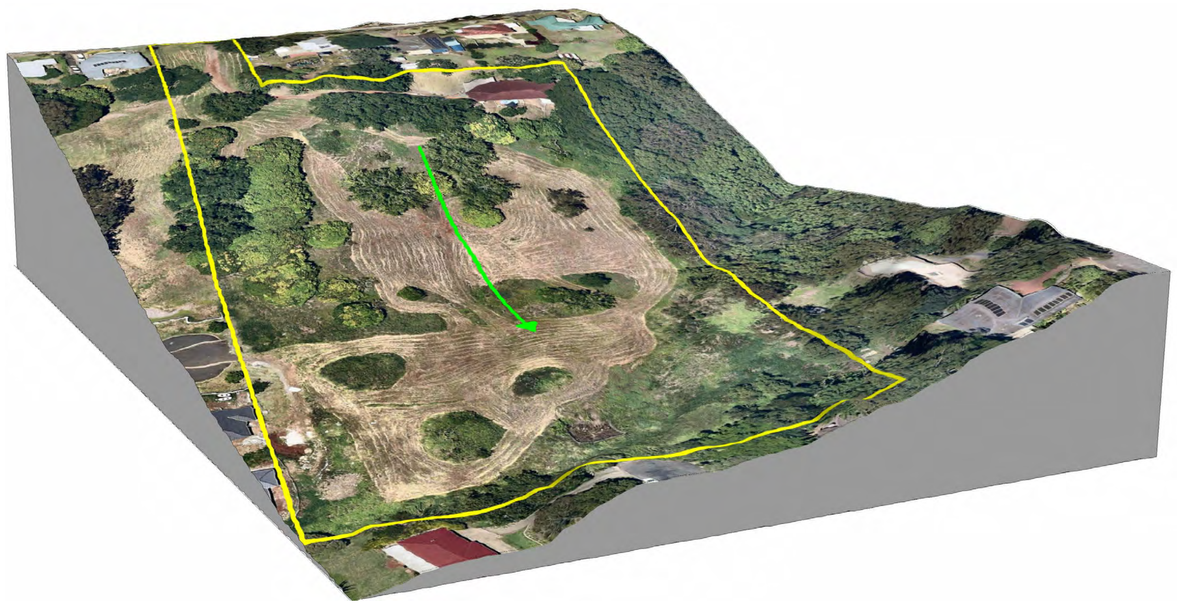
Drawn	Date	Scale	
BW	28/05/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	107	2

C:\Users\BrackWatson\Protest Engineering\Projects - PTP_00739 - 658 Ballina Road Pty Ltd - 658 Ballina Road, Goonellabah\Site Plans\PTP_00739 - Test Location Plan.rvt

4/03/2022 9:17:50 AM

658 BALLINA ROAD, GOONELLABAH: LINE C SEISMIC SECTION

LINE C LOCATION AND DIRECTION



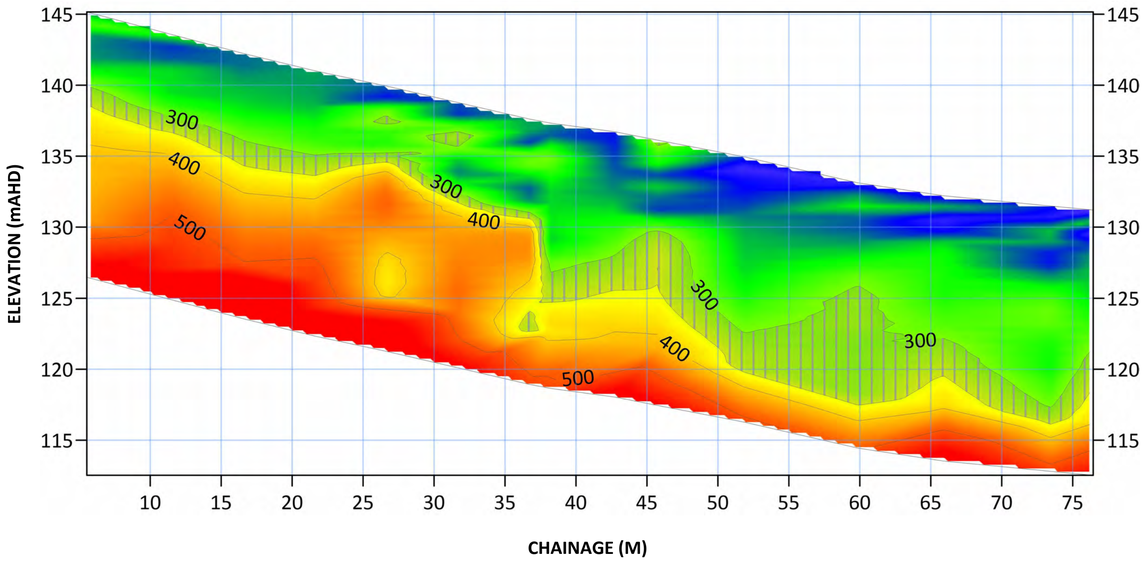
SHEAR VELOCITY SCALES

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY SOFT SOILS	0	80	
SOFT SOILS	80	120	
FIRM SOILS	120	160	
STIFF SOILS	160	200	
VERY STIFF SOILS	200	250	
HARD SOILS	250	400	

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR ROCK (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY LOW STRENGTH ROCK	300	350	
LOW STRENGTH ROCK	350	400	
MEDIUM STRENGTH ROCK	400	500	
HIGH STRENGTH ROCK	500	600	

LINE C SITE IMAGE

LINE C SEISMIC (Vs) PROFILE



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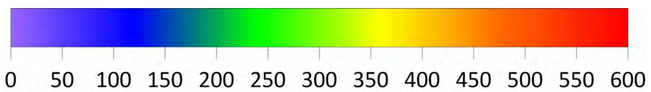

Regional Locality

Client

658 BALLINA ROAD PTY LTD

Consultant

PROTEST ENGINEERING

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3. Verify all dimensions on site.

Project

658 BALLINA ROAD, GOONELLABAH

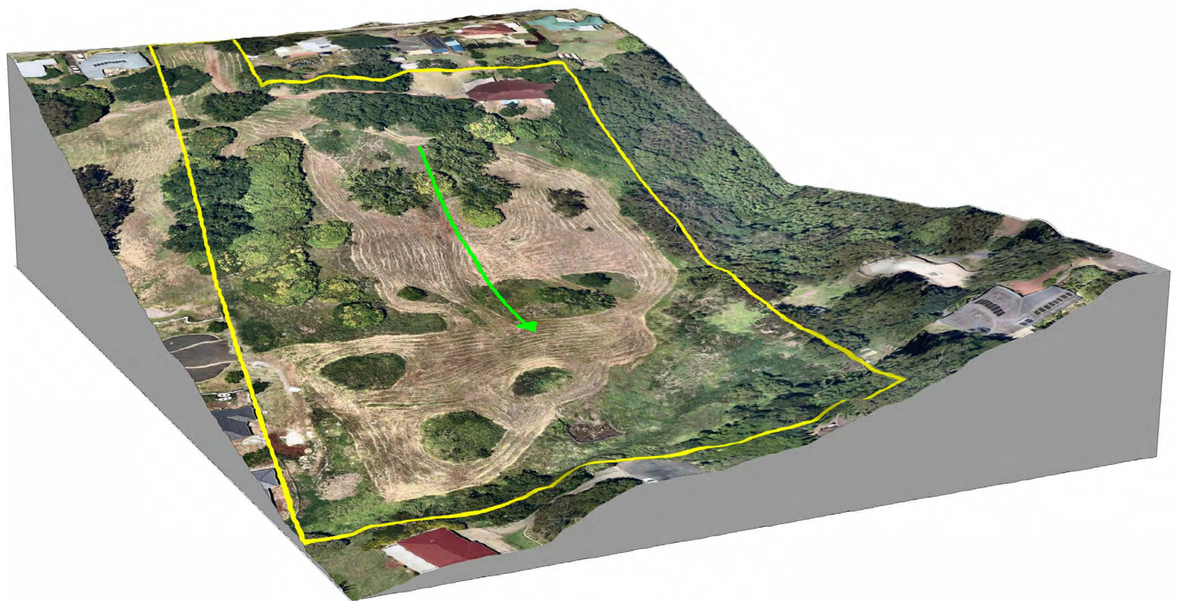
Drawing Title

658 BALLINA ROAD, GOONELLABAH - LINE C SEISMIC SECTIONS

Drawn	Date	Scale	
BW	28/05/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	108	2

658 BALLINA ROAD, GOONELLABAH: LINE C INFERRED MATERIALS

LINE C LOCATION AND DIRECTION

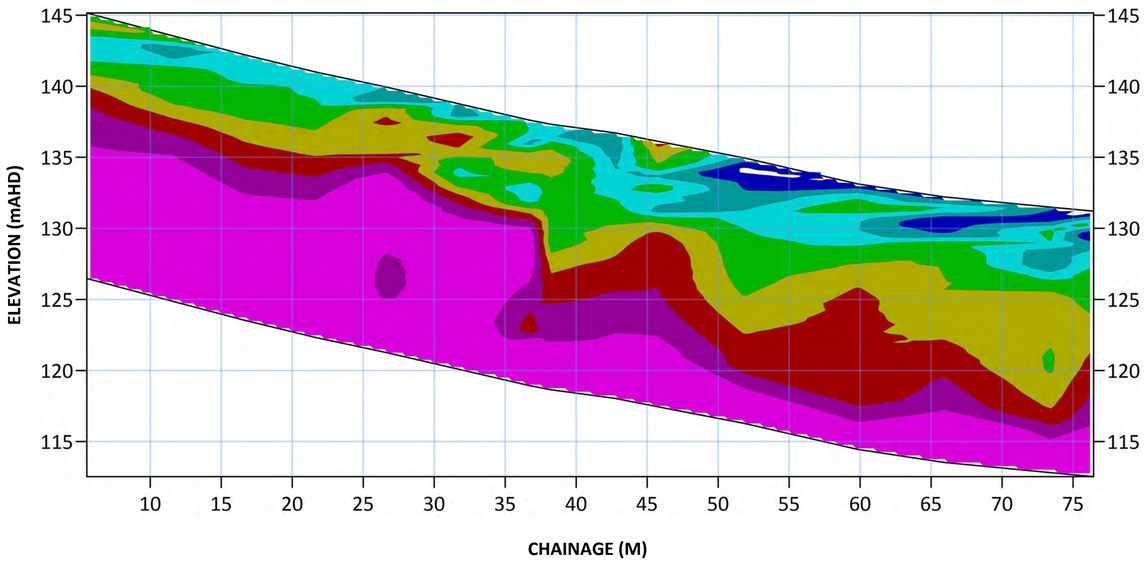


SHEAR VELOCITY COMPOSITIONS

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)				
STRENGH	LOWER VS VALUE	UPPER VS VALUE	COMPOSTION OF GROUND PROFILE	COMPOSITION OF SOIL MANTLE
VERY SOFT SOILS	0	80	0%	0%
SOFT SOILS	80	120	2%	5%
FIRM SOILS	120	160	4%	9%
STIFF SOILS	160	200	9%	20%
VERY STIFF SOILS	200	250	13%	30%
HARD SOILS	250	300	16%	36%
VERY LOW STRENGTH ROCK	300	350	14%	-
LOW STRENGTH ROCK	350	400	10%	-
MEDIUM STRENGTH OR STRONGER ROCK	400	+	33%	-

LINE C SITE IMAGE

LINE C SEISMIC (Vs) PROFILE



Legend

Regional Locality

Client

658 BALLINA ROAD PTY LTD

Consultant

PROTEST ENGINEERING

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Project

658 BALLINA ROAD, GOONELLABAH

Drawing Title

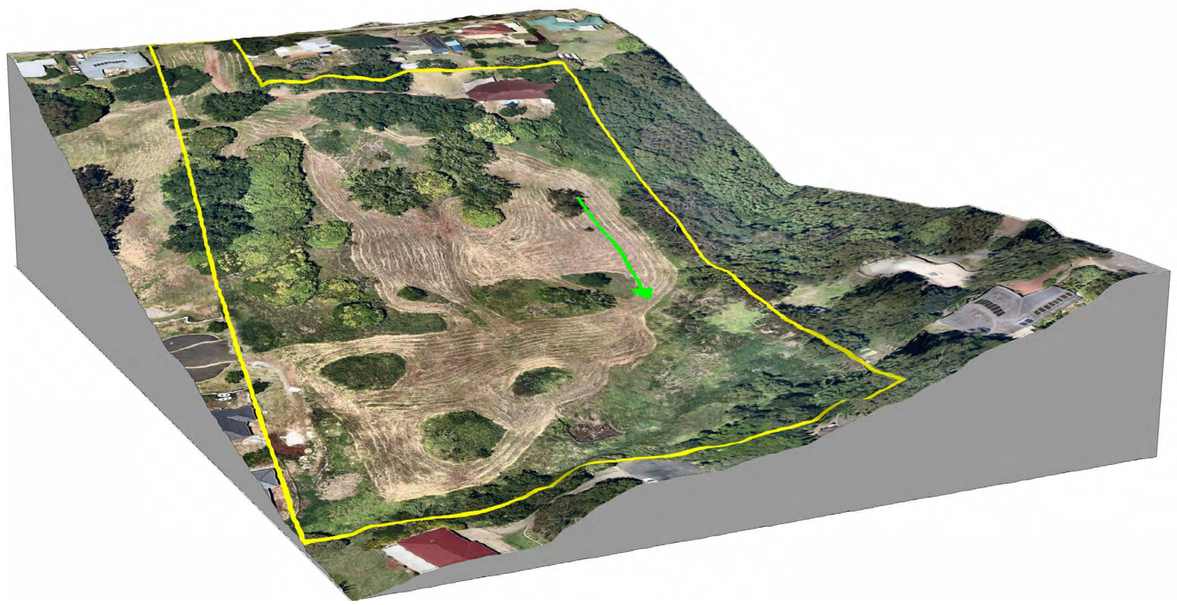
658 BALLINA ROAD, GOONELLABAH - LINE C INFERRED MATERIALS

Drawn	Date	Scale	A1
BW	28/05/2021		

Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	109	2

658 BALLINA ROAD, GOONELLABAH: LINE D SEISMIC SECTION

LINE D LOCATION AND DIRECTION



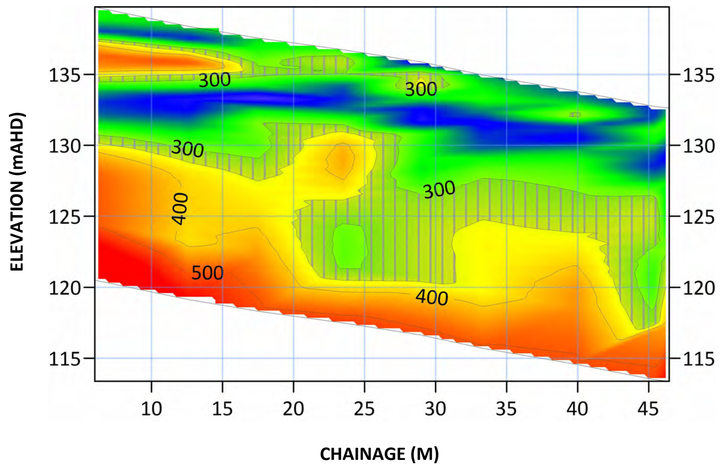
SHEAR VELOCITY SCALES

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY SOFT SOILS	0	80	
SOFT SOILS	80	120	
FIRM SOILS	120	160	
STIFF SOILS	160	200	
VERY STIFF SOILS	200	250	
HARD SOILS	250	400	

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR ROCK (m/s)			
STRENGH	LOWER VS VALUE	UPPER VS VALUE	SCALE
VERY LOW STRENGTH ROCK	300	350	
LOW STRENGTH ROCK	350	400	
MEDIUM STRENGTH ROCK	400	500	
HIGH STRENGTH ROCK	500	600	

LINE D SITE IMAGE

LINE D SEISMIC (Vs) PROFILE



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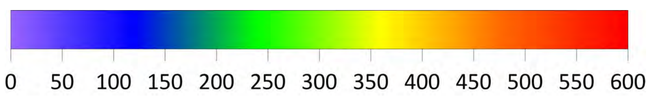

Regional Locality

Client

658 BALLINA ROAD PTY LTD

Consultant

PROTEST ENGINEERING

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3. Verify all dimensions on site.

Project

658 BALLINA ROAD, GOONELLABAH

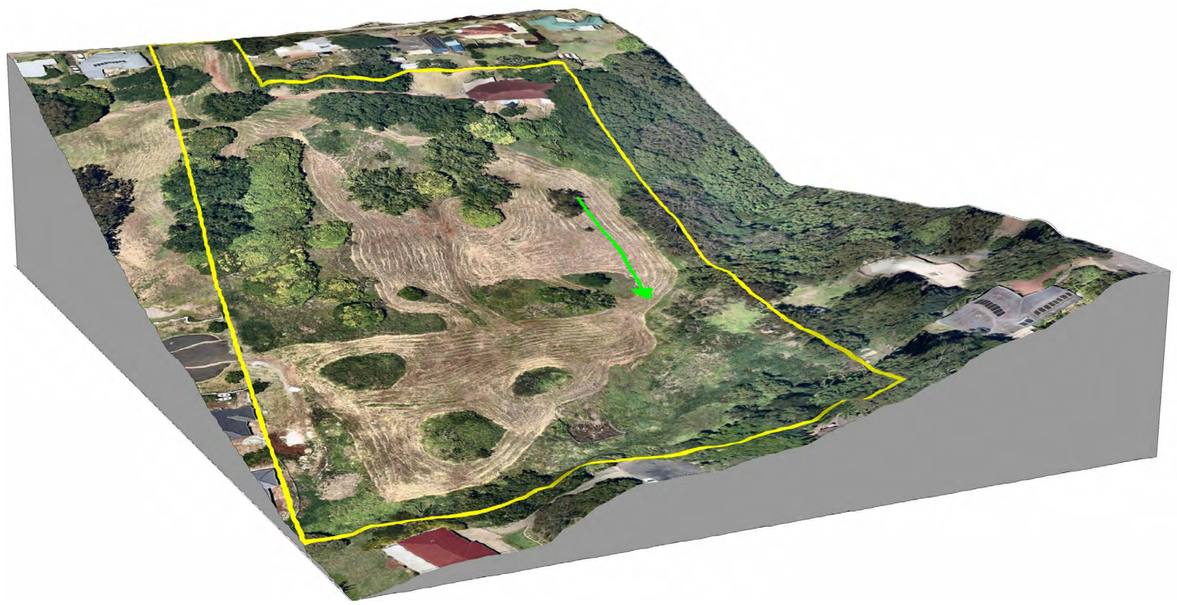
Drawing Title

658 BALLINA ROAD, GOONELLABAH - LINE D SEISMIC SECTIONS

Drawn	Date	Scale	
BW	28/05/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	110	2

658 BALLINA ROAD, GOONELLABAH: LINE D INFERRED MATERIALS

LINE D LOCATION AND DIRECTION

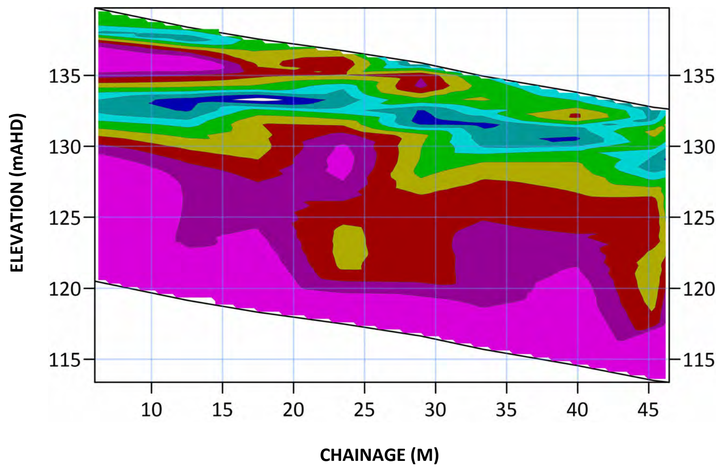


SHEAR VELOCITY COMPOSITIONS

TYPICAL SHEAR VELOCITY (Vs) RANGES FOR COHESIVE SOILS (m/s)				
STRENGH	LOWER VS VALUE	UPPER VS VALUE	COMPOSTION OF GROUND PROFILE	COMPOSITION OFSOIL MANTLE
VERY SOFT SOILS	0	80	0%	0%
SOFT SOILS	80	120	1%	3%
FIRM SOILS	120	160	5%	14%
STIFF SOILS	160	200	7%	20%
VERY STIFF SOILS	200	250	10%	29%
HARD SOILS	250	300	12%	34%
VERY LOW STRENGTH ROCK	300	350	22%	-
LOW STRENGTH ROCK	350	400	18%	-
MEDIUM STRENGTH OR STRONGER ROCK	400	+	25%	-

LINE D SITE IMAGE

LINE D SEISMIC (Vs) PROFILE



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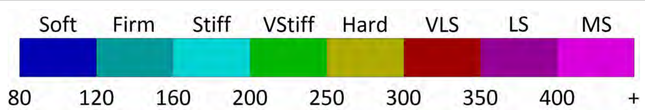

Regional Locality

Client

658 BALLINA ROAD PTY LTD

Consultant

PROTEST ENGINEERING

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Project

658 BALLINA ROAD, GOONELLABAH

Drawing Title

658 BALLINA ROAD, GOONELLABAH - LINE D INDERRED MATERIALS

Drawn	Date	Scale	
BW	28/05/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	111	2

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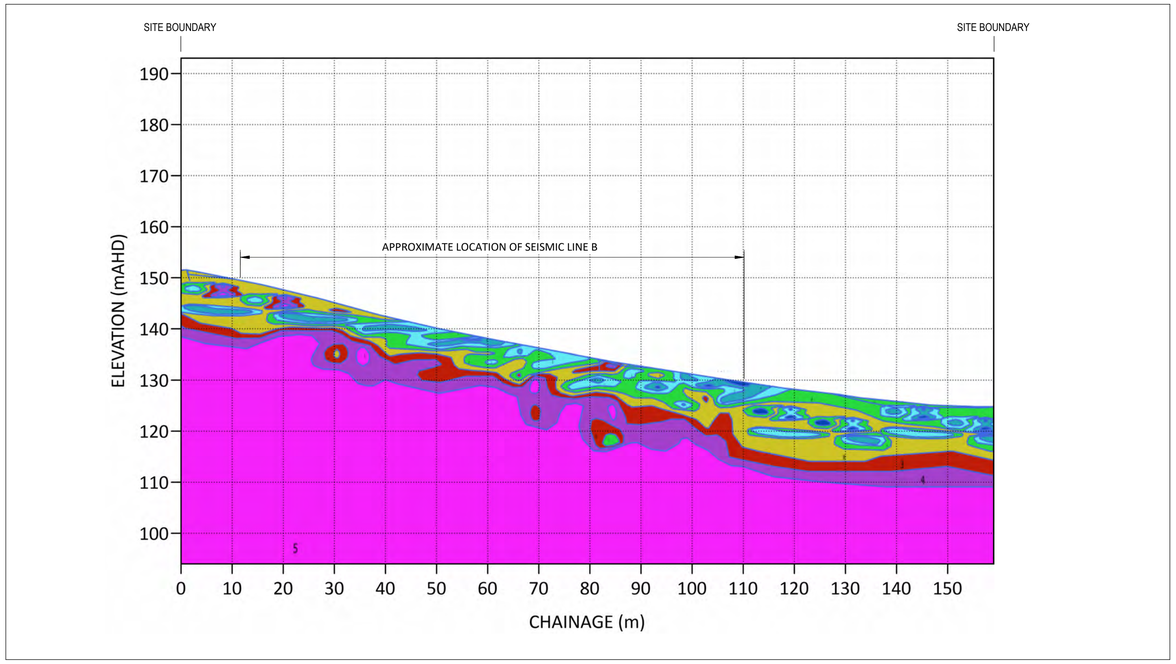
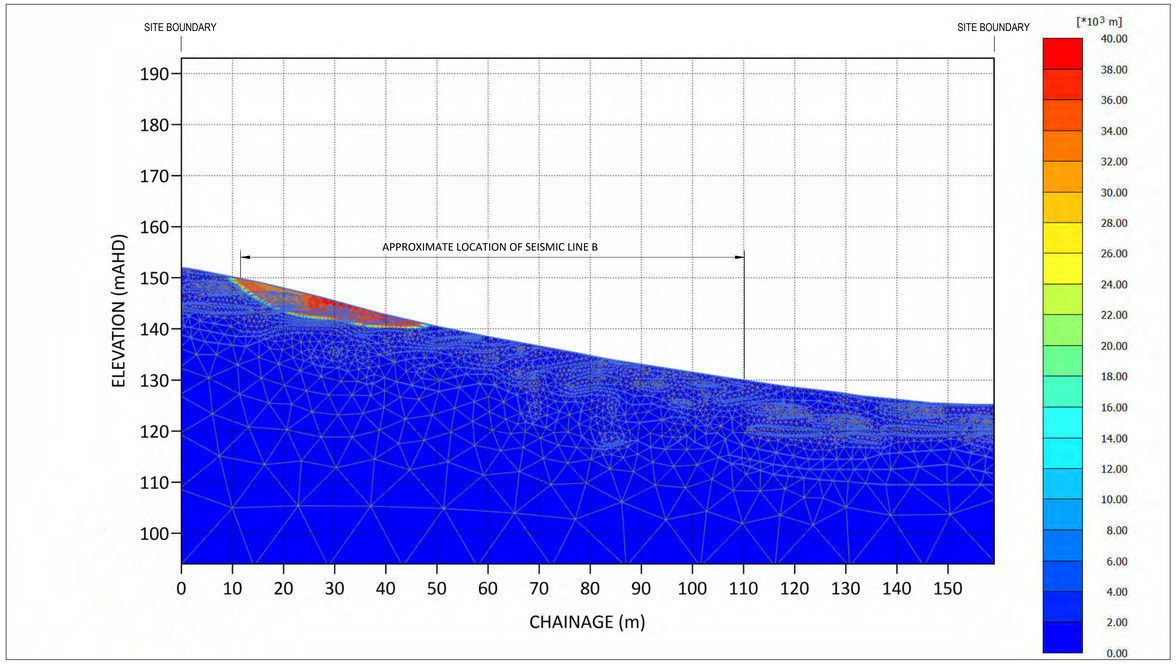
658 BALLINA ROAD, GOONELLABAH: PLAXIS ANALYSIS 1 RESULTS - EXISTING SITE

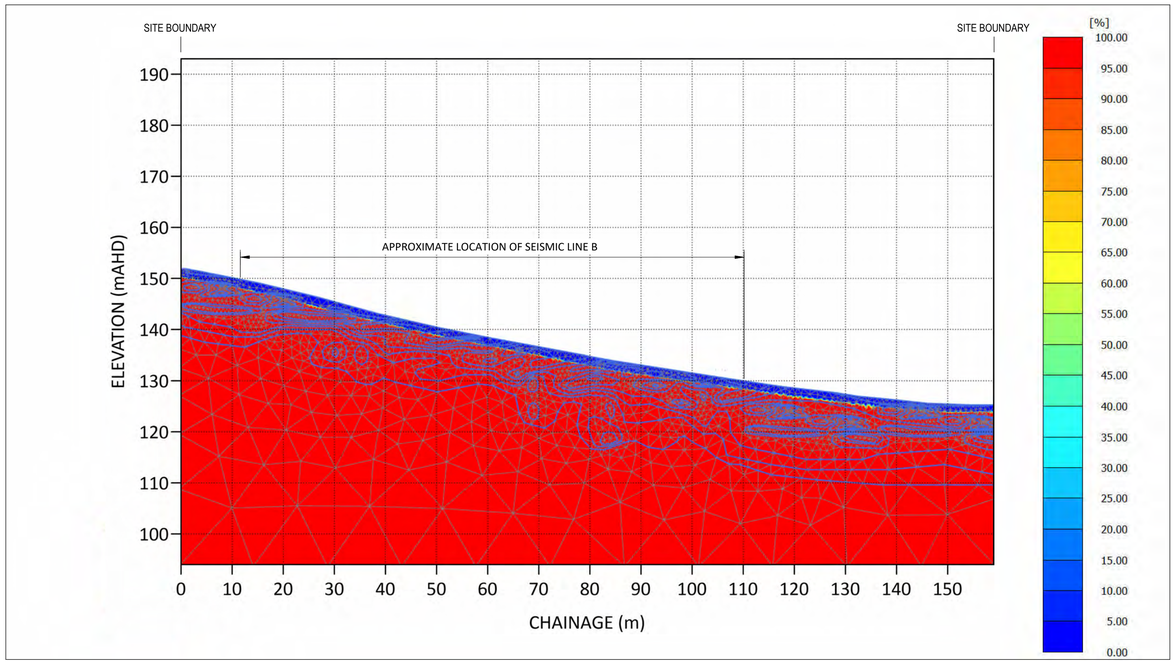
EXISITNG SITE - MATERIALS PLOT



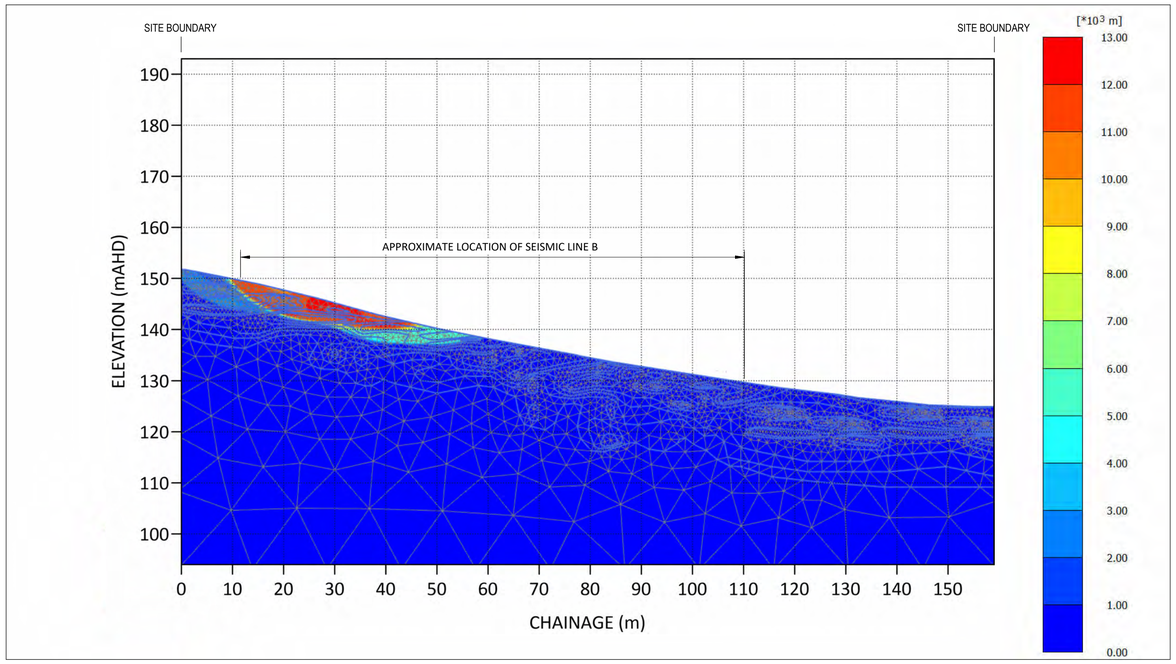
EXISITNG SITE - DISPLACEMENT PROFILE - NO GROUNDWATER



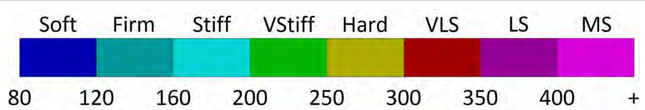
EXISITNG SITE - SATURATION LEVELS - WITH GROUNDWATER



EXISITNG SITE - DISPLACEMENT PROFILE - WITH GROUNDWATER



Legend



Regional Locality

Client

658 BALLINA ROAD PTY LTD

Consultant

PROTEST ENGINEERING

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Project

658 BALLINA ROAD, GOONELLABAH

Drawing Title

658 BALLINA ROAD, GOONELLABAH - PLAXIS ANALYSIS 1 - EXISTING GROUND PROFILE

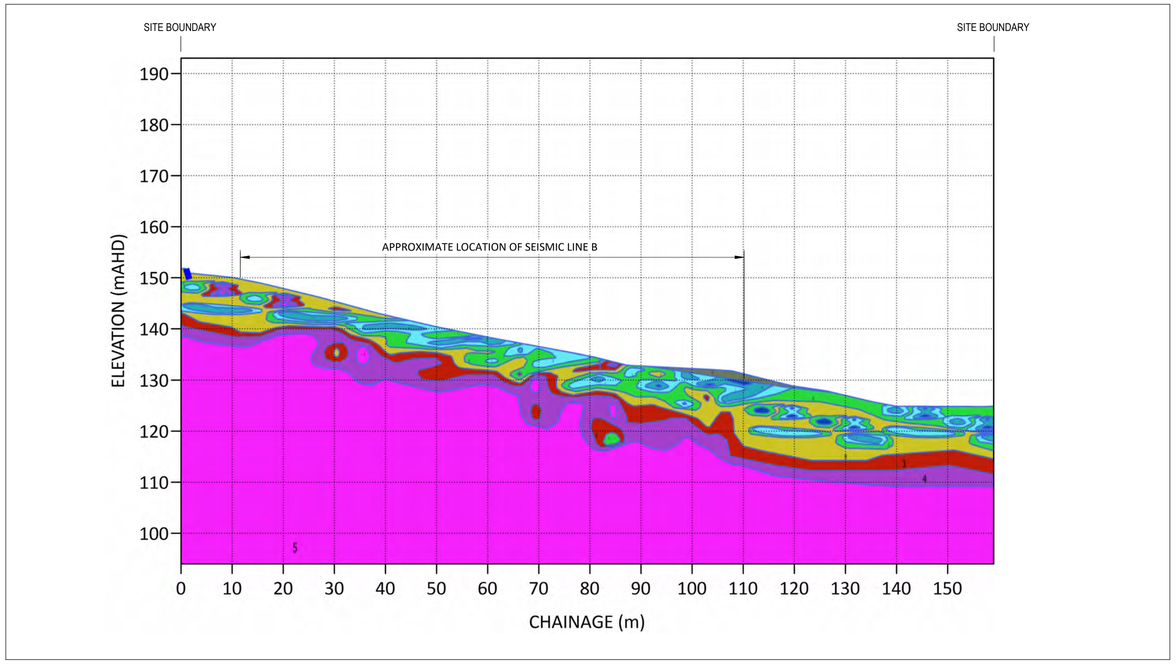
Drawn	Date	Scale	
BW	14/10/2021	A1	
Designed	Project No.	Dwg No.	Issue
RK	PTP/00739	112	2

C:\Users\BrixWilkinson\Protest Engineering\Projects - PTP_00739 - 658 Ballina Road Pty Ltd - 658 Ballina Road, Goonellabah\Site Plans\PTP_00739 - Test Location Plan.rvt

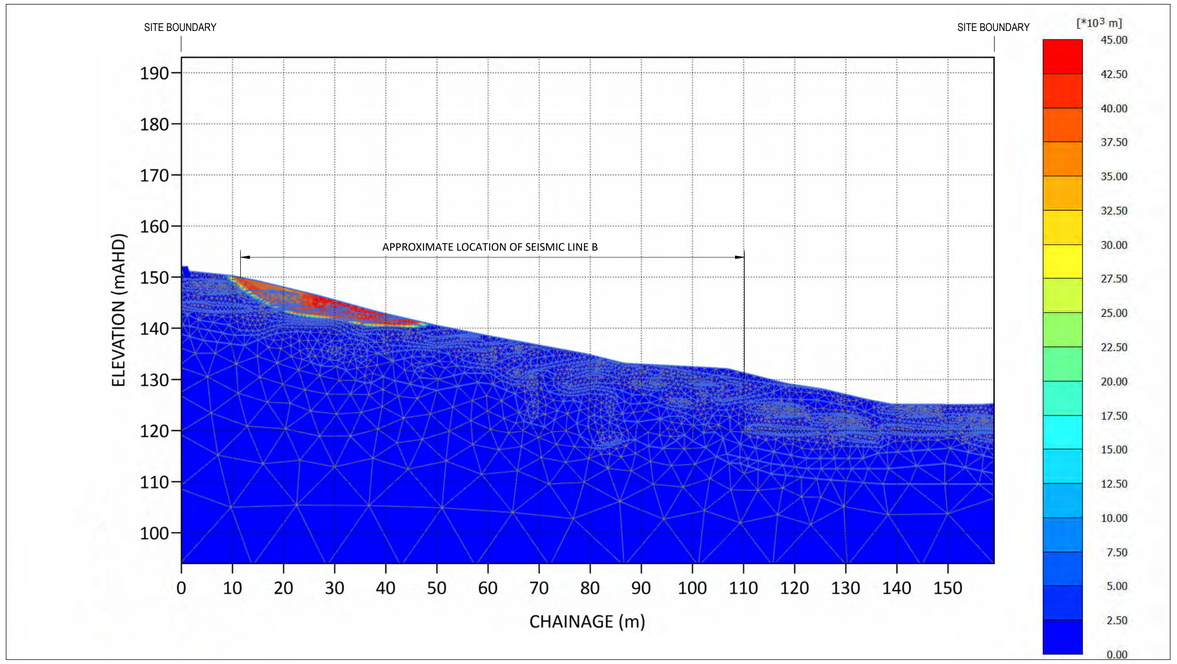
4/03/2022 9:18:00 AM

658 BALLINA ROAD, GOONELLABAH: PLAXIS ANALYSIS 1 RESULTS - PROPOSED SITE

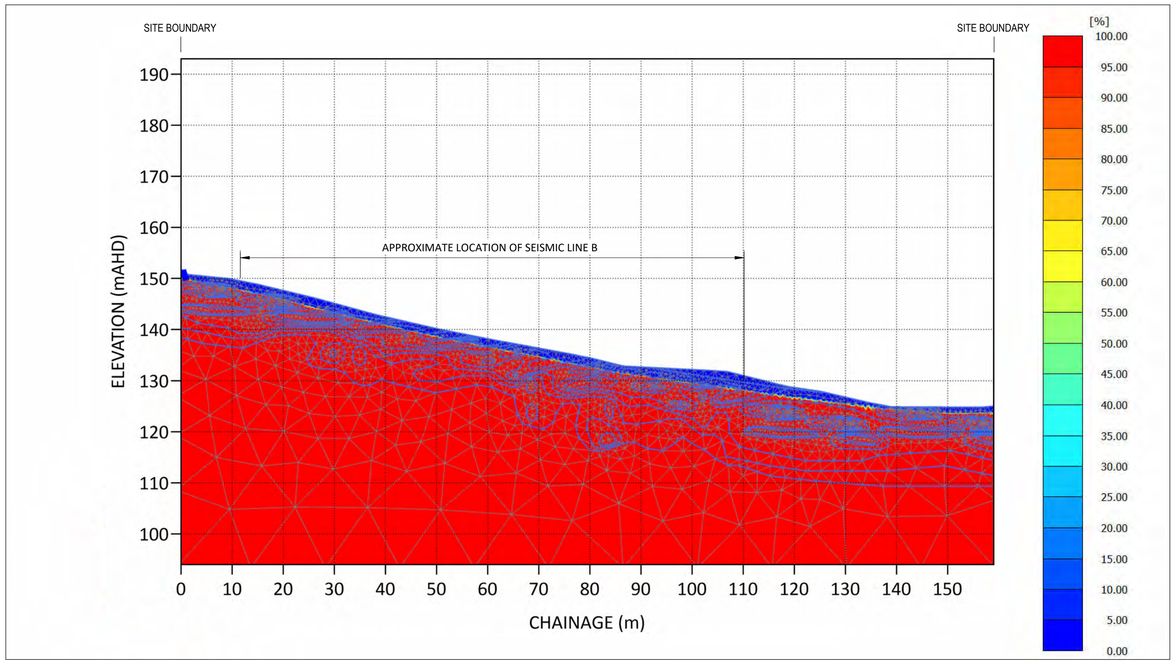
PROPOSED SITE - MATERIALS PLOT



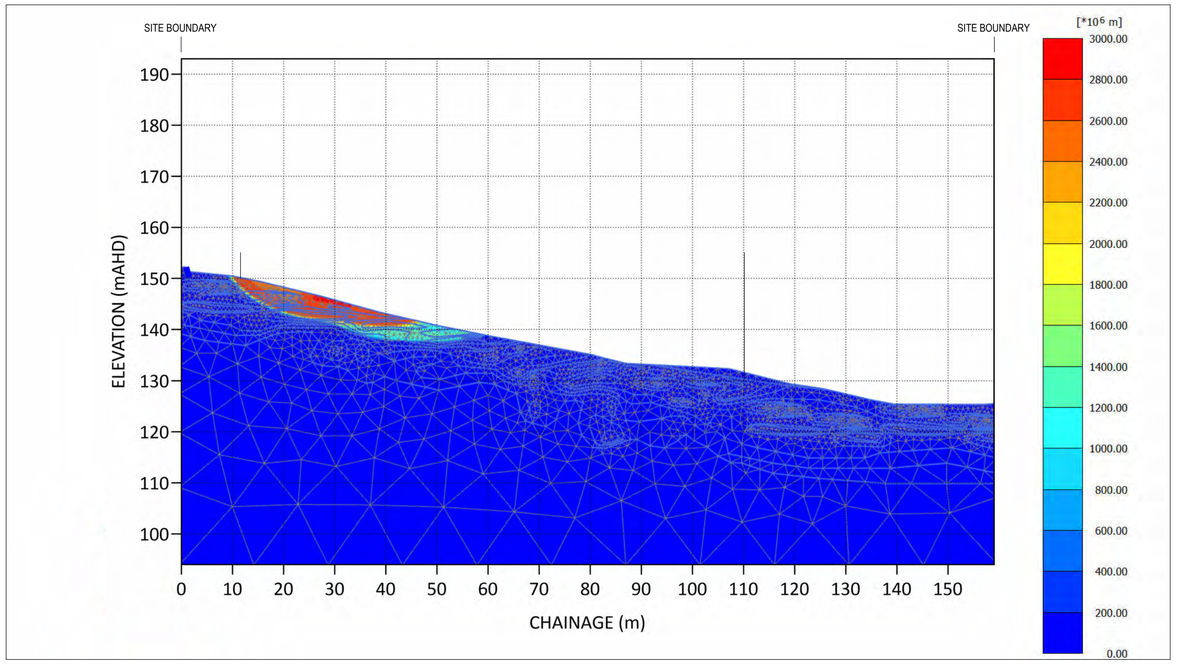
PROPOSED SITE - DISPLACEMENT PROFILE - NO GROUNDWATER



PROPOSED SITE - SATURATION LEVELS - WITH GROUNDWATER



PROPOSED SITE - DISPLACEMENT PROFILE - WITH GROUNDWATER



Legend

Soft	Firm	Stiff	VStiff	Hard	VLS	LS	MS
80	120	160	200	250	300	350	400 +

Regional Locality

Client: 658 BALLINA ROAD PTY LTD

Consultant: PROTEST ENGINEERING

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Project: 658 BALLINA ROAD, GOONELLABAH

Drawing Title: 658 BALLINA ROAD, GOONELLABAH - PLAXIS ANALYSIS 1 - PROPOSED

Drawn	Date	Scale	A1	
BW	14/10/2021			
Designed	Project No.		Dwg No.	Issue
RK	PTP/00739		113	2

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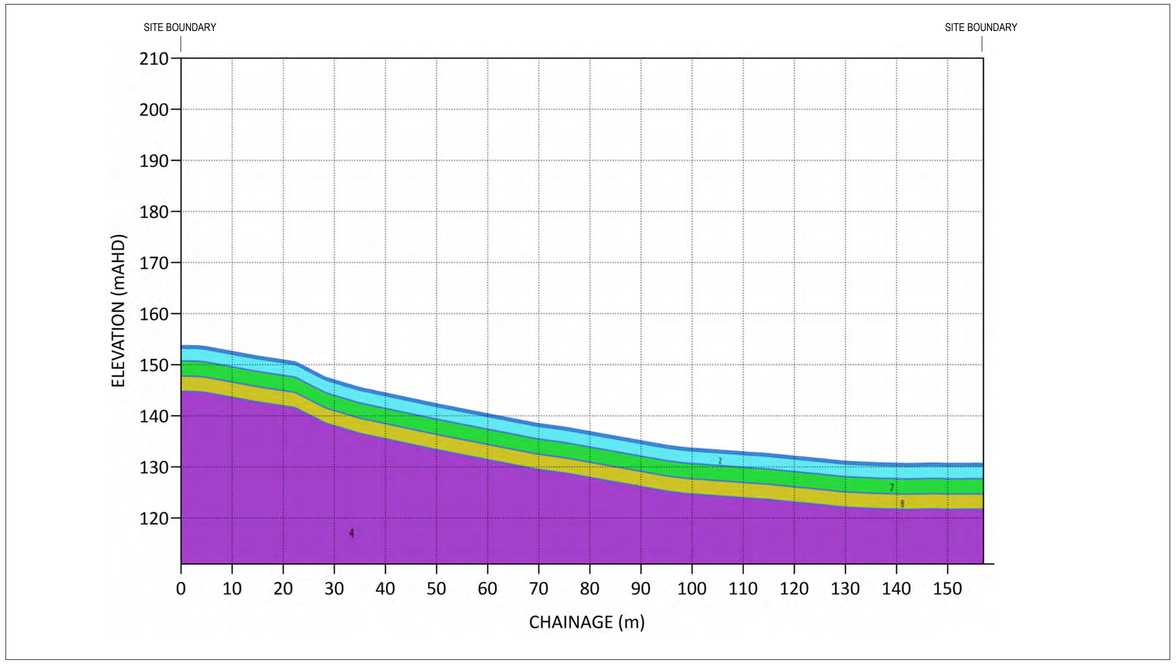
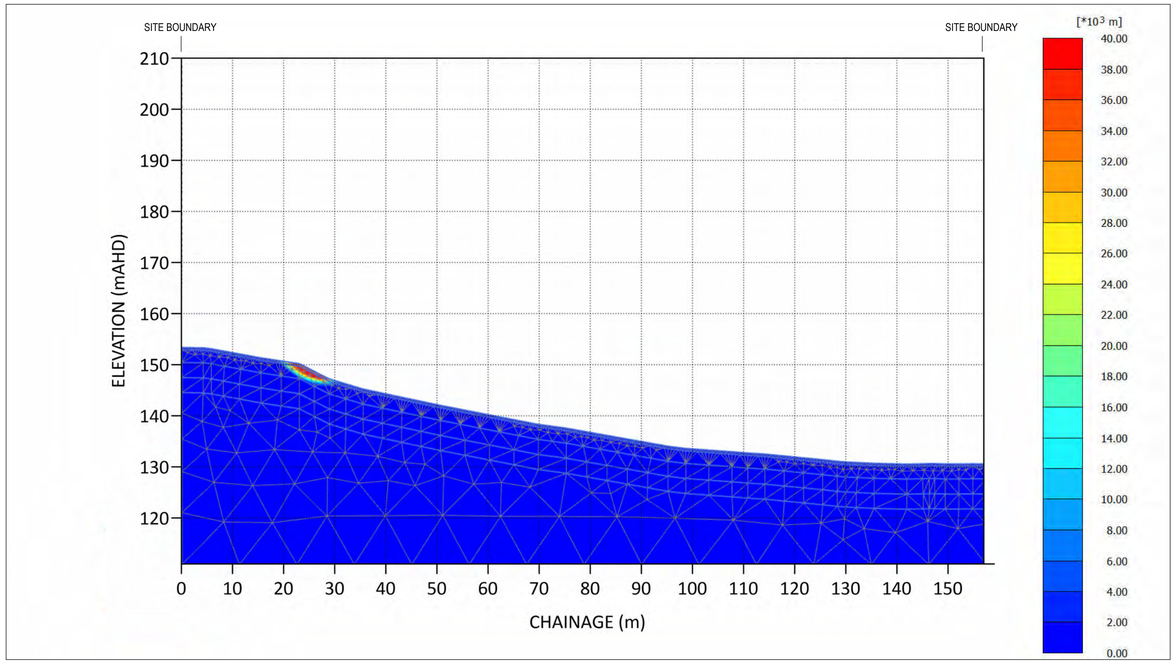
4/03/2022 5:18:24 AM

658 BALLINA ROAD, GOONELLABAH: PLAXIS ANALYSIS 2 RESULTS - EXISTING / PROPOSED SITE

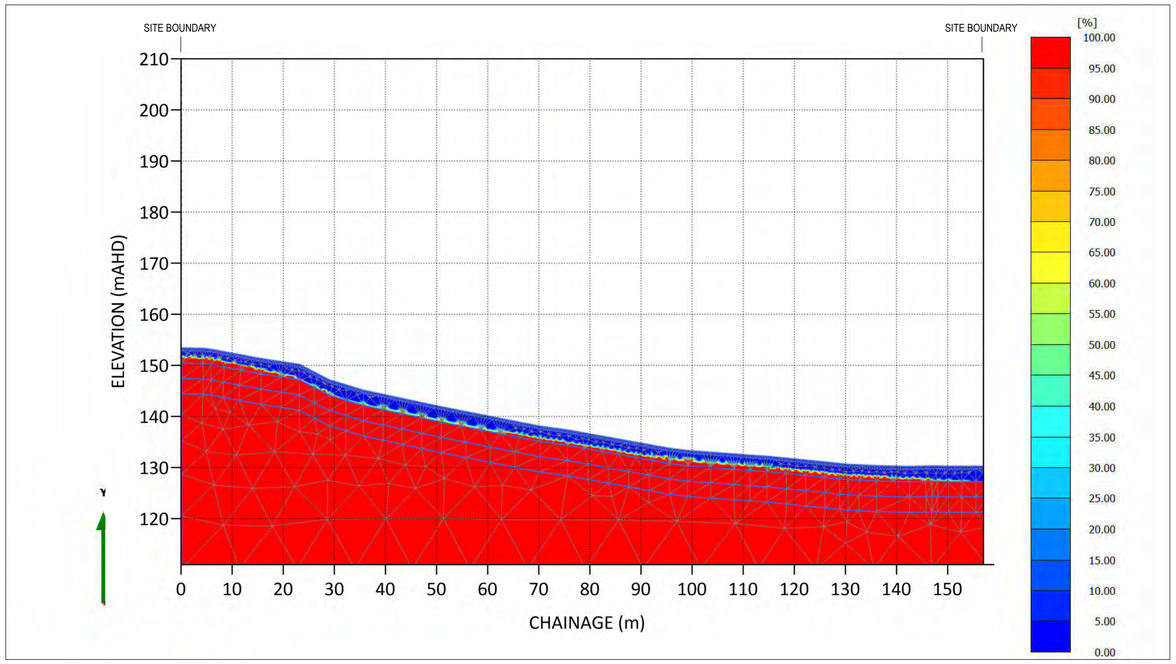
EXISITNG / PROPOSED SITE - MATERIALS PLOT



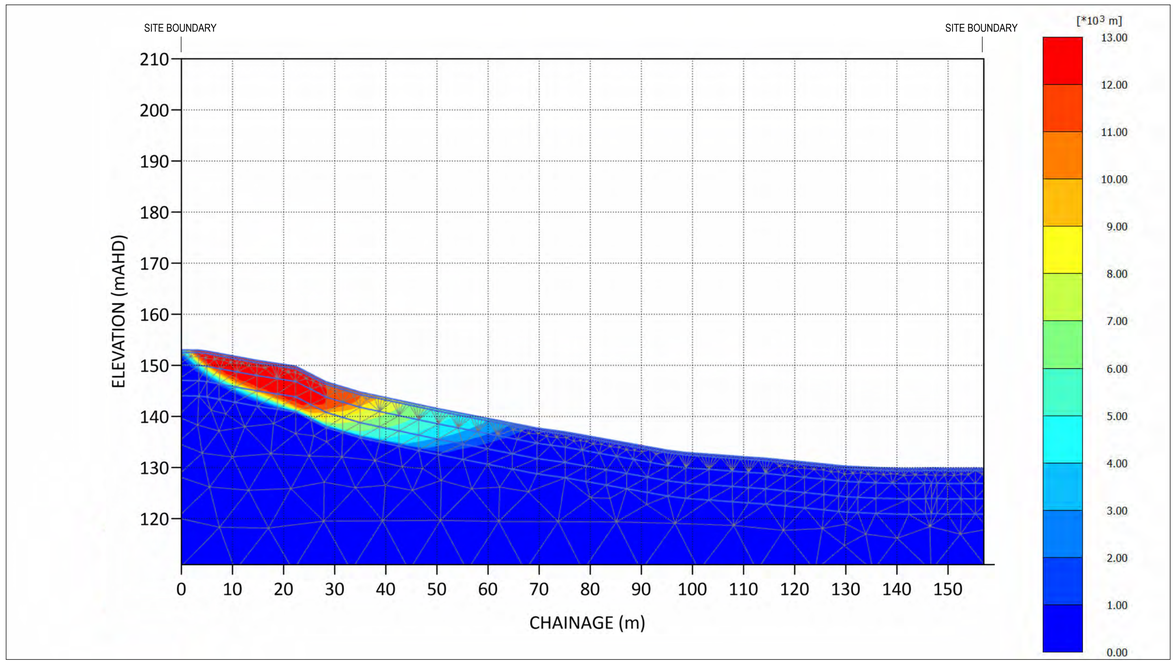
EXISITNG / PROPOSED SITE - DISPLACEMENT PROFILE - NO GROUNDWATER



EXISITNG / PROPOSED SITE - SATURATION LEVELS - WITH GROUNDWATER



EXISITNG / PROPOSED SITE - DISPLACEMENT PROFILE - WITH GROUNDWATER



Legend

Soft	Firm	Stiff	VStiff	Hard	VLS	LS	MS
80	120	160	200	250	300	350	400 +

Regional Locality

Client: 658 BALLINA ROAD PTY LTD

Consultant: PROTEST ENGINEERING

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Project: 658 BALLINA ROAD, GOONELLABAH

Drawing Title: 658 BALLINA ROAD, GOONELLABAH - PLAXIS ANALYSIS 2 - EXISTING / PROPOSED GROUND PROFILE

Drawn	Date	Scale	A1	
BW	14/10/2021			
Designed	Project No.		Dwg No.	Issue
RK	PTP/00739		114	2

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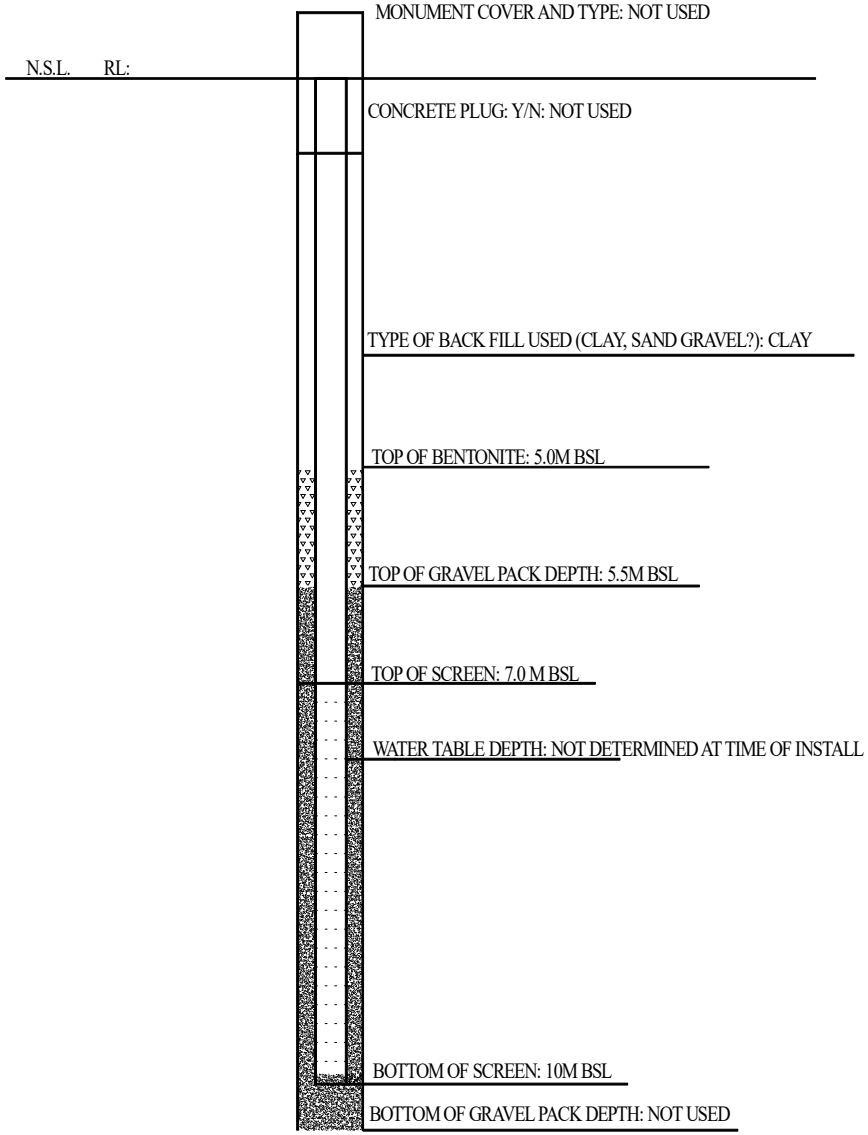
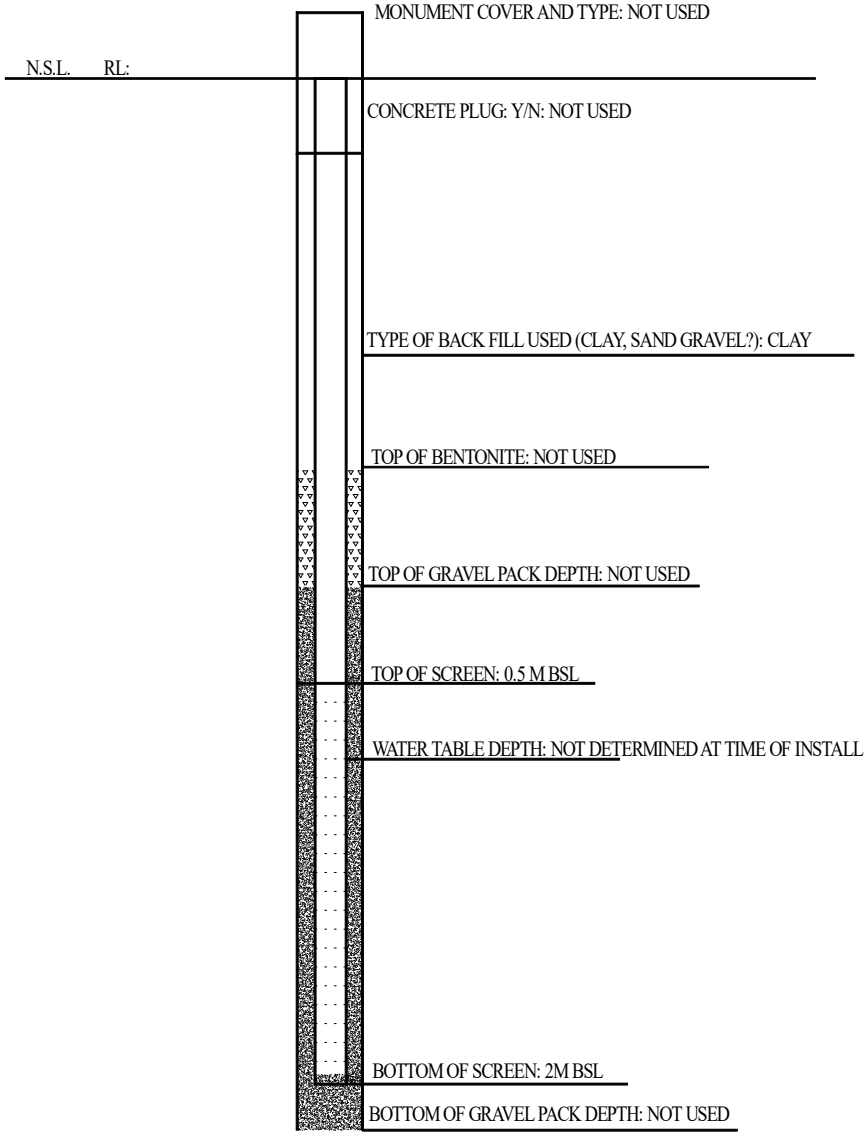
4/03/2022 5:18:07 AM

BH 1: UTM: MAP:56J EASTING: 532113 NORTHING: 6812149



BH 2: UTM: MAP:56J EASTING: 532107 NORTHING: 6812243



Unit 3 / 42 Machinery Drive
PO Box 6885
Tweed Heads South NSW 2486
PH: 0755 233 979
FAX: 0755 233 981
EMAIL: admin@geotechinvestigations.com
WEB: www.geotechinvestigations.com

CLIENT: PROTEST ENGINEERING

PROJECT: NO.658 BALLINA ROAD BALLINA

DRAWING REF: GWMW Log

LEGEND

DATE: 06.10.2021

OUR REF / JOB No.: GI 6145-a sp

DRAWN BY: JDW

Drawing not to scale. Printed dimensions only

658 BALLINA ROAD, GOONELLABAH: DIP METER SITE PHOTOS

DIP METER FROM BASE OF MONITORING WELL 1

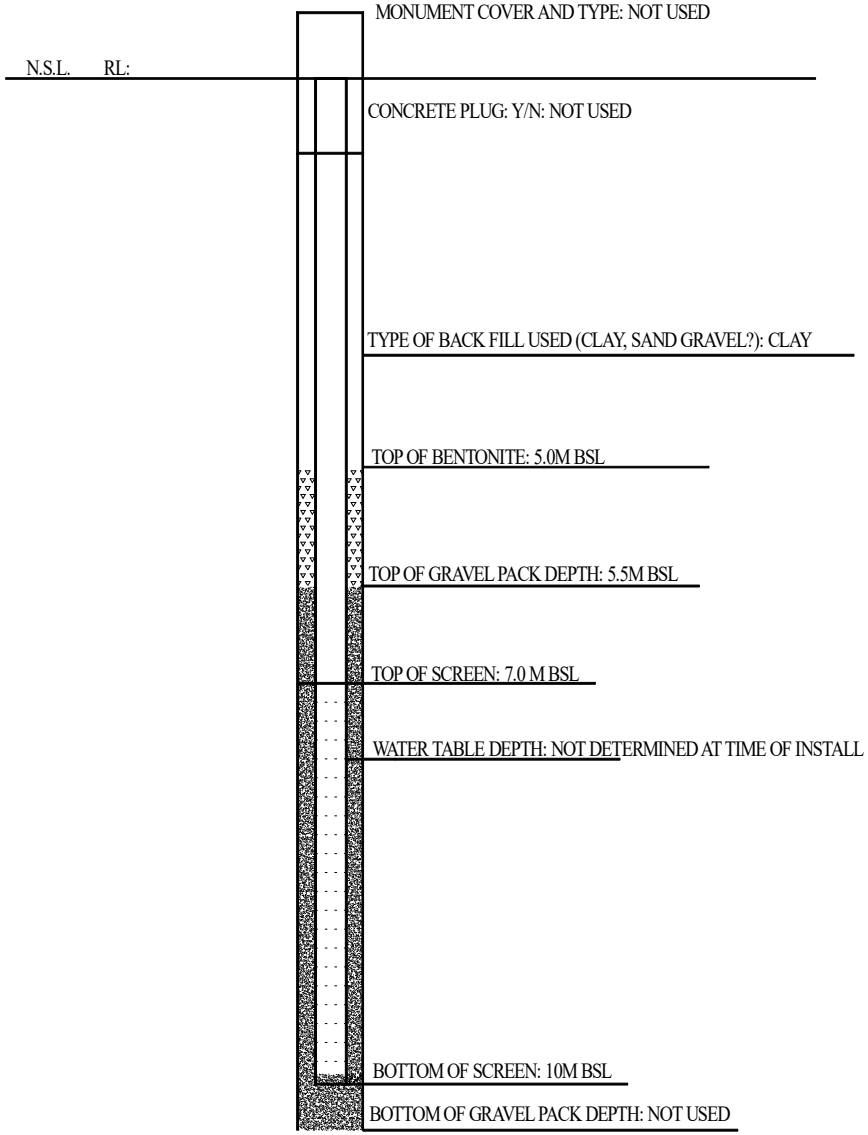
Legend	Regional Locality	Client	Consultant		Project	Drawing Title
		658 BALLINA ROAD PTY LTD	PROTEST ENGINEERING	1. This is the property of the engineer and may not be used, copied or reproduced wholly or inpart without the express permission of the engineer. 2. Figured dimension take precedence over scale. 3. Verify all dimensions on site.	658 BALLINA ROAD, GOONELLABAH	658 BALLINA ROAD, GOONELLABAH - DIP METER SITE PHOTO

Drawn	Date	Scale	A1	
BW	14/10/2021			
Designed	Project No.		Dwg No.	Issue
RK	PTP/00739		115	2

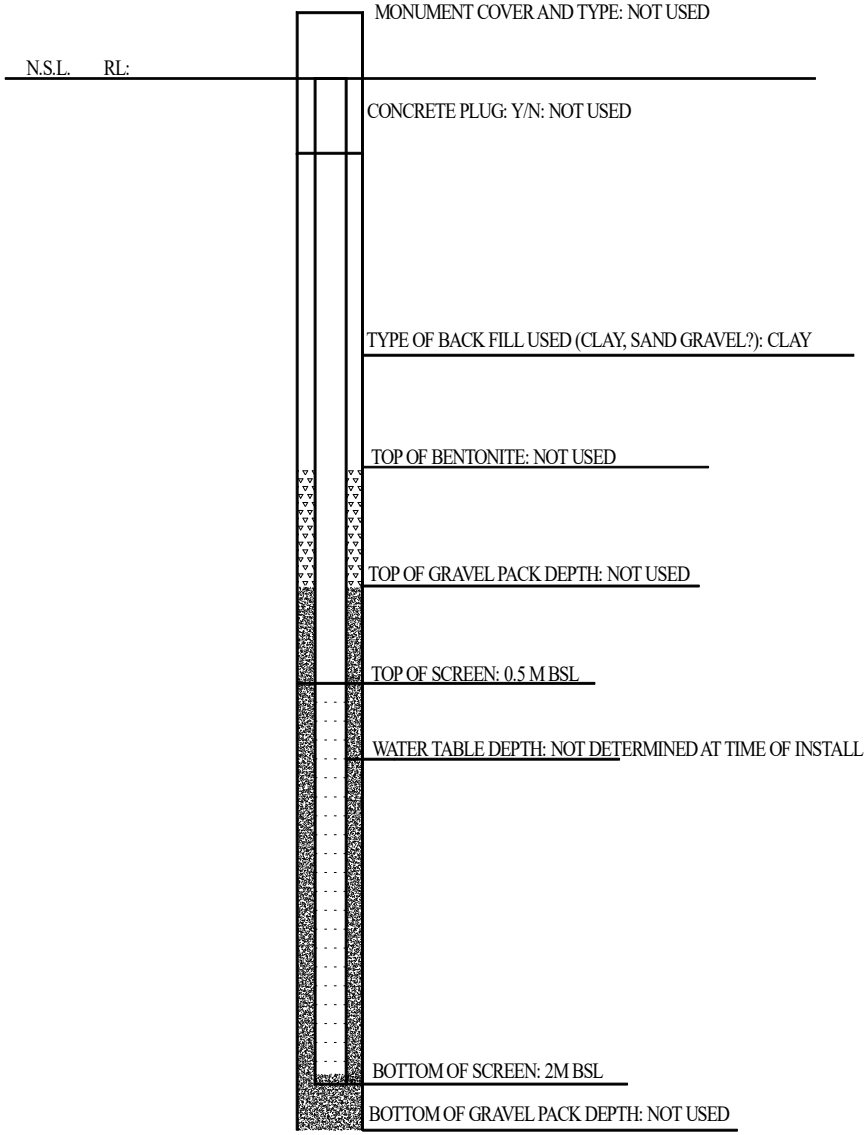
C:\Users\BradWilkinson\AutoCAD\Protest Engineering\Projects - General\PTP_00739 - 658 Ballina Road Pty Ltd - 658 Ballina Road, Goonellabah\Site Plans\PTP_00739 - Test Location Plan.rvt

4/11/2021 12:59:23 PM

BH 1: UTM: MAP:56J EASTING: 532113 NORTHING: 6812149



BH 2: UTM: MAP:56J EASTING: 532107 NORTHING: 6812243



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CLIENT: PROTEST ENGINEERING

PROJECT: NO.658 BALLINA ROAD BALLINA

DRAWING REF: GWMW Log

LEGEND

DATE: 06.10.2021

OUR REF / JOB No.: GI 6145-a sp

DRAWN BY: JDW

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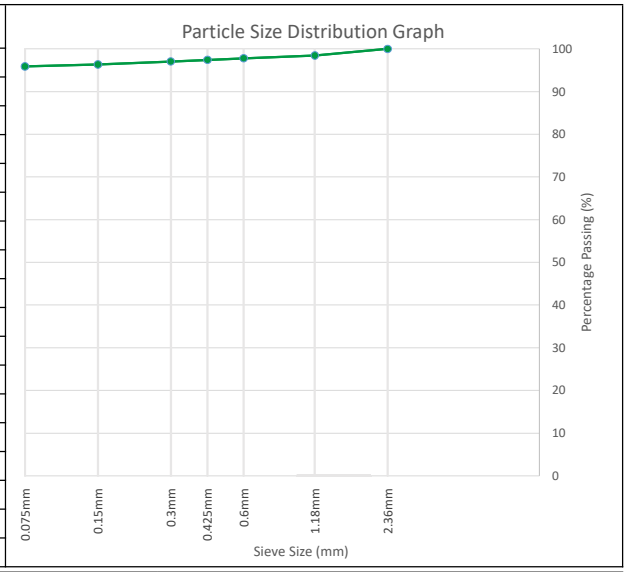
Material Quality Report

Client :	**658 Ballina Road Pty Ltd**	Report Number :	**SR/PTP/00739 - 2/1**
Client Address :	**12/475 Scottsdale Drive, Varsity Lakes, 4227, QLD**	Report Date :	**31/05/2021**
Project Name :	**658 Ballina Road, Goonellabah**	Test Request :	**-**
Project Number :	**PTP/00739**	**Page 1 of 1**	
Location :	**Goonellabah**		

Test Methods :	**AS1289.3.6.1, AS1289.2.1.1**
Material Description	**Silty Clay trace Sand**

Sample Number :	**S/107689**	Sampling Method :	**AS1289.1.2.1 - cl6.5**
Date Tested :	**31/05/2021**	Time :	**10:06**
Material Source :	**INSITU**	Location 1 :	**BH1**
Material Type :	**-**	Location 2 :	**0.5 - 0.8 m**
Lot Number :	**-**	Location 3 :	**532075**
PSD Specification Number :	**N/A**	Location 4 :	**6812210**
ATT Specification Number :	**N/A**		

AS Sieve Size (mm) :	Percent Passing (%) :	Specification Limits :
75.0		
63.0		
53.0		
37.5		
26.5		
19.0		
16		
13.2		
9.5		
6.7		
4.75		
2.36	**100**	
1.18	**98**	
0.600	**98**	
0.425	**97**	
0.300	**97**	
0.150	**96**	
0.075	**96**	



Atterberg Limits :	Test Methods:	Test Results :	Specification Limits :		Test Results :	Specifications Limits :
Liquid Limit (%) :	**AS1289.3.1.2**	**63**		Weighted PI (PI x $P_{0.425}$) :	**1405**	
Plastic Limit (%) :	**AS1289.3.2.1**	**49**		Weighted LS (LS x $P_{0.425}$) :	**991**	
Plasticity Index (%) :	**AS1289.3.3.1**	**14**		Fines Ratio ($P_{0.075}$ / $P_{0.425}$) :	**0.98**	
Linear Shrinkage (%) :	**AS1289.3.4.1**	**10**				
Notes :	**History of Sample: Oven Dried, Method of Preparation: Dry Sieved, Linear Shrinkage: Nil Occurred**					

Remarks :	-

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Document Number : RF9 Date : 11/05/2021

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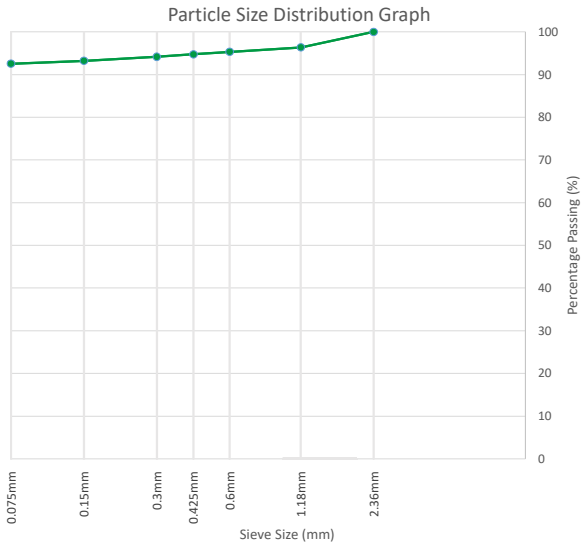
Material Quality Report

Client :	**658 Ballina Road Pty Ltd**	Report Number :	**SR/PTP/00739 - 3/1**
Client Address :	**12/475 Scottsdale Drive, Varsity Lakes, 4227, QLD**	Report Date :	**31/05/2021**
Project Name :	**658 Ballina Road, Goonellabah**	Test Request :	**-**
Project Number :	**PTP/00739**	**Page 1 of 1**	
Location :	**Goonellabah**		

Test Methods :	**AS1289.3.6.1, AS1289.2.1.1**
Material Description	**Silty Clay trace Sand**

Sample Number :	**S/107691**	Sampling Method :	**AS1289.1.2.1 - cl6.5**
Date Tested :	**31/05/2021**	Time :	**10:07**
Material Source :	**INSITU**	Location 1 :	**BH2**
Material Type :	**-**	Location 2 :	**0.6 - 0.9 m**
Lot Number :	**-**	Location 3 :	**532113**
PSD Specification Number :	**N/A**	Location 4 :	**6812254**
ATT Specification Number :	**N/A**		

AS Sieve Size (mm) :	Percent Passing (%) :	Specification Limits :
75.0		
63.0		
53.0		
37.5		
26.5		
19.0		
16		
13.2		
9.5		
6.7		
4.75		
2.36	**100**	
1.18	**96**	
0.600	**95**	
0.425	**95**	
0.300	**94**	
0.150	**93**	
0.075	**93**	



Atterberg Limits :	Test Methods:	Test Results :	Specification Limits :		Test Results :	Specifications Limits :
Liquid Limit (%) :	**AS1289.3.1.2**	**63**		Weighted PI (PI x $P_{0.425}$) :	**1803**	
Plastic Limit (%) :	**AS1289.3.2.1**	**44**		Weighted LS (LS x $P_{0.425}$) :	**1282**	
Plasticity Index (%) :	**AS1289.3.3.1**	**19**		Fines Ratio ($P_{0.075}$ / $P_{0.425}$) :	**0.98**	
Linear Shrinkage (%) :	**AS1289.3.4.1**	**13.5**				
Notes :	**History of Sample: Oven Dried, Method of Preparation: Dry Sieved, Linear Shrinkage: Nil Occurred**					

Remarks :	-

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Document Number : RF9 Date : 11/05/2021

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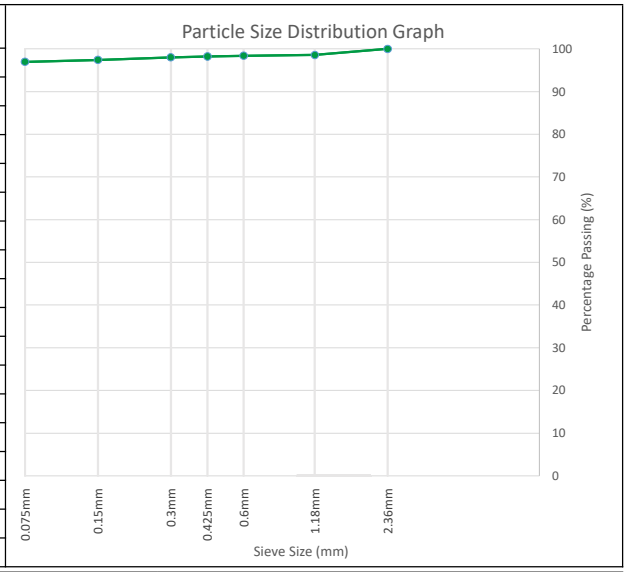
Material Quality Report

Client :	**658 Ballina Road Pty Ltd**	Report Number :	**SR/PTP/00739 - 4/1**
Client Address :	**12/475 Scottsdale Drive, Varsity Lakes, 4227, QLD**	Report Date :	**31/05/2021**
Project Name :	**658 Ballina Road, Goonellabah**	Test Request :	**-**
Project Number :	**PTP/00739**	**Page 1 of 1**	
Location :	**Goonellabah**		

Test Methods :	**AS1289.3.6.1, AS1289.2.1.1**
Material Description	**Silty Clay trace Sand**

Sample Number :	**S/107692**	Sampling Method :	**AS1289.1.2.1 - cl6.5**
Date Tested :	**31/05/2021**	Time :	**10:08**
Material Source :	**INSITU**	Location 1 :	**BH2**
Material Type :	**-**	Location 2 :	**3.0 - 3.3 m**
Lot Number :	**-**	Location 3 :	**532113**
PSD Specification Number :	**N/A**	Location 4 :	**6812254**
ATT Specification Number :	**N/A**		

AS Sieve Size (mm) :	Percent Passing (%) :	Specification Limits :
75.0		
63.0		
53.0		
37.5		
26.5		
19.0		
16		
13.2		
9.5		
6.7		
4.75		
2.36	**100**	
1.18	**99**	
0.600	**98**	
0.425	**98**	
0.300	**98**	
0.150	**97**	
0.075	**97**	



Atterberg Limits :	Test Methods:	Test Results :	Specification Limits :		Test Results :	Specifications Limits :
Liquid Limit (%) :	**AS1289.3.1.2**	**77**		Weighted PI (PI x $P_{0.425}$) :	**3481**	
Plastic Limit (%) :	**AS1289.3.2.1**	**42**		Weighted LS (LS x $P_{0.425}$) :	**2081**	
Plasticity Index (%) :	**AS1289.3.3.1**	**35**		Fines Ratio ($P_{0.075}$ / $P_{0.425}$) :	**0.99**	
Linear Shrinkage (%) :	**AS1289.3.4.1**	**21**				
Notes :	**History of Sample: Oven Dried, Method of Preparation: Dry Sieved, Linear Shrinkage: Nil Occurred**					

Remarks :	-

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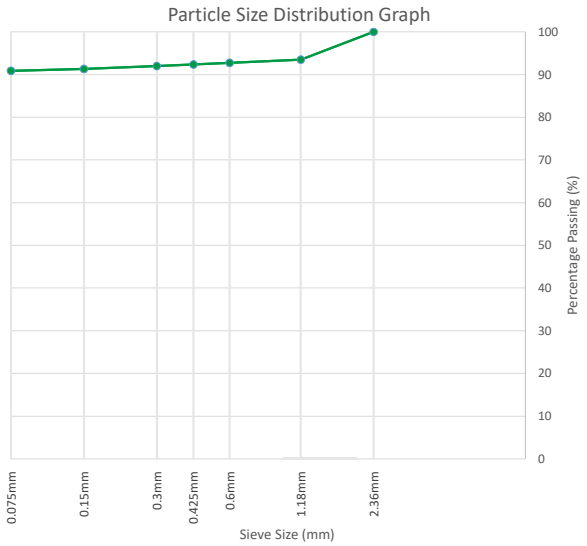
Client :	**658 Ballina Road Pty Ltd**	Report Number :	**SR/PTP/00739 - 5/1**
Client Address :	**12/475 Scottsdale Drive, Varsity Lakes, 4227, QLD**	Report Date :	**31/05/2021**
Project Name :	**658 Ballina Road, Goonellabah**	Test Request :	**-**
Project Number :	**PTP/00739**	**Page 1 of 1**	
Location :	**Goonellabah**		

Test Methods :	**AS1289.3.6.1, AS1289.2.1.1**
Material Description	**Silty Clay trace Sand**

Sample Number :	**S/107694**	Sampling Method :	**AS1289.1.2.1 - cl6.5**
Date Tested :	**31/05/2021**	Time :	**10:09**
Material Source :	**INSITU**	Location 1 :	**BH3**
Material Type :	**-**	Location 2 :	**1.0 - 1.2 m**
Lot Number :	**-**	Location 3 :	**532152**
PSD Specification Number :	**N/A**	Location 4 :	**6812187**
ATT Specification Number :	**N/A**		

AS Sieve Size (mm) :	Percent Passing (%) :	Specification Limits :
75.0		
63.0		
53.0		
37.5		
26.5		
19.0		
16		
13.2		
9.5		
6.7		
4.75		
2.36	**100**	
1.18	**93**	
0.600	**93**	
0.425	**92**	
0.300	**92**	
0.150	**91**	
0.075	**91**	



Atterberg Limits :	Test Methods:	Test Results :	Specification Limits :		Test Results :	Specifications Limits :
Liquid Limit (%) :	**AS1289.3.1.2**	**70**		Weighted PI (PI x $P_{0.425}$) :	**2166**	
Plastic Limit (%) :	**AS1289.3.2.1**	**47**		Weighted LS (LS x $P_{0.425}$) :	**1596**	
Plasticity Index (%) :	**AS1289.3.3.1**	**23**		Fines Ratio ($P_{0.075}$ / $P_{0.425}$) :	**0.98**	
Linear Shrinkage (%) :	**AS1289.3.4.1**	**17.5**				
Notes :	**History of Sample: Oven Dried, Method of Preparation: Dry Sieved, Linear Shrinkage: Nil Occurred**					

Remarks :	-

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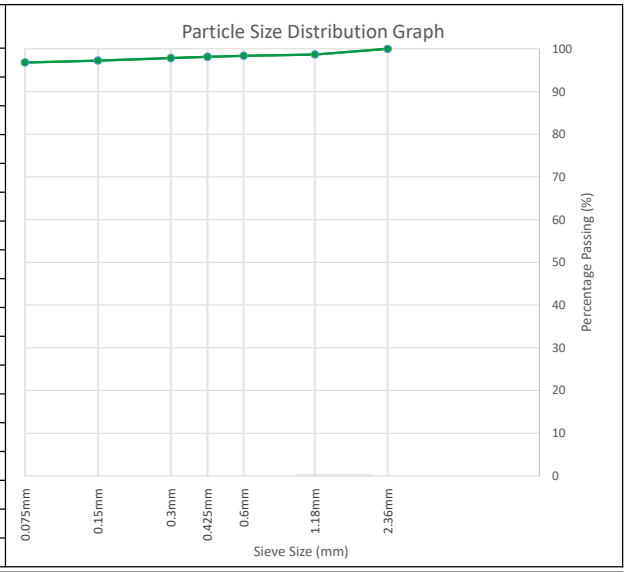
Client :	**658 Ballina Road Pty Ltd**	Report Number :	**SR/PTP/00739 - 6/1**
Client Address :	**12/475 Scottsdale Drive, Varsity Lakes, 4227, QLD**	Report Date :	**31/05/2021**
Project Name :	**658 Ballina Road, Goonellabah**	Test Request :	**-**
Project Number :	**PTP/00739**	**Page 1 of 1**	
Location :	**Goonellabah**		

Test Methods :	**AS1289.3.6.1, AS1289.2.1.1**
Material Description	**Silty Clay trace Sand**

Sample Number :	**S/107696**	Sampling Method :	**AS1289.1.2.1 - cl6.5**
Date Tested :	**JS**	Time :	**10:11**
Material Source :	**INSITU**	Location 1 :	**BH4**
Material Type :	**-**	Location 2 :	**3.0 - 3.2 m**
Lot Number :	**-**	Location 3 :	**532121**
PSD Specification Number :	**N/A**	Location 4 :	**6812098**
ATT Specification Number :	**N/A**		

AS Sieve Size (mm) :	Percent Passing (%) :	Specification Limits :
75.0		
63.0		
53.0		
37.5		
26.5		
19.0		
16		
13.2		
9.5		
6.7		
4.75		
2.36	**100**	
1.18	**99**	
0.600	**98**	
0.425	**98**	
0.300	**98**	
0.150	**97**	
0.075	**97**	



Atterberg Limits :	Test Methods:	Test Results :	Specification Limits :		Test Results :	Specifications Limits :
Liquid Limit (%) :	**AS1289.3.1.2**	**86**		Weighted PI (PI x $P_{0.425}$) :	**3139**	
Plastic Limit (%) :	**AS1289.3.2.1**	**54**		Weighted LS (LS x $P_{0.425}$) :	**1694**	
Plasticity Index (%) :	**AS1289.3.3.1**	**32**		Fines Ratio ($P_{0.075}$ / $P_{0.425}$) :	**0.99**	
Linear Shrinkage (%) :	**AS1289.3.4.1**	**17.5**				
Notes :	**History of Sample: Oven Dried, Method of Preparation: Dry Sieved, Linear Shrinkage: Cracking Occurred**					

Remarks :	-

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Kenney Pham - Signatory

Document Number : RF9 Date : 11/05/2021

Proposed residential subdivision of lot 4 DP 406893, Goonellabah

Test of Significance for the Koala (Phascolarctos cinereus)

GM Project Development and Management

20 March 2022

Final

cumberland ecology

Report No. 21135RP3

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Version	Date Issued	Amended by	Details
1	20/03/2022	DR, CEP, CC	Final

Approved by:	David Robertson
Position:	Director
Signed:	David Robertson
Date:	20 March, 2022

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Figure 4 Lismore Council mapping that map core koala habitat on and adjacent to the subject land
Figure 5 Aerial photograph of subject land and surrounds, showing wider context for koala habitat in the locality

Glossary

This glossary is adapted from the Comprehensive Koala Plan of Management for south-east Lismore (Lismore City Council 2013)

"Assessment Report" means "Koala Habitat Assessment Report" for either "small impact development" or "large impact development" as detailed in Section 4.2 of this Plan.

"**BDAR**" or Biodiversity Development Assessment Report, is an official document that identifies how a person or persons (as the developer or their delegate) will propose to avoid, minimize and offset impacts from your proposed development upon native vegetation or biodiversity listed under the *Biodiversity Conservation Act 2016* and the Biodiversity Regulation 2017.

"building envelope" means an area of land designated for construction of a dwelling, buildings and ancillary infrastructure as well as any land required to be cleared for a bushfire asset protection zone, ancillary gardens and landscaping.

"Comprehensive Koala Plan of Management" means a plan of management prepared in accordance with *State Environmental Planning Policy 44 – Koala Habitat Protection*.

"core koala habitat" means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population. This is the same meaning as that defined by *State Environmental Planning Policy 44 – Koala Habitat Protection*.

"development" means:

(a) the use of land, and

(b) the subdivision of land, and

(c) the erection of a building, and

(d) the carrying out of a works, and

(e) the demolition of a building or works, and

(f) any other act, matter or thing referred to in section 26 (of the *Environmental Planning & Assessment Act 1979*) that is controlled by an environmental planning instrument but does not include any development of a class or description prescribed by the regulations for the purposes of this definition.

This is the same meaning as that defined by the *Environmental Planning & Assessment Act 1979*.

"development application" or **"DA"** means an application for consent under Part 4 of the *Environmental Planning & Assessment Act 1979* to carry out development but does not include an application for a complying development certificate. This is the same meaning as that defined by the *Environmental Planning & Assessment Act* 1979.

"development footprint" means the land that is likely to be impacted by any "small impact development", including any asset protection zone and ancillary infrastructure.

"diameter at breast height over bark" or **"dbhob"** is the diameter of a tree measured 1.4 metres above the ground.

"EP&A Act" means the *Environmental Planning and Assessment Act* 1979.

"greenfield site" means land that is substantially undeveloped (except for agricultural use) that has not been previously developed for an urban and/or residential land use.

"ha" means hectares.

"infrastructure" means all structures associated with the construction of a single dwelling, dual occupancy and/or secondary dwelling and includes gardens, landscaping, water tanks, on-site wastewater management systems, any access route, road or driveway; but excludes farm dams.

"koala habitat" means "core koala habitat" and/or "preferred koala habitat".

"koala movement corridor" means an area or tract of land that is used, or could be used, by koalas when moving between different areas of their home range or habitat. These areas may include cleared land; but. do not include "koala habitat".

"koala planning area" means the land to which this Plan applies as described and mapped in Figure 1.

"land" includes:

(a) the sea or an arm of the sea,

(b) a bay, inlet, lagoon, lake or body of water, whether inland or not and whether tidal or non-tidal, and

(c) a river, stream or watercourse, whether tidal or non-tidal, and

(d) a building erected on the land.

This is the same meaning as that defined by the *Environmental Planning & Assessment Act 1979*.

"large impact development" means a development that has potential for large adverse impacts on the koala population, preferred koala food trees and/or preferred koala habitat within the *study area* of the proposal. This category of development requires both a Statement of Environmental Effects and an Assessment of Significance (Section 5A *Environmental Planning & Assessment Act 1979*, Section 94 *Threatened Species Conservation Act 1995*) to accompany the development application. This category of development includes designated development, integrated development and development requiring concurrence under the *Environmental Planning & Assessment Act 1979* but, depending on the nature and scale of the proposed development, this may be varied in writing at the discretion of Council.

"Lismore DCP" means Lismore Development Control Plan.

"Lismore LEP" means the Lismore Local Environment Plan 2012. 39

"LGA" means local government area.

"mm" means millimetre.

"no-build zone" means a designated area of land where the construction of dwellings, buildings and the like are precluded.

"PoM" means plan of management.

"preferred koala habitat" means any area identified as either Primary, Secondary A or Secondary B koala habitat as defined in the table below. Vegetation

Vegetation	Category	Definition
Vegetation classified as Preferred Koala Habitat	Primary	Vegetation associations and/or communities wherein "primary food tree species" comprise the dominant or co-dominant (i.e. ≥ 50%) overstorey tree species.
	Secondary A	Vegetation associations and/or communities wherein "primary food tree species" are sub-dominant components of the overstorey tree species and usually (but not always) growing in association with one or more "secondary food tree species".
	Secondary B	Vegetation associations and/or communities wherein "primary food tree species" are absent, habitat containing "secondary and/or supplementary food tree species" only.
Other Vegetation	Other	Native vegetation associations and/or communities within which "preferred koala food trees" are absent.
	Unknown	Vegetation for which there is insufficient data available to enable classification. This includes both individual trees and clumps of trees which are unmapped owing to the resolution of the mapping. These trees may be verified as *koala habitat* by a Koala Habitat Assessment.

1. Introduction

1.1. Purpose

I, Dr David Robertson of Cumberland Ecology Pty. Ltd. (Cumberland Ecology) have been commissioned by CA Construction Management, on behalf of Graham Peter Meineke trading as GM Project Development and Management (the Applicant), to serve as an ecology expert in the New South Wales (NSW) Land and Environment Court (LEC) Class 1 proceedings (Case number 2021/00044443). The proceedings were commenced by the Applicant against Lismore City Council (referred to as 'the Respondent'). My relevant experience is summarised in ***Section 1.4*** of this report, and within my Curriculum Vitae (CV) in **Appendix A**.

The purpose of this document is to provide a test of significance as required under s 7.3 of the *NSW Biodiversity Conservation Act 2016* (BC Act) to investigate the impacts of a proposed residential development at Lot 4 DP 406893, 658 Ballina Road, Goonellabah. Under the BC Act, if a proposed development is determined by a test of significance as likely to have a significant impact on one or more threatened flora and fauna, then a Biodiversity Development Assessment Report (BDAR) is required to be prepared.

As set out by the BC Act, a BDAR is an official document that identifies how a person or persons (as the developer or their delegate) will propose to avoid, minimize and offset impacts from your proposed development upon native vegetation or biodiversity listed under the BC Act and the Biodiversity Regulation 2017.

Refer to the Glossary for a complete list of terms used in this report.

1.2. Background

Cumberland Ecology was engaged by GM Project Development and Management to prepare a test of significance report for a proposed residential subdivision ("the proposal") of Lot 4 DP 406893, 658 Ballina Road, Goonellabah in the Lismore Local Government Area (LGA), hereafter referred to as the subject land (**Figure 1**).

Since the development application was lodged for this proposal for consideration by Lismore Council (council), the proposal has been modified several times to address concerns raised by the council. One focus of concern was the potential impacts of the proposal on the Koala (*Phascolarctos cinereus*) as detailed in the Statement of Facts and Contentions

Lismore LGA has a large population of Koalas and a Comprehensive Koala Plan of Management has been prepared for south-eastern Lismore (Lismore Council 2013). Referred to hereafter as the CKPoM, it provides for the sustainable future management of koalas. Under the CKPoM, proposed developments are classified as either large or small developments for the purposes of determining offsetting required to compensate for any predicted impacts to Koala habitat.

The proposed development is classified as a "large" development under the CKPoM, which is defined as follows:

> *"a development that has potential for large adverse impacts on the koala population, preferred koala food trees and/or preferred koala habitat within the study area of the proposal. This category of development requires both a Statement of Environmental Effects and an Assessment of Significance (Section 5A Environmental Planning & Assessment Act 1979, Section 94 Threatened Species Conservation Act 1995) to accompany the development application."*

With the repeal of the *Threatened Species Conservation Act 1995* and replacement by the BC Act, the required test is now the test of significance. A test of significance is prepared to determine whether a significant impact is likely to be caused to threatened flora or fauna listed under the BC Act. If a significant impact is found likely, the proponent is required to prepare a BDAR.

In late 2021, Arbor Ecological was engaged by GM Project Development and Management to prepare a test of significance for a preceding version of the proposal to determine the likelihood of a significant impact upon Koala. Referred to hereafter as "the Arbor Ecological test of significance", it concluded that no significant impact was likely upon Koalas. The earlier version of the proposal is shown in **Figure 2**. A copy of Arbor Ecological test of significance is provided in **Appendix B** to this report.

The BC Act requires ecological consultants to follow the Biodiversity Assessment Method or "BAM" as set out in the BAM Manual (DPIE 2020). Under the BAM, proponents are required to consider first designing their proposal to avoid and minimise impacts to threatened flora and fauna, then adding mitigation measures to ameliorate predicted impacts as far as practical. Impact assessment is conducted after consideration of reasonable avoidance and mitigation measures, with any residual impacts that cannot be avoided subject to offsetting.

The version of the proposal assessed by Arbor Ecological included a suite of modifications to the original proposal, which were designed to avoid and mitigate the impacts of the proposed residential development on the Koala.

Avoidance measures included:

- Avoiding clearing of some saplings of preferred Koala feed trees by redesigning the layout of the development; and
- Avoiding cutting off a predicted movement corridor for Koalas on the subject land by widening a movement corridor proposed in the north-western corner of the site.

Mitigation measures included:

- Provision of Koala-permeable fencing throughout the development to permit free movement of Koala;
- Banning dog ownership by future residents of the development;
- Provision of road calming devices to slow traffic movement in the development;
- Provision of signage along the road to alert drivers moving through the subdivision to the potential presence of Koala; and
- Provision of additional plantings of preferred Koala feed trees, with nine (9) additional trees proposed for planting on site.

As the proposed development will clear some seedlings of preferred Koala feed trees, there will be a residual impact on the Koala and so there is a requirement for offsetting as set out in the CKPoM. The proponent has offered replacement planting in a Council reserve to form an appropriate offset for the proposal.

Following the work by Arbor Ecological and without prejudice discussions between the parties, the proposal was modified by removal of one lot to give more space for proposed mitigation. The lot size of a number of lots was also increased. This report therefore re-does the test of significance and considers the ecological impacts of the reduced development footprint, which is shown in **Figure 3**.

1.3. Document structure

The remaining chapters of this document are set out as follows:

- Chapter 2: Methods for the Preparation of this Assessment;
- Chapter 3: Koala Habitat On and Around the Subject Land;
- Chapter 4: Avoidance, Mitigation and Offsetting Measures;
- Chapter 5: Test of Significance; and
- Chapter 6: Conclusion.

1.4. Authorship

I, and those who have assisted me in the research for the preparation of this document, have been given a copy of Division 2 "Provisions applicable to expert evidence generally" of Part 31 of the Uniform Civil Procedure Rules (2005) and have read, understood and adopt this document and its Schedule 7, 'Expert witness code of conduct'. I, and those who have assisted me, understand that we have an overriding duty to assist the Court impartially on matters relevant to our collective area of expertise, and that our paramount duty is to the Court and not to the retaining company. The evidence provided to the Court – both written and oral - will follow this Code of Conduct, and we are bound by that Code of Conduct. Notwithstanding that I have had some assistance in the preparation of this report, the opinions and conclusions are my own.

a. Primary Authorship

The author of this report is Dr David Robertson, Director of Cumberland Ecology. A copy of my CV is provided in **Appendix A** of this report.

As Director of Cumberland Ecology, I have prepared many assessments of impacts from proposed developments upon threatened flora and fauna in NSW, including Koala.

I am a member of the *Environment Institute of Australia and New Zealand* and have over 30 years' experience working as an ecologist, including work as a University lecturer (ecology) and a consultant. I am an Accredited BAM Assessor under the *Biodiversity Conservation Act 2016* (NSW) and was also an Accredited Biobank Assessor under the now repealed *Threatened Species Conservation Act 1995* (NSW). For the past 15 years I have directed my own ecological consultancy practice, Cumberland Ecology, which has offices in Sydney and Brisbane.

During my career to date, I have been involved in the management of many varied ecological assessments in Australia and overseas. I have worked on ecological impact assessments, threatened species assessments, biodiversity offsetting and monitoring. My experience includes both terrestrial and freshwater ecology. My

international experience has included ecological impact assessment projects in Hong Kong, Thailand, Sri Lanka, the Philippines (Mindanao) and the Solomon Islands.

Since the inception of my consultancy company, Cumberland Ecology Pty Ltd in 2003, I have worked with my team of ecologists at Cumberland Ecology on ecological investigations throughout NSW, averaging 60-80 projects per year. We have worked extensively within the Sydney Region (particularly Western Sydney), Hunter Valley, Gunnedah Basin, Western Blue Mountains, and Grafton/Clarence Valley Region.

I have had, and continue to have, direct involvement in many large-scale vegetation mapping and flora and fauna impact assessment projects. Cumberland Ecology has also worked on many projects that entail biodiversity offsets, large and small. I have worked on a range of offsetting projects in New South Wales, Queensland, Hong Kong, and the Philippines. My work on offsets has included work for private companies to develop offsets, working as a peer reviewer for the NSW Department of Planning and Environment (DPE) to review offset proposals and providing advice directly to DPE about the policy for the development and assessment of offsets for major projects.

I have also served as expert witness in numerous proceedings in the Land and Environment Court of NSW, including Class 1, Class 3, Class 4 and Class 5 proceedings.

b. Other Team Members

Two other staff members of Cumberland Ecology worked under my direction to assist with the preparation of this report, Ms Cecilia Eriksson Pinatacan and Ms Cassandra Cheeseman. Their qualifications and role in the report are as follows:

Ms Cecilia Eriksson Pinatacan is employed as an GIS Specialist and senior project manager with Cumberland Ecology. Her role in this project and qualifications are as follows:

- Role: Project management, GIS mapping, assistance with research and information compilation; and
- Qualifications: Bachelor of Science (Honours) in Marine Biology, University of Technology Sydney, NSW; Master of Science (Major in Marine Science and Management), University of Technology Sydney, NSW.

Ms Cassandra Cheeseman is employed as a paralegal and ecologist with Cumberland Ecology. Her role in these proceedings and qualifications are as follows:

- Role: client liaison, literature review, legal research assistance; and

Qualifications: Bachelor of Laws with the Degree of Bachelor of Environment, Macquarie University, Sydney; Certificate of Sustainability, University of Tasmania.

2. Methods for the Preparation of this Assessment

2.1. Desktop Assessment

The preparation of this report involved a literature review of preceding ecological work on the subject land by Birdwing Ecological Services (2021) and Arbor Ecological (2021). Literature about the Koala in Lismore, and generally in eastern Australia was also considered. Key Koala literature included:

- Biolink, 2017, Koala Habitat & Population Assessment, Lismore Local Government Area (part). Final Report to Lismore City Council.
- DAWE (2022) Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory. Department of Agriculture, Water and Environment.
- DECC (NSW). 2008. Recovery Plan for the Koala (*Phascolarctos cinereus*). Department of Environment and Climate Change, Sydney, NSW.
- Lismore City Council (2013) Comprehensive Koala Plan of Management for south-east Lismore. Lismore City Council, Lismore, NSW.
- Species habitat, ecology and threat notes sourced from NSW Office of Environment & Heritage threatened species profile for Koala at www.environment.nsw.gov.au.

2.2. Site Examination Using Drone

Recent flooding in Lismore prevented a scheduled site inspection by the author of this report. In *lieu* of this, the proponent of the site organised a photographic investigation of the subject land and forest habitats in surrounding land using drone technology.

Dr Robertson outlined desired flight paths that the drone should fly and then the drone was flown over the subject land and surrounds. The drone flew at relatively low altitude and took high resolution footage of the vegetation on site and in the locality. The results of the drone footage were considered in the test of significance.

2.3. Test of Significance

An updated test of significance was completed taking into consideration all of the avoidance and mitigation measures proposed in the preceding Arbor Ecological test of significance, while considering the revised, lower yielding residential development design.

2.4. Limitations

Due to substantial flooding within the locality of the subject land, Dr Robertson was unable to attend the subject land in person to ground truth the previous ecological studies. Therefore, this report has been prepared relying on desktop assessment, including recent drone footage of the subject land and surrounds. Notwithstanding that, the subject land has simple, largely cleared vegetation and it has been surveyed for native vegetation and Koala on several occasions by previous investigations. This has furnished adequate information for the preparation of this report.

3. Koala Habitat On and Around the Subject Land

3.1. Introduction

This chapter briefly summarises the koala habitat that is known in the locality and on the subject land, then addresses the key threats that are known to operate on Koalas generally and in the Lismore LGA.

3.2. Habitat in the Locality

There is an abundance of records of Koalas in the locality, as has been summarised in the Arbor Ecology test of significance (**Appendix B**). Records are known from immediately around and on the subject land.

Koala habitats in the Lismore area are mapped by Lismore Council and classified as primary habitat, Secondary A or Secondary B habitats based upon the classification in the CKPoM. These are shown in the table below, taken from the CKPoM.

Table 1 Classification of Koala habitats within the CKPoM

Vegetation	Category	Definition
Vegetation classified as Preferred Koala Habitat	Primary	Vegetation associations and/or communities wherein "primary food tree species" comprise the dominant or co-dominant (i.e. ≥ 50%) overstorey tree species.
	Secondary A	Vegetation associations and/or communities wherein "primary food tree species" are sub-dominant components of the overstorey tree species and usually (but not always) growing in association with one or more "secondary food tree species".
	Secondary B	Vegetation associations and/or communities wherein "primary food tree species" are absent, habitat containing "secondary and/or supplementary food tree species" only.
Other Vegetation	Other	Native vegetation associations and/or communities within which "preferred koala food trees" are absent.
	Unknown	Vegetation for which there is insufficient data available to enable classification. This includes both individual trees and clumps of trees which are unmapped owing to the resolution of the

Vegetation	Category	Definition
		mapping. These trees may be verified as *koala habitat* by a Koala Habitat Assessment.

Preferred Koala food trees for the Lismore area covered by the CKPoM include any of the tree species listed in the table below:

Table 2 Preferred koala food trees as per the CKPoM

	Common Name	Scientific Name
Primary food tree species	Forest red gum*	*Eucalyptus bancroftii*
	Tallowwood	*E. tereticornis*
	Swamp mahogany	*E. microcorys*
	Grey Gum	*E. robusta*
Secondary and/or supplementary food tree species		*E. punctata***
	Thin-leaved stringybark	*E. eugenoides*
	White stringybark	*E. globoidea*
	Small-fruited grey gum	*E. propinqua*
	Narrow-leaved red gum	*E. seeana*

**includes the naturally occurring E. tereticornis x E. Robusta hybrid referred to as E. patentinervis (Bale, 2003). **Includes synonom E. biturbinata*

Of these species Forest Red Gum are widespread in forest patches around the subject land.

Council GIS mapping layers illustrate that primary preferred habitats occur to the immediate west of the subject land and to the north and north east of the subject land. An excerpt of the mapping is shown below.

3.3. Habitat in the Subject Land

As shown in **Figure 1**, the subject land is predominantly cleared land but has patches of regenerating weeds such as Camphor Laurel and patches of regenerating Koala feed trees amid grassland on the subject land.

The preferred feed trees on the subject land include a patch of densely regenerating small saplings and some scattered larger saplings/small trees. These comprise Forest Red Gum (*E. tereticornis*) and Tallowwood (*E. microcorys*).

Exotic weed species occur in patches in the south and east and include Lantana, Camphor Laurel, Broad-leaved Privet, Easter Cassia/ Senna, Yellow Bells, Coffee, Loquat, White Sapote, Tobacco Bush, Passionfruit species.

Despite the largely cleared nature of the site, the land is recognised as a movement corridor for the local koala population and therefore, for the purposes of this report, represents core koala habitat. There are patches of forest habitat to the west and north-east of the subject land that contain koala feed trees and it is likely that

koalas are traversing the site to move between these patches. It is also likely to be used by younger animals, particularly males, to disperse to other habitat areas.

An analysis of koala records and koala habitat in the vicinity of the site indicates that the western and north-eastern forest patches adjacent to the site are most likely to trigger koala movement through the site. As shown in **Figure 4,** they are patches of preferred Koala habitat. The north-eastern forest patch, shown better in **Figure 5** is extensive and is likely to regularly support Koalas.

The presence of preferred Koala feed trees is limited at present on the subject land as it has been historically cleared. Nevertheless, small trees/saplings do occur. The preferred Koala feed trees within the subject land have been described in the Arbor Ecological test of significance, which is presented in **Appendix B**. These include:

- For retention koala food trees (i.e. T1, T2, T3, T4 and T6) will be retained; given legal protection status via a legal covenant on property title
- *For removal of T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH)*, ten (10) Parramatta Red Gum/ Drooping Red Gum (*Eucalyptus parramattensis*) are to be planted on the site in strategic locations within the street verge and public reserve in the northern portion of the site in the vicinity of proposed lots 8 to 15. These plantings are planned to create koala habitat islands and linkages to promote free and safe koala movement with traffic calming measures, permeable fences and without domestic dog threats. The planting design will be subject to Council review and approval. No plantings are to occur within the Koala Corridor due to APZ performance requirements. No plantings are to occur in the southern portion of the site so as to not encourage koala movement in the area of the Bruxner Highway which is recognised as a koala vehicle collision black spot.
- For removal of 122 koala food tree saplings (DBH from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH) within an area of approximately 112m2, compensatory works will be undertaken in line with Appendix 5 – Habitat Compensation Policy and outlined in a VMP/PoM approved by Council and fully funded by the proponent with a minimum five-year management period, as per the CKPoM.

To the south of the site, opportunities for dispersal of Koalas are limited and hazardous. This is because the Bruxner Highway directly adjoins the site to the south creating a barrier to free and safe koala movement south of the site where a highly built and urbanised environment exists. Biolink (2017) identify this area as *Black Spot 4 West* for koala vehicle-strike in the Lismore LGA. Several NSW BioNet koala vehicle strikes are recorded locally including one on the Bruxner Highway

The locations of Koala feed trees proposed for retention are shown in **Figure 3**.

3.4. Key Threats to the Koala

Koalas have recently been listed as endangered under the Commonwealth EPBC Act and the approved conservation advice for the species lists a range of threats to koalas. These include large scale impacts from land clearing, climate change and disease, which impact across the range of the species. They also include

some impacts such as vehicle strike and attacks from domestic dogs which are prevalent in suburban areas (DAWE 2022). **Table C.1** in **Appendix C** summarises what are key threats to Koala across NSW and Qld.

Within Lismore, Biolink (2017) analysed Koala data and found that disease (~50%), road accidents (~25%) and dog attacks (~25%) contributed to 75% of the recorded koala deaths in the LGA.

4. Avoidance, Mitigation and Offsetting Measures

4.1. Introduction

This chapter summarises the work done to avoid and minimise, mitigate and offset impacts to the Koala from the proposed development. This approach is as required under BAM (2020).

Under the BAM, an assessment must document the reasonable measures taken by the proponent to avoid or minimise clearing of native vegetation and threatened species habitat during proposal design, including placement of temporary and permanent ancillary construction and maintenance facilities (DPIE 2020). The types of measures that can be used to demonstrate this under BAM 2020 (DPIE 2020) include:

> *a. reducing the proposal's clearing footprint by minimising the number and type of facilities*
>
> *b. locating ancillary facilities in areas that have no biodiversity values*
>
> *c. locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas with the lowest vegetation integrity scores)*
>
> *d. locating ancillary facilities in areas that avoid habitat for species and vegetation that has a high threat status (e.g. an endangered ecological community (EEC) or critically endangered ecological community (CEEC) or is an entity at risk of a serious and irreversible impact (SAII)*
>
> *e. actions and activities that provide for rehabilitation, ecological restoration and/or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat on the subject land.*

By "reasonable measures", the BAM requires ecological consultants and proponents to consider an appropriate level of avoidance and mitigation, given the context of the development and other competing considerations. For this reason, avoidance and mitigation measures are developed on a project-by-project basis.

4.2. Development of Avoidance Measures

All versions of the proposal have included consideration of the need to avoid Koala habitats on the subject land. As stated in the preceding chapter, the subject land is largely cleared but serves as a thoroughfare for Koala movement between patches of preferred habitat nearby. There are also some large saplings of preferred feed trees on the subject land.

Avoidance measures implemented for the proposal includes:

- Maximising the retention of preferred Koala feed trees on site by redesigning the lot configuration and proposed housing envelopes to avoid clearing most large saplings of preferred Koala feed trees;
- Reduction of the number of lots proposed by one lot, to increase the average lot size to 989 metres square and increase the area available for retention and future planting of feed trees in some parts of the site; and
- Reconfiguring the lot layout to preserve potential movement potential of Koalas across the north-western portion of the subject land. Such considerations have led to a widening a movement corridor proposed in the north-western corner of the site from 5 m wide to 7 m wide.

These avoided features are shown in **Figure 3**,

4.3. Development of Mitigation Measures

Mitigation measures are measures that can be taken to lessen the environmental impacts that could arise from the construction and operation of a development proposal. A suite of mitigation measures has been developed for the proposal. These include:

- Provision of Koala-permeable fencing throughout the development to permit free movement of Koala;
- Banning dog ownership by future residents of the development;
- Provision of road calming devices to slow traffic movement in the development;
- Provision of signage along the road to alert drivers moving through the subdivision to the potential presence of Koala; and
- Provision of additional plantings of preferred Koala feed trees, with nine (9) additional trees proposed for planting on site.

These measures are designed to address known key threats to Koalas in Lismore and other suburban environments, particularly road accidents and dog attacks.

The provision of Koala-permeable fencing will permit Koalas to move across the subject land between houses using land in addition to the formal proposed "movement corridor" in the north-west of the subject land.

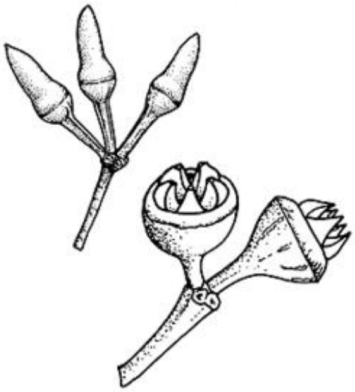
The planting of additional feed trees of *Eucalyptus parramattensis* (Parramatta Red Gum) will help to increase the feed supply available to Koalas moving through the landscape. This species is a red gum that is not native to Lismore but is a known preferred Koala feed tree. It is a better alternative for planting in a suburban area than the native *Eucalyptus tereticornis* (Forest Red Gum), which is a much larger tree. By selecting *E. parramattensis* as a feed tree to plant, more trees can be planted within the development. The excerpt below taken from PlantNet, the botanic gardens database, shows the relative sizes of these two trees. *Eucalyptus parramattensis* grows to a maximum height of less than 15 m and so is much less likely to cause problems for houses in the long term than *E. tereticornis*, which can reach 50 m.

NEW SOUTH WALES FLORA ONLINE Printable Page New South Wales Flora Online

Eucalyptus tereticornis Sm.

Family **Myrtaceae**

Common name: Forest Red Gum, Buringoa (D'harawal)



Eucalyptus tereticornis Sm. APNI*

Description: Tree to 50 m high; bark smooth, white or grey, shedding in large plates or flakes.

Juvenile leaves disjunct, broad-lanceolate to ovate, dull blue-green or green.

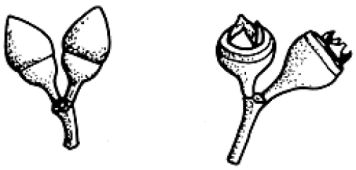
Adult leaves disjunct, narrow-lanceolate or lanceolate, 10–20 cm long, 1–3 cm wide, green, dull, concolorous. Umbellasters 7- to rarely 11-flowered; peduncle narrowly flattened or angular, 7–25 mm long; pedicels terete, 3–10 mm long. Buds cylindrical or fusiform, 10–20 mm long, 4–8 mm diam., scar present; calyptra conical or elongate acute, longer than and as wide as hypanthium.

Fruit globose or ovoid, 4- or 5-locular, 4–6 mm long, 4–8 mm diam.; disc raised; valves exserted.

Eucalyptus parramattensis E.C.Hall

Family **Myrtaceae**

Common name: Parramatta Red Gum, Drooping Red Gum



Eucalyptus parramattensis E.C.Hall APNI*

Description: Tree to 15 m high; bark smooth (not shedding cleanly), white or grey, shedding in large plates or flakes.

Juvenile leaves disjunct, narrow-lanceolate to lanceolate, dull green. Adult leaves disjunct, narrow-lanceolate or lanceolate, 7–20 cm long, 1–3.5 cm wide, green, dull, concolorous.

Umbellasters 7-flowered; peduncle terete or angular, 5–10 mm long; pedicels terete, 2–8 mm long. Buds ovoid, 4–10 mm long, 4–6 mm diam., scar present; calyptra hemispherical to conical, at least as long and at least as wide as hypanthium.

Fruit hemispherical or globose, 4–9 mm long, 5–9 mm diam.; disc flat or raised (slightly); valves exserted.

4.4. Development of Offsetting Measures

As explained by the Arbor Ecological test of significance (**Appendix B**), the clearance of koala feed tree species will be offset according to measures from the KPoM. Proposed offsetting follows the prescription of offsetting large developments in the KPoM and includes:

- For removal of T5 (*Tallowwood*, 17cm DBH) and T9 (*Forest Red Gum*, 10cm DBH), ten (10) *Parramatta Red Gum/ Drooping Red Gum (Eucalyptus parramattensis*) are to be planted on the site in strategic locations within the street verge and public reserve in the northern portion of the site in the vicinity of proposed lots

8 to 15. These plantings are planned to create koala habitat islands and linkages to promote free and safe koala movement with traffic calming measures, permeable fences and without domestic dog threats. The planting design will be subject to Council review and approval. No plantings are to occur within the Koala Corridor due to APZ performance requirements. No plantings are to occur in the southern portion of the site discourage movement of animals towards the Bruxner Highway which is recognised as a koala vehicle collision black spot (Biolink 2017).

- For removal of 122 koala food tree saplings (DBH from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH) within an area of approximately 112m2, compensatory works will be undertaken in line with Appendix 5 – Habitat Compensation Policy and outlined in the CKPoM approved by Council. This work will be fully funded by the proponent with a minimum five-year management period, as required by the CKPoM.

Habitat compensation works are proposed to be undertaken on a public reserve of Council's choice, e.g. the nearby Camelot Reserve Goonellabah. Site constraints prohibit further tall koala food tree plantings on the site.

5. Test of Significance

5.1. The Koala on the Subject Site

As set out in previous chapters, the Koala is known to occur on and around the subject land. Primary habitats occur to the west and north-east of the subject land, and the subject land is assumed to be a thoroughfare for moving animals allowing movement to and from these patches of primary habitats.

Some preferred food trees occur on the site in the form of large and small saplings. The majority of the former will be retained on site while the smaller patch of densely regenerating saplings will be cleared and offset as per the CKPoM.

5.2. Test of Significance

The following matters are to be considered for the purposes of determining whether a proposed development is likely to significantly affect the Koala or its habitat:

(a) *In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The construction of fences, roads and houses and the occupation of the site by humans will change the features of the site from old farmland to suburban environs. This will to a degree impede Koala use of the site. However, there is abundant evidence that Koalas move into and through suburban areas in the Lismore area as indicated by the analysis of Koala records by Biolink (2017). The proposed use of the subject land as a thoroughfare for Koala is likely to continue based on the avoidance and mitigation measures set out in **Chapter 4** of this report**.**

Land to the west, northwest and forested areas elsewhere in the locality support relatively large areas of well-developed primary koala habitat that will not be affected by the proposal and will continue to provide more substantial habitat for resident koalas in the locality.

The proposal will not impact the species such that the viable local population is likely to be placed at risk of extinction.

As explained in Biolink (2017) the Koala population spans a large area of the LGA and includes a large number of animals. The population, though disease-impacted, appears to be a large and viable population.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable – this test is for a threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Habitat to be removed will be minimal.

Due to detailed re-design and reduction in the proposed yield of the development, most larger saplings will be avoided.

The proposal will result in the clearing of two regrowth saplings, i.e. T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH), and 122 regrowth koala food tree saplings within an area of approximately 112m^2. The DBH of saplings range from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH.

As per the requirements of the CKPoM there will be compensatory planting of feed trees in a Council-owned reserve that will augment habitat for Koala in the locality in the long term.

Remaining scattered regrowth koala food trees (i.e. T1, T2, T3, T4 and T6) will be retained; given legal protection status via a legal covenant on property title, e.g. Section 88B/E; and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 3**.

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The proposal will not sever habitat connections by fragmenting habitat, or isolate areas of koala habitat or restrict movement of koalas through or around the site or throughout the broader landscape. Scattered regrowth koala food trees to be retained will be given legal protection status via a legal covenant on property title, e.g. Section 88B/E, and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 1**. Proposed koala habitat plantings in the northern portion of the site will increase available habitat.

Free and safe movement of koalas will be facilitated across the west and northwest portions of the site and between adjoining areas of koala habitat via a Koala Corridor which will effectively incorporate retained scattered regrowth koala food trees. Lot boundary fences to the west and northwest and between lots 8 and 9 are to be a koala permeable fence that does not impede koala movement as outlined in the CKPoM, e.g. post and wire fence with bottom strand being plain wire placed a minimum of 300 mm above the ground. This will be achieved via a legal covenant on property title, e.g. Section 88B/E.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

While the land on site is used as a thoroughfare by Koala, current evidence does not indicate that it is intensively used as such. During the field assessment on 09/11/21 by ecologist Michael Hallinan there were no signs of koala use or occupation of the site including koala scats or characteristic pock/ scratch marks on smooth-barked trees. Similarly, there were no signs of koala site use or occupation by Birdwing Ecological Services (2021) and North Coast Environmental Services (2018).

Koala habitat on the site does not appear to be an important home range component of the local koala population. The long-term koala survival and persistence in the local area is unlikely to be significantly affected by the proposal.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

Declared Areas of Outstanding Biodiversity Value (AOBV) represent the most valuable sites for biodiversity conservation in NSW (OEH 2018).

No Areas of Outstanding Biodiversity Value (AOBV) listed under the *Biodiversity Conservation Regulation 2017* occur on or near the subject land and the proposal will not impact any declared area of outstanding biodiversity value.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

To a limited extent, the proposal is part of a key threatening process - that of clearing of native vegetation. However, due to avoidance and mitigation measure proposed, and the existing heavily cleared and modified site, clearing will not be either extensive or significant.

A threatening process is defined under the *Biodiversity Conservation Act 2016* as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities.

In addition to deciding whether the action/activity constitutes a key threatening process (KTP), consideration must also be given to whether the proposal is likely to exacerbate a KTP. Species listed in the determination as being 'at risk' warrant consideration if these species are known or likely to occur within the study area of the development or activity.

The current list of key threatening processes listed under the BC Act and an assessment of whether parts of the proposal constitutes or exacerbates a KTP is shown below in **Table 3.**

Table 3 Key Threatening Process (KTP) assessment

Listed Key Threatening Processes (as described in the final determination of the Scientific Committee to list key threatening processes)	Likelihood of the parts of the proposal to be classed as a KTP		
	Likely	Possible	Unlikely
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, *Manorina melanocephala* (Latham, 1802)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process)			✓

Listed Key Threatening Processes (as described in the final determination of the Scientific Committee to list key threatening processes)	Likelihood of the parts of the proposal to be classed as a KTP	
Anthropogenic climate change		✓
Bushrock removal (as described in the final determination of the Scientific Committee to list the threatening process)		✓
Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process)	✓	
Competition and grazing by the feral European Rabbit, *Oryctolagus cuniculus* (L.)		✓
Competition and habitat degradation by Feral Goats, *Capra hircus* Linnaeus 1758		✓
Competition from feral honey bees, *Apis mellifera* L.		✓
Death or injury to marine species following capture in shark control programs on ocean beaches (as described in the final determination of the Scientific Committee to list the key threatening process)		✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments (as described in the final determination of the Scientific Committee to list the key threatening process)		✓
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners		✓
Habitat degradation and loss by Feral Horses (brumbies, wild horses), Equus caballus Linnaeus 1758		✓
Herbivory and environmental degradation caused by feral deer		✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition		✓
Importation of Red Imported Fire Ants *Solenopsis invicta* Buren 1972		✓
Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations		✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis		✓
Infection of native plants by *Phytophthora cinnamomi*		✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓
Introduction of the large earth bumblebee, *Bombus terrestris* (L.)		✓
Invasion and establishment of exotic vines and scramblers		✓
Invasion and establishment of Scotch broom (*Cytisus scoparius*)		✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)		✓

Listed Key Threatening Processes (as described in the final determination of the Scientific Committee to list key threatening processes)	Likelihood of the parts of the proposal to be classed as a KTP
Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. lat)	✓
Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.	✓
Invasion of native plant communities by *Chrysanthemoides monilifera*	✓
Invasion of native plant communities by exotic perennial grasses	✓
Invasion of the Yellow Crazy Ant, *Anoplolepis gracilipes* (Fr. Smith) into NSW	✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	✓
Loss of hollow-bearing trees	✓
Loss and/or degradation of sites used for hill-topping by butterflies	✓
Predation and hybridisation by feral dogs (Canis lupus familiaris) http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=20116	✓
Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)	✓
Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)	✓
Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish) (as described in the final determination of the Scientific Committee to list the threatening process)	✓
Predation by the Ship Rat *Rattus rattus* on Lord Howe Island	✓
Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa* Linnaeus 1758	✓
Removal of dead wood and dead trees	✓

5.3. Test of Significance Conclusion

The proposal will impose some negative ecological effects associated with land subdivision; construction of dwellings and infrastructure; intensified human occupation; and clearing of koala habitat consisting of a single Tallowwood and Forest Red Gum and an approximate 112m^2 area of juvenile sapling trees. The vegetation is, however, considered to not be critical to the survival or recovery of the local Koala population.

The proposal is considered unlikely to significantly contribute to key threatening processes or significantly reduce habitat values for the Koala or other forest species, including foraging, movement, roosting, nesting, reproduction or sheltering values in the locality and beyond. The long-term koala survival and persistence in the local area is unlikely to be significantly affected by the proposal.

The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/ compensation measures outlined in **Chapter 4**. Thus preparation of a biodiversity development assessment report by an accredited assessor is not necessary in relation to s.7.3 of the *NSW Biodiversity Conservation Act 2016*.

6. Conclusion

If approved, the proposed development will see the creation of a residential development, with houses and a road in place of what is essentially largely cleared old agricultural land. As explained in the test of significance in the preceding chapter, this will to some extent limit the movement of Koala through the landscape and to an extent discourage the movement of Koala between patches of core habitat, particularly the western and north-eastern forest patches.

The reduced footprint proposed, coupled with the mitigation measures designed to facilitate Koala movement on site (retention and planting of feed trees, plus Koala-permeable fencing), and lessen the risks (ban on dog ownership and traffic calming measures) will allow continued movement of Koalas within the site. The planting of preferred Koala feed trees will also add to food resources that occur on the subject land.

The regular occurrences of Koalas in the suburban areas of Lismore (Biolink 2017) attest to ongoing Koala movement in settled areas and indicate that it is likely that some animals will continue to move through the subject lands between forest patches.

The proposal is not likely to threaten the survival of the local population or clear significant areas of known habitat. Consistent with the findings of the Arbor Ecological test of significance, this test of significance (**Chapter 5**) concludes that no significant impact is likely and there is no requirement for a BDAR to be prepared to accompany the development application.

7. References

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APPENDIX A :

CV of Dr Robertson

Dr David Robertson - Director

Experience

Dr David Robertson is a senior ecologist with more than 30 years' experience in ecological survey, impact assessment, and research. David is the director of Cumberland Ecology.

Recent consultancy work has included:

- Senior consultant for numerous mining projects in Australia and in the Philippines;
- Court appointed expert for the NSW Land and Environment Court;
- Flora and fauna investigations for Environmental Impact Assessments;
- Development of ecological management plans and habitat reconstruction;
- Negotiations about the level of mitigation and offset measures required for flora and fauna impacts.

Environmental Impact Assessment

David has directed numerous large ecological assessments for major projects in a variety of service sectors in Australia and internationally. These include the power industry, water supply, road construction and mining.

Threatened Species Assessments

David has directed or managed numerous threatened species assessments in Australia and overseas to address legislative requirements. Projects were conducted in numerous jurisdictions. Work on threatened species has included preliminary survey and impact assessment, detailed impact assessment and mitigation, monitoring and plans of management.

Provision of Strategic Ecological Advice

Strategic ecological advice has been provided by David to aid the selection of potential development sites in Australia, Hong Kong, Philippines, Thailand, Sri Lanka and China. Included development of selection criteria (e.g. biodiversity status, land use, conservations principles such as connectivity, fragmentation, island theory, edge effects, potential for restoration).

Statements of Evidence and Expert Testimony

David is a highly experienced and credible expert witness and is capable of providing expert evidence in both terrestrial and aquatic areas of ecology. David has provided expert evidence for Australian Senate Select Committees, Australian Heritage Commission, Commissions of Inquiry, Land and Environment Court hearings and at Mining Wardens inquiries.

Education

- Bachelor of Science (Honours), Ecology. University of Melbourne, 1980.
- Doctor of Philosophy, Ecology. University of Melbourne, 1986.
- BAM Accredited Assessor Training. Muddy Boots (Accredited 2017).

Professional Affiliations

- Certified Environmental Practitioner (CEnvP).
- Environmental Institute of Australia and New Zealand (Member) and Certified Environmental Practitioner.
- Ecological Society of Australia (ESA).

Key Court Proceedings

Dr David Robertson has extensive court experience as an expert witness. He is recognised as highly qualified due to a combination of his knowledge, skill and experience, and has been called as an expert witness in a variety of court cases, panels and tribunals.

Supreme Court - NSW

- Cubelic Holdings Pty Ltd v Angas Securities Limited - LEC Proceedings 2017/00258682 (in progress)

Planning and Environment Court (QLDPEC)

- Kenlynn Pty Ltd v Noosa Shire Council- QLDPEC Proceedings 456/2018

NSW Land and Environment Court (LEC)

Class 1 Proceedings

- 7 Rivendell Way Pty Ltd v The Hills Shire Council [2018] NSWLEC 1166
- Aesthete No. 9 Pty Limited v Blue Mountains City Council [2017] NSWLEC 1199
- Anglican Community Services v Campbelltown City Council – LEC Proceedings No. 2019/101308 (in progress)
- Anglican Retirement Villages, Diocese of Sydney v Wollongong City Council [2013] NSWLEC 1181
- Arcidiacono Family Trust v Blacktown City Council - LEC Proceedings 2018/00110060
- Auspat International No. 2 Pty Ltd v Randwick City Council - LEC Proceedings No. 2018/00140781
- Aveo North Shore Retirement Villages Pty Ltd v Northern Beaches Council - LEC Proceedings 2018/00295642 (in progress)
- B T Goldsmith Planning Services Pty Limited v Blacktown City Council [2007] NSWLEC 229
- Baclon Pty Ltd v Tweed Shire Council [2013] NSWLEC 1239 - *Commissioner Morris - [107] I accept Dr Robertson's evidence.*
- Bango Wind Farm & Anor ats Ian James George Renwood/Renwood v Independent Planning Commission - [2018] NSWLEC 1632
- Bellevue Projects v Ku-ring-gai Council- LEC Proceedings 2018/00008386
- Blakeney v Mosman Council [2013] NSWLEC 100
- Bluestone Capital Ventures No. 1 Pty Ltd v The Minister for Planning [2018] NSWLEC 1676
- Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited [2013] NSWLEC 48
- Bunnings Properties P/L ats Ku-ring-gai Council. NSW Land and Environment Court Proceedings N10560 of 2015 (in progress)
- CBD Prestige Property Holding Pty Limited v Hornsby Shire Council [2006] NSWLEC 629
- Champions Quarry Pty Limited v Lismore City Council [2011] NSWLEC 1071
- Codlea Pty Ltd v Te Tseng - NSWSC Proceedings 2018/0077942
- Cohen v Penrith City Council [2020] NSWLEC 1331
- Colin Wallace v Central Coast Council LEC Proceedings No 2021/51735 (in progress)
- CPDM Pty Ltd v Ku-ring-gai Council [2018] NSWLEC 1565
- Crescent Newcastle v Newcastle City Council & Friends of King Edward Park Inc - LEC Proceedings No. 2019/291831
- D&A Milray Pty Ltd v Ku-ring-gai Council [2017] NSWLEC 1612
- Darryl Collins v Hornsby Shire Council - LEC Proceedings 2018/00237337
- Dax McBurney & Kate McBurney v Northern Beaches Council - LEC Proceedings 2018/00215027
- Denning Tweed Heads Pty Ltd v Tweed Shire Council [2018] NSWLEC 1108
- Dukor 24 Pty Ltd v Northern Beaches Council [2018] NSWLEC 1315
- Eco-Villages Australia Pty Ltd v Pittwater Council [2012] NSWLEC 49
- Elite Construction v Coffs Harbour City Council - LEC Proceedings 2018/00122374 (in progress)
- Fife Capital Pty Ltd v Cumberland Council (No.2) [2017] NSWLEC 1569
- Gandangara Local Aboriginal Council v Sutherland Shire Council [2009] NSWLEC 1105
- Gartner Trovato Architects Pty Limited v Northern Beaches Council [2017] NSWLEC 1177
- Graham Peter Meineke trading as GM Projects Development and Management v Lismore City Council LEC Proceedings No 2021/00044443 (in progress)
- Hanson South Coast Pty Limited v Eurobodalla Shire Council [2007] NSWLEC 493
- Hockitt Pastoral Company Ltd. v Great Lakes Council [2007] NSWLEC 514
- HSH Group Pty Ltd v Ku-ring-gai Municipal Council [2017] NSWLEC 1263

- Japara Healthcare v Northern Beaches Council - LEC Proceedings 2017/320651
- Julian Malnic & anor v Northern Beaches Council [2017] NSWLEC 1761
- Kennards Self Storage Pty Limited v Campbelltown City Council [2021] NSWLEC 31
- Kid Property Pty Ltd v Wollondilly Shire Council [2021] NSWLEC 1301
- Liverpool City Council v Moorebank Recyclers Pty Limited; Benedict Industries Pty Ltd v Minister for Planning (No 2) [2017] NSWLEC 53
- Maria Gialouris v Hornsby Shire Council - LEC Proceedings No. 2020/00248847
- Mairds Pty Ltd v Campbelltown City Council LEC Proceedings No 2020/00145412 (in progress)
- Maybrook Manor Pty Limited v Warringah Council [2008] NSWLEC 1160
- Menangle Sand and Soil Pty Ltd v Minister for Planning - LEC Proceedings No. 2018/342158
- Mohamad El Dana v Bankstown City Council [2008] NSWLEC 1484
- Moran v Ku-ring-gai Council [2021] NSWLEC 1404
- Northern Rivers Surveying Pty Ltd trading as Northern Rivers Land Solutions v Ballina Shire Council [2020] NSWLEC 1101
- Palm Lake Works Pty Ltd v Ballina Shire Council - LEC Proceedings No. 2018/326045 (in progress)
- Paloma Blanca Pastoral Pty Ltd v Wingecarribee Shire Council - LEC Proceedings No. 2018/334118
- Penrith Lakes Development Corporation Ltd v Penrith City Council [2015] NSWLEC 9
- Peter Blake v Ku-ring-gai Council LEC Proceedings No 2020/00260875 (in progress)
- Port Stephens Council ats Unicomb - LEC Proceedings No. 2018/00352721 (in progress)
- Randwick City Council ats Auspat International No, 2 Pty Ltd - LEC Proceedings 2018/20084 (in progress)
- Residents Against Intermodal Development Moorebank Incorporated v Minister for Planning [2018] NSWLEC 1130
- Rocla Materials Pty Ltd & Anor ats The Trustee for the Gerald and Catherine Barnard Family Trust t/a Australian Walkabout Wildlife Park Pty Ltd. [2015] NSWLEC 1465
- RVA Australia Pty Ltd v Sutherland Shire Council No. 2 [2017] NSWLEC 1449
- Samar Holdings (Aust) Pty Ltd v Sutherland Shire Council - LEC Proceedings No. 2019/00043230 (in progress)
- Sealark Pty Ltd v Independent Planning Commission of New South Wales - NSWLEC 19/78149 (in progress)
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- SLushY Pty Limited v Ku-ring-gai Council [2021] NSWLEC 1394
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- Statewide v Canterbury-Bankstown Council - LEC Proceedings 2018/00193736
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- The Trustee for Gordon Cres Development Unit Trust v Lane Cove Municipal Council - LEC Proceedings 2018/00089765
- Warriewood Vale Pty Ltd v Northern Beaches Council [2016] NSWLEC 77
- Williamtown and Surrounds Resident's Action Group Incorporated v Williamtown Sand Syndicate Pty Limited and Independent Planning Commission - LEC Proceedings 2018/174506
- Willow Properties Pty Ltd and Paloma Blanca Pastoral Pty Ltd v Wingecarribee Shire Council [2018] NSWLEC 1493
- WillowTree Planning Pty Ltd v Hornsby Shire Council - NSWLEC 2018/292092
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- Woolcott Group Pty Limited v Rostry Pty Limited & Anor [2016] NSWLEC 1113
- Zeina Itaoui v Wollongong City Council – LEC Proceedings 2019/103570 (In progress)

Class 2 Proceedings

- NSW Crown Holiday Parks Land Manager trading as Reflections Holiday Parks Terrace Reserve v Byron Shire Council (No 2)

Class 3 Proceedings

- Calarco and Anor v Liverpool City Council - LEC Proceedings No. 2019/23960 (in progress)
- Fletcher v Roads and Maritime Services - LEC Proceedings 2016/158967
- Cannchar Pty Ltd v Queanbeyan-Palerang Regional Council [2018] NSWLEC 1234
- Kalambaka Pty Limited v Minister Administering the Environmental Planning and Assessment Act 1979 [2009] NSWLEC 57
- Maloney v Minister Administering the Environmental Planning and Assessment Act 1979 [2011] NSWLEC 121

Class 4 Proceedings

- Hoxton Park Residents Action Group v Liverpool City Council (No 4) [2012] NSWLEC 67
- The Hills Shire Council v Ko-veda Holiday Park Estate Limited & Ors - LEC Proceedings No. 2019/13074
- Michael Ryan v Winten (No 12) Pty Ltd) and ors – LEC Proceedings 2019/6908 (in progress)
- Peter James Harris ats Inland Rivers - LEC Proceedings 2017/340269 (in progress)

Class 5 Proceedings

- Hornsby Council v Henlong Property Group Pty Ltd & Jian Zhou - LEC Proceedings 2017/385910
- Chief Executive of the Office of Environment and Heritage v Rinaldo (Nino) Lani [2012] NSWLEC 115
- AJ Lloyd - [41] Moreover, I have no hesitation in accepting Dr Robertson's evidence that there is no basis for concluding that any large old trees with hollows were removed.
- Chief Executive , Office of Environment and Heritage v Borah - LEC Proceedings No. 2019/32083
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- Chief Executive of the Office Of Environment and Heritage v John William Edwin Corlis LEC Proceedings 2019/63544-63547 (in progress)
- Director-General of the Department of Environment, Climate Change and Water v Walker Corporation Pty Ltd (No 2) [2011] NSWLEC 229
- Environment Protection Authority v Coal and Allied Operations Pty Ltd. [2013] NSWLEC 134
- Environment Protection Authority v Riverina (Australia) Pty Ltd. [2014] NSWLEC 191
- Kirsty Ruddock v Bao Lin Pty Ltd (ACN 162 411 681) LEC Proceedings No 2020/8682 (in progress)
- Sutherland Shire Council v Benedict Industries Pty Ltd (No 7) [2015] NSWLEC 184

Panel Experience

- Wollongong Coal Pty Ltd (WCL) – Risk Assessment Panel
- South Coast Sensitive Urban Lands Review – Experts Panel

Peer Reviews

- Cumberland Ecology (2018 & 2019). Review of Matters of National Environmental Significance Report: NSW Health Infrastructure Tweed Valley Hospital. Prepared by Greencap. Carlingford Court, NSW.
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- Cumberland Ecology (2011). Peer Review regarding Assessment of Significance (prepared by Ecological Australia) and Ecology Referral (by Ku-Ring-Gai Council dated 6 December 2011) for Knox Grammar School. Carlingford Court, NSW.
- Cumberland Ecology (2011). Peer Review of Wallarah Underground Coal Project. Prepared for Hansen Bailey. Carlingford Court, NSW.
- Cumberland Ecology (2010). Re: Review of Revised Statement of Commitments and Offset Strategy - Moolarben Coal Project. Prepared for Department of Planning. Carlingford Court, NSW.
- Cumberland Ecology (2011). Review Ecological Assessment Reports for Proposed Retail Development for Woolworths Baulkham Hills. Prepared by Hunt & Mills. Carlingford Court, NSW.
- Cumberland Ecology (2012). Review of Vegetation Management Plan (VMP) for the Prospect Aquatic Investments Pty Ltd for the Wet‟n‟Wild Sydney theme park. Prepared by Eco Logical Australia Pty Ltd. Carlingford Court, NSW.
- Cumberland Ecology (2009). Review of Flora and Fauna Impact Assessment (FFIA) for the M2 Upgrade Project. Prepared by M2 Upgrade Project Alliance. Carlingford Court, NSW.

APPENDIX B :

Michael Hallinan Test of Significance for Koala in relation to proposed residential subdivision of lot 4 DP 406893

B.1. Introduction

Arbor Ecological was engaged by Praedium Partnership to prepare a test of significance report for a proposed residential subdivision of lot 4 DP 406893, 658 Ballina Road, Goonellabah in the Lismore Local Government Area. That test, the "Arbor Ecological test of significance" was based upon a preceding footprint proposed for the development. That footprint is illustrated in **Figure 2** in this report and included provision for 15 lots.

The Arbor Ecological test of significance concluded that the previous version of the proposed residential development would not have a significant impact upon the local population of the Koala and so no Biodiversity Development Assessment Report is required to further investigate the impacts of the proposal on this species.

The entire Arbor Ecological Report is included within this appendix for to provide background information and for comparative purposes to contrast the preceding development with the current proposal.

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Date 11/12/21

Praedium Partnership
Attn. Craig Adams

Re: Threatened Species Test of Significance for the Koala (*Phascolarctos cinereus*) in relation to proposed residential subdivision of lot 4 DP 406893

1. Background

Arbor Ecological was engaged by Praedium Partnership to prepare a test of significance report for a proposed residential subdivision of lot 4 DP 406893, 658 Ballina Road, Goonellabah in the Lismore Local Government Area, hereafter referred to as the site[1], refer to **Figure 1**.

The following test of significance has been undertaken in response to provisions of s.7.3 of the *NSW Biodiversity Conservation Act 2016* to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. The test is also referred to as the 5-part test.

This assessment follows the *Threatened Species Test of Significance Guidelines* (NSW Office of Environment and Heritage (OEH), 2018, *Threatened Species Test of Significance Guidelines*, including assessment criteria definitions and guiding principles. It is understood that no threatened species likelihood of occurrence assessment was required in this instance since the Koala (*Phascolarctos cinereus*) was identified as the sole species requiring further assessment and inclusion in a test of significance.

Potential impacts to the Koala and koala habitat are the focus of this assessment. Impact assessment focuses on proposed vegetation clearing; land subdivision and construction of dwellings and infrastructure; and intensified human occupation of the site. A number of impact avoidance, minimisation and offset compensation measures are proposed as outlined below.

[1] **The site** is the total area which may be directly affected by the proposal. The **study area** refers to the site and any additional areas that are likely to be affected by the proposal, either directly or indirectly. For the purposes of this assessment the site area and study area are considered to be the same.

It is understood that the proposed development was incorrectly assessed as a *small impact development* and should have been assessed as a *large impact development* in relation to the Comprehensive Koala Plan of Management for south-east Lismore (CKPoM)[2]. This is because of its potential impact on koala habitat connectivity. If the large-scale impact assessment pathway is followed, then the existing koala record from the site would have satisfied requirements for recognition of the site as core koala habitat.

A field assessment of koala habitat was undertaken by ecologist Michael Hallinan on 09/11/21. This followed koala habitat assessments by Birdwing Ecological Services (2021)[3] and North Coast Environmental Services (2018)[4]. The field assessment by Michael Hallinan found no signs of koala use or occupation of the site including koala scats or characteristic pock/ scratch marks on smooth-barked trees. Similarly, there were no signs of koala site use or occupation by Birdwing Ecological Services (2021) and North Coast Environmental Services (2018).

The site is currently clear of mature native forest vegetation having been cleared some time ago for horticultural pursuits. Since the time of clearing, the site has been managed partly as an orchard, and regularly mown.

The conservation status, habitat requirements and listed threats for the Koala are outlined as follows:

2. Koala Ecology

2.1. Conservation Status

NSW status: Vulnerable, Protected - *Biodiversity Conservation Act 2016*
Commonwealth status: Vulnerable - *Environment Protection and Biodiversity Conservation Act 1999*

2.2. Habitat and Ecology Notes[5]

- Inhabit eucalypt woodlands and forests.
- Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.
- Inactive for most of the day, feeding and moving mostly at night.
- Spend most of their time in trees, but will descend and traverse open ground to move between trees.
- Home range size varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size.

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[2] Lismore City Council (2013) *Comprehensive Koala Plan of Management for south-east Lismore*. Lismore City Council, Lismore, NSW
[3] Birdwing Ecological Services, 2021, *Additional information – addressing requirements of the Lismore Comprehensive Koala Plan of Management, Proposed residential subdivision at 658 Ballina Road, Goonellabah*. 20 September 2021, unpublished report.
[4] North Coast Environmental Services, 2018, *Koala Habitat Assessment Report, v1, Lot 4 DP 406893, 658 Ballina Road, Goonellabah*. September 2018, unpublished report.
[5] **Species habitat, ecology and threat notes** sourced from NSW Office of Environment & Heritage threatened species profiles at www.environment.nsw.gov.au

- Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.
- Females breed at two years of age and produce one young per year.

2.3. Threats[5]

Koalas are threatened by a number of human-induced threats and these have been documented in the KPoM, including:

- Loss, modification and fragmentation of habitat.
- Vehicle strike.
- Predation by roaming or domestic dogs.
- Intense prescribed burns or wildfires that scorch or burn the tree canopy.
- Koala disease (e.g. *Chlamidia*).
- Heat stress through drought and heatwaves.
- Human-induced climate change.
- Inadequate support for fauna rehabilitation.
- Poor understanding of sources of trauma and mortality.
- Poor understanding of population distribution and trend.
- Poor understanding of animal movements and use of habitat.

2.4. Records from the locality[6]

As described in the KPoM a viable local population of koalas occurs in the locality.

Bionet search results show 2711 koala records within a 10km^2 area centred on the site since 1960. The following information was noted from an analysis of records in the vicinity of the site, refer to **Figure 2**:

- Koalas have been recorded within or close to the site between 1991 and 2019. The 1991 record was of an animal observed as "*Dead* and *Cause of death unknown"*. It is understood that Council's representative is aware of three additional BioNet koala records from the site from the period between 1991 and 2019. These records are however not available to registered Bionet public account holders.
- Several koala records from adjoining and nearby properties and the long term persistence of a koala population in the locality of the site is acknowledged.
- The majority of nearby koala records occur to the west and northwest of the site and most records are from the past 9 years since 2012.

[6] **The locality** refers to land within a 10km x 10km area centred on the site.

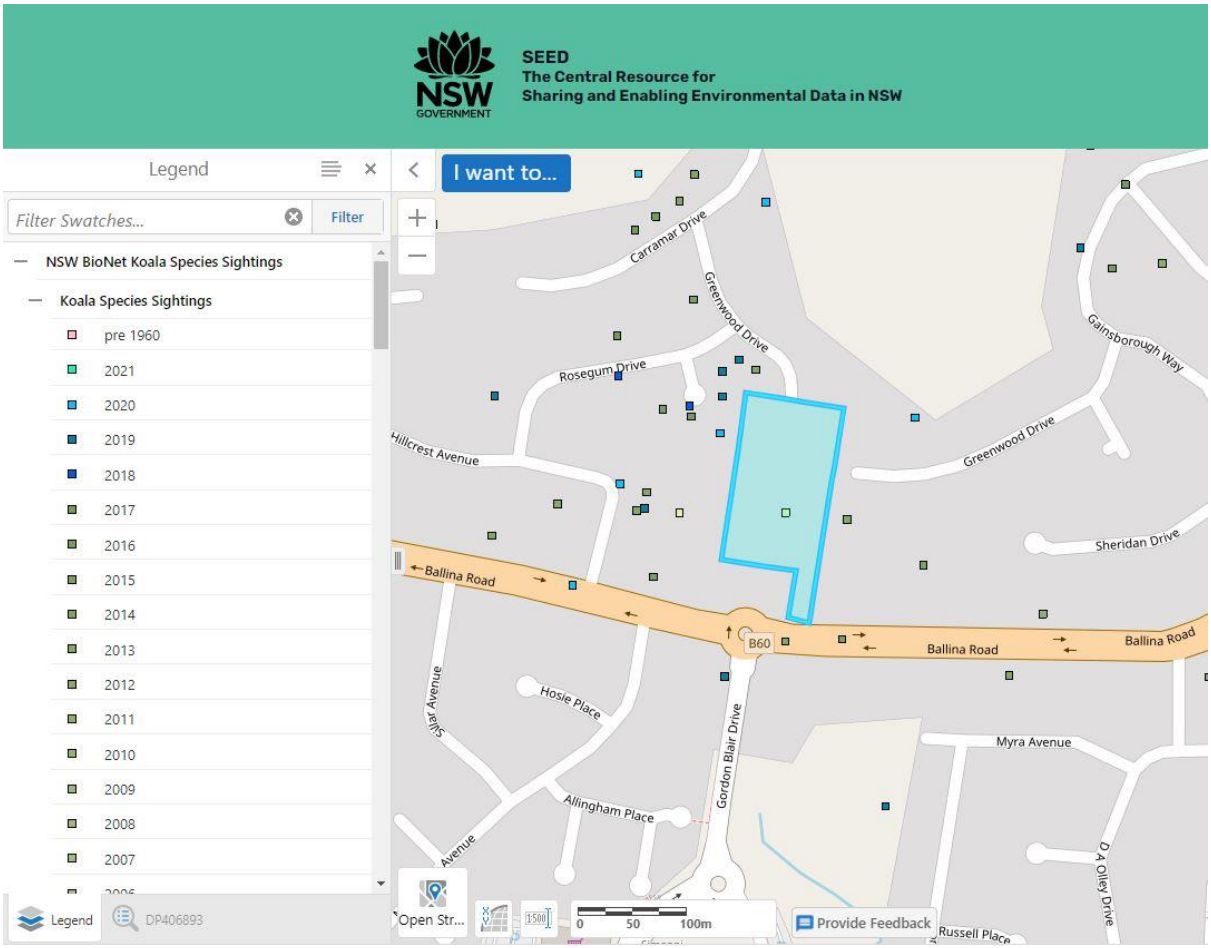


Figure 2. Koala records within and surrounding the site, source SEED, NSW Government.

2.5. Habitat mapping for the site and surrounds

The following information was noted from an analysis of Lismore City Council environmental mapping of the site and surrounds, refer to **Figure 3**:

- The area of the site is included in the Koala Planning Area of the CKPoM.
- Sizeable areas of koala habitat occur on adjoining properties to the north and west of the site. These are mapped by Lismore City Council as *Primary Koala Habitat* and *HCV Vegetation and Habitats*. Well developed, tall mature koala food trees occur on these properties. Mapped *Primary Koala Habitat* also exists to the north of the site amongst residential properties and further to the north on larger rural lots.
- Mapped *Primary Koala Habitat* in the western and northern portions of the site consists of juvenile and semi-mature koala food trees and a large clump of exotic weedy vegetation concentrated to the southwest.
- No mapped *Wildlife Corridors* occur in the area of the site or surrounding properties.

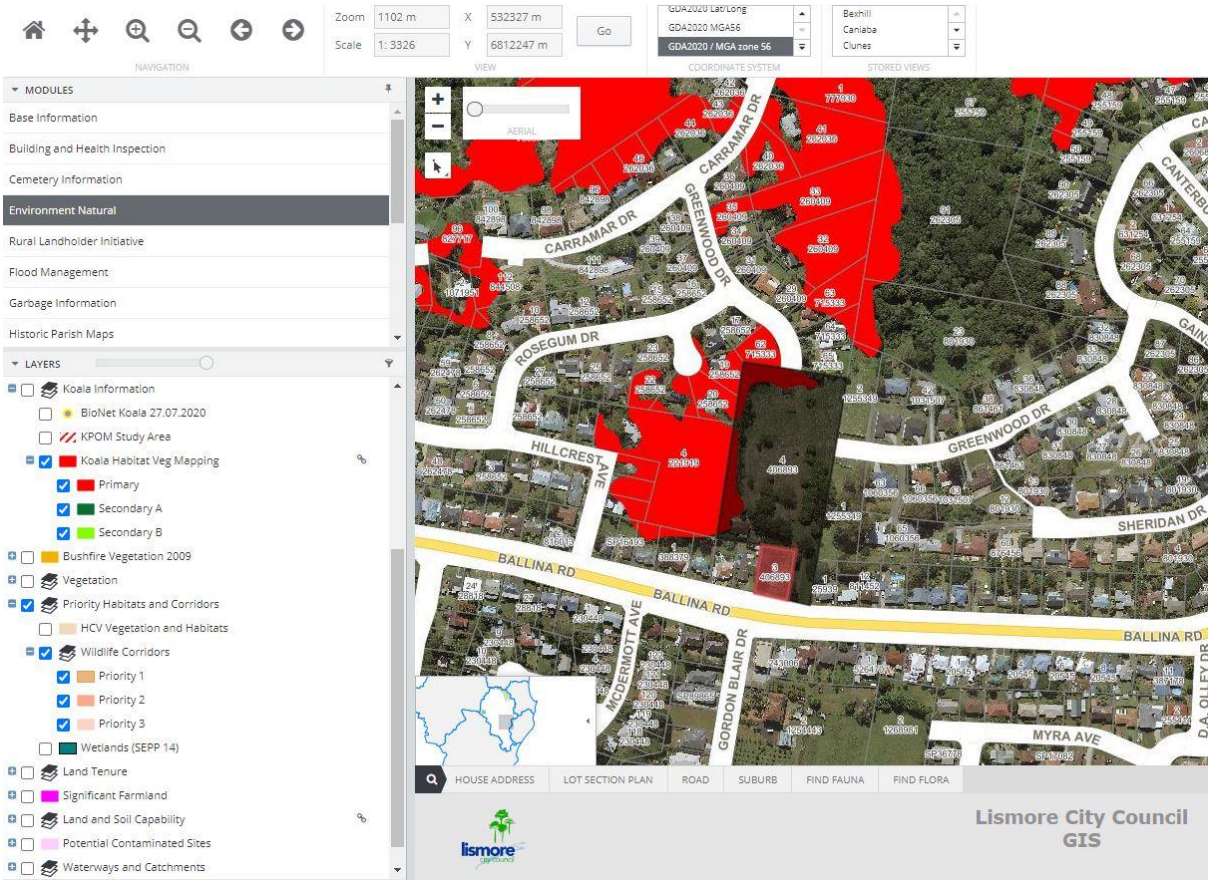


Figure 3. Koala records within and surrounding the site, source Lismore City Council.

2.6. Koala habitat connectivity and movement corridor values

Despite the largely cleared nature of the site, the land is recognised as a movement corridor for the local koala population and therefore represents core koala habitat. There are patches of forest habitat to the north and west of the subject site that contain koala feed trees and it is likely that koalas are traversing the site to move between these patches. It is also likely to be used by younger animals, particularly males, to disperse to other habitat areas.

An analysis of koala records and koala habitat in the vicinity of the site indicates that the western and northern portions of the site offer the best opportunities to support koala movement through and around the site. The following information supports this finding:

- The Bruxner Highway directly adjoins the site to the south creating a barrier to free and safe koala movement south of the site where a highly built and urbanised environment exists. Biolink (2017)[7] identify this area as *Black Spot 4 West* for koala vehicle-strike in the Lismore LGA. A number of NSW BioNet koala vehicle strikes are recorded locally including one on the Bruxner Highway

[7] Biolink, 2017, *Koala Habitat & Population Assessment, Lismore Local Government Area (part)*. Final Report to Lismore City Council, September 2017, accessed 07/12/21, www.lismore.nsw.gov.au/managing-the-health-and-habitat-of-our-koala-population-in-south-east-lismore.

directly adjacent to the southern portion of the site. Poor Koala habitat connectivity and movement corridors occur to the south of the site.

- NSW BioNet and Biolink (2017) note numerous records of dog attacks of koalas within urbanised areas surrounding the site. The persistence of forested areas of koala habitat to the west and north of the site offer some protection against dog attack.

In recognition of the importance of the thoroughfare that the subject land provides for koalas, the proposed development has been modified to make the site permeable to koalas post development. The suite of impact avoidance and impact mitigation measures proposed if the site is developed are outlined below to support koala movement through and around the site, particularly to the west and north where the best koala habitat connectivity and movement corridor values exist.

3. Impact Avoidance and Minimisation

The proposed development has been modified to facilitate continued movement across it by the local koala population.

Proposed impact avoidance and minimisation measures are as follows:

- The subdivision layout has been carefully planned to avoid the need for removal of koala food trees; permit free koala access to retained trees and koala habitat plantings; and allow free and safe koala movement through the site and between areas of adjoining habitat, particularly to the west and north where the best koala habitat connectivity and movement corridors exist.
- Koala food tree removal has been minimised to two trees above 10 cm DBH: T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH).
- Additionally, a patch of smaller 122 regenerating koala food tree seedlings/saplings are required to be removed within an area of approximately 112m^2. The extremely crowded growing environment for these saplings would likely lead to natural thinning of juvenile/sapling trees if trees were not removed. The DBH of saplings range from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH. These trees will be offset in accordance with the KPoM, with replantings proposed for a suitable Council reserve nearby (see below).
- Remaining scattered regrowth koala food trees (i.e. T1, T2, T3, T4 and T6) will be retained; given legal protection status via a legal covenant on property title, e.g. Section 88B/E; and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 1**.
- Free and safe movement of koalas will be facilitated across the west and northern portions of the site and between adjoining areas of koala habitat via a Koala Corridor (refer to **Figure 1**) which will effectively incorporate all retained scattered regrowth koala food trees and proposed plantings in the vicinity of proposed lots 8 to 15.
- Lot boundary fences to the west and north and between lots 8 and 9 are to be koala permeable fences that does not impede koala movement as outlined in s.4.6.2 of the CKPoM, e.g. post and wire fence with bottom strand being plain wire placed a minimum of 300 mm above the ground. This will be achieved via a legal covenant on property title, e.g. Section 88B/E.
- No stormwater engineering works will be carried out in the Koala Corridor.
- The keeping of domestic dogs on the site is to be prohibited via a legal covenant on property title, e.g. Section 88B/E, to minimise the risk of harm to koalas.

- Development consent for the installation of any swimming pools on the site will be conditional on the provisions outlined in s.4.6.2 of the CKPoM to minimise the risk of harm to koalas.
- Road traffic management within the site will be in line with the provision outlined in s.4.6.2 of the CKPoM to minimise the risk of harm to koalas, i.e. *appropriate road design standards, warning signage, traffic calming devices, and roadside lighting which restrict motor vehicles to a maximum speed of 40 kilometres per hour within the subject site*.
- All retained koala food trees on site will have Tree Protection Zone (TPZ) fence specifications (e.g. fence locations and performance criteria) detailed in a tree protection plan drawing for the duration of the construction process. The tree protection plan drawing will be prepared in accordance with *AS4970 protection of trees on development sites* by a minimum AQF level 5 Arborist.
- To ensure that no koalas are directly impacted, ecologist pre-clearing surveys will be undertaken immediately prior to clearing on each day of clearing and spotter catcher/ ecologist monitoring of clearing works will be undertaken throughout the clearing process.
- The following unexpected fauna find procedure will be followed in the case of an unexpected fauna find during clearing works:
  - Immediately stop works.
  - Do not approach the animal.
  - If necessary, the project ecologist will contact a local wildlife care group (e.g. WIRES Ph 1300094737 or Friends of the Koala Ph 6622 1233) and/ or veterinarian who can organise for the care of any injured fauna.
  - A 10m no-work exclusion zone would be established around any non-threatened fauna encountered during works; and a 25m exclusion zone established around any threatened fauna (e.g. koala) until the animal/s voluntarily moves on.
- Koala habitat values and protection measures will be clearly communicated to machinery operator/s and project personnel during pre-start/ toolbox meetings.

4. Impact Offset/ Compensation

The clearance of koala feed tree species will be offset according to measures from the KPoM.

Proposed impact offset/ compensation measures are as follows for residual impacts that cannot practically be avoided or minimised:

- *For removal of T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH)*, ten (10) Parramatta Red Gum/ Drooping Red Gum (*Eucalyptus parramattensis*) are to be planted on the site in strategic locations within the street verge and public reserve in the northern portion of the site in the vicinity of proposed lots 8 to 15. These plantings are planned to create koala habitat islands and linkages to promote free and safe koala movement with traffic calming measures, permeable fences and without domestic dog threats. The planting design will be subject to Council review and approval. No plantings are to occur within the Koala Corridor due to APZ performance requirements. No plantings are to occur in the southern portion of the site so as to not encourage

koala movement in the area of the Bruxner Highway which is recognised as a koala vehicle collision black spot.

- *For removal of 122 koala food tree saplings (DBH from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH) within an area of approximately 112m^2*, compensatory works will be undertaken in line with *Appendix 5 – Habitat Compensation Policy* and outlined in a VMP/PoM approved by Council and fully funded by the proponent with a minimum five-year management period, as per the CKPoM. Habitat compensation works are proposed to be undertaken on a public reserve of Council's choice, e.g. the nearby Camelot Reserve Goonellabah. Site constraints prohibit further tall koala food tree plantings on the site.

5. Test of Significance Assessment Criteria

The following matters are to be taken into account for the purposes of determining whether a proposed development is likely to significantly affect the Koala or its habitat:

(a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposed development will not significantly impact the habitat of the koala population described in the KPoM such that the local population would be likely to be placed at risk of extinction.

The subject land is important to the local population of koalas as it is a thoroughfare and some koalas from the local population would periodically traverse the site when dispersing and/or moving between areas of primary habitat, such as occur to the north and west of the subject land.

There is also regenerating saplings of primary feed tree species on the subject land that could, in time provide more substantial foraging opportunities for koalas.

As explained above (in **Sections 3 and 4**), the proposal has been modified to permit koalas to continue to move across the site, maintaining habitat connectivity between primary habitats to the north and west of the subject land.

Feed trees will be largely maintained and additional specimens of red gums (*Eucalyptus paramattensis*) replanted. Dogs are not permitted to be kept on site, and there will be traffic calming measures installed along the interior roads to slow traffic.

Land to the west, north and forested areas elsewhere in the locality support relatively large areas of well-developed koala habitat that will not be affected by the proposal and will continue to provide habitat for resident koalas in the locality.

Removal of dense exotic weed cover in the southwest portion of the site to be cleared for bushfire protection will permit improved koala access to tall mature koala food trees on the adjoining lot to the southwest. Exotic weed species include Lantana, Camphor Laurel, Broad-leaved Privet, Easter Cassia/ Senna, Yellow Bells, Coffee, Loquat, White Sapote, Tobacco Bush, Passionfruit species; and the native weed Umbrella Tree.

The feed tree species to be cleared as a result of the proposal will be offset as per the KPoM, with replanting to occur in a local Council reserve that is within the land used by the local population.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. Eleven endangered ecological communities are recorded in the locality of the site on NSW BioNet. However, the field assessment determined that vegetation in the study area did not have the structural and floristic integrity to be consistent with any NSW listed Endangered Ecological Community (EEC) or Commonwealth EPBC Act listed Threatened Ecological Community (TEC).

Cleared open areas, a dense exotic weed cover area to the southwest and exotic orchard trees are not consistent with any NSW BioNet listed Plant Community Type (PCT). Isolated areas of native vegetation most closely matches the NSW BioNet listed Plant Community Type (PCT) 1073 *Pink Bloodwood - Tallowwood moist open forest of the far northern ranges of the NSW North Coast Bioregion*. This PCT is not associated with any EEC or TEC.

(c) In relation to the habitat of a threatened species or ecological community:

> ***(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***

The proposed development will not block koala movement across the subject land and habitat trees will be retained on site, with only limited clearing.

The proposal will result in the clearing of two regrowth trees, i.e. T5 (Tallowwood, 17cm DBH) and T9 (Forest Red Gum, 10cm DBH), and 122 regrowth koala food tree saplings within an area of approximately 112m^2. The DBH of saplings range from 0.5cm to 6cm including 47 < 1cm DBH and 12 > 4cm DBH.

Remaining scattered regrowth koala food trees (i.e. T1, T2, T3, T4 and T6) will be retained; given legal protection status via a legal covenant on property title, e.g. Section 88B/E; and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 1**.

Removal of dense exotic weed cover in the southwest portion of the site to be cleared for bushfire protection will permit improved koala access to tall mature koala food trees on the adjoining lot to the southwest.

The feed tree species to be cleared as a result of the proposal will be offset as per the KPoM, with replanting to occur in a local Council reserve that is within the land used by the local population.

(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

As described in Sections 3 and 4 above, the project has been designed to be permeable to koalas and so the proposal will not significantly increase habitat fragmentation, isolate areas of koala habitat or restrict movement of koalas through or around the site or throughout the broader landscape.
Most of the larger regrowth of koala food trees to be retained will be given legal protection status via a legal covenant on property title, e.g. Section 88B/E, and remain available for use by the local koala population. This includes trees within *Easement 'F'* as shown on **Figure 1**. Proposed koala habitat plantings in the northern portion of the site will increase available habitat.

Free and safe movement of koalas will be facilitated across the west and north of the site and between adjoining areas of koala habitat via a Koala Corridor which will effectively incorporate retained scattered regrowth koala food trees; and link with proposed strategic plantings within the street verge and public reserve in the northern portion of the site in the vicinity of proposed lots 8 to 15. Lot boundary fences to the west and north and between lots 8 and 9 are to be a koala permeable fence that does not impede koala movement as outlined in the CKPoM, e.g. post and wire fence with bottom strand being plain wire placed a minimum of 300 mm above the ground. This will be achieved via a legal covenant on property title, e.g. Section 88B/E.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Due to modifications of the proposal, the impacts on important habitat will be limited and will not have a significant impact on the local occurrence of koalas.

The subject land, though now largely cleared, forms part of a movement corridor for the local population. It facilitates periodic movement of koalas between patches of nearby primary habitat, such as occurs to the immediate north and west of the subject land.

There will be two trees greater than 10 cm DBH removed, and a patch of smaller seedlings/saplings. All such trees will be offset as required under the KPoM.

The importance of the movement corridor, and the regenerating feed trees on site have been acknowledged and the proposed development redesigned as explained in Sections 3 and 4 above.

The regenerating feed trees proposed to be removed and the limited additional fragmentation of habitat will not prevent koalas moving across the site. There will also be additional trees planted on site that will offset the loss of the regenerating specimens to be removed.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

Declared Areas of Outstanding Biodiversity Value (AOBV) represent the most valuable sites for biodiversity conservation in NSW (OEH 2018).

No Areas of Outstanding Biodiversity Value (AOBV) listed under the *Biodiversity Conservation Regulation 2017* occur on or in close proximity to the subject site and the proposal will not impact any declared area of outstanding biodiversity value.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposal will entail limited clearing of regenerating native vegetation, which is a key threatening process, as explained below. However, this will be restricted to two saplings above 10 cm DBH and a patch of smaller seedlings, with all cleared vegetation to be offset following the requirements of the CKPoM.

A threatening process is defined under the *Biodiversity Conservation Act 2016* as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities.

In addition to deciding whether the action/activity constitutes a key threatening process (KTP), consideration must also be given to whether the proposal is likely to exacerbate a KTP. Species listed in the determination as being ‘at risk’ warrant particular consideration if these species are known or likely to occur within the study area of the development or activity.

The current list of key threatening processes listed under the BC Act and an assessment of whether parts of the proposal constitutes or exacerbates a KTP is shown below in **Table 1.**

Table 1. Key Threatening Process (KTP) assessment

Listed Key Threatening Processes (as described in the final determination of the Scientific Committee to list key threatening processes)	Likelihood of the parts of the proposal to be classed as a KTP		
	Likely	Possible	Unlikely
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, *Manorina melanocephala* (Latham, 1802)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process)			✓
Anthropogenic climate change			✓
Bushrock removal (as described in the final determination of the Scientific Committee to list the threatening process)			✓
Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process)	✓		
Competition and grazing by the feral European Rabbit, *Oryctolagus cuniculus* (L.)			✓
Competition and habitat degradation by Feral Goats, *Capra hircus* Linnaeus 1758			✓
Competition from feral honey bees, *Apis mellifera* L.			✓
Death or injury to marine species following capture in shark control programs on ocean beaches (as described in the final determination of the Scientific Committee to list the key threatening process)			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments (as described in the final determination of the Scientific Committee to list the key threatening process)			✓
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners			✓
Habitat degradation and loss by Feral Horses (brumbies, wild horses), Equus caballus Linnaeus 1758			✓
Herbivory and environmental degradation caused by feral deer			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Importation of Red Imported Fire Ants *Solenopsis invicta* Buren 1972			✓
Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family			✓

Listed Key Threatening Processes (as described in the final determination of the Scientific Committee to list key threatening processes)	Likelihood of the parts of the proposal to be classed as a KTP		
	Likely	Possible	Unlikely
Myrtaceae			
Introduction of the large earth bumblebee, *Bombus terrestris* (L.)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. lat)			✓
Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.			✓
Invasion of native plant communities by *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses			✓
Invasion of the Yellow Crazy Ant, *Anoplolepis gracilipes* (Fr. Smith) into NSW			✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees			✓
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)			✓
Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)			✓
Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish) (as described in the final determination of the Scientific Committee to list the threatening process)			✓
Predation by the Ship Rat *Rattus rattus* on Lord Howe Island			✓
Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa* Linnaeus 1758			✓
Removal of dead wood and dead trees			✓

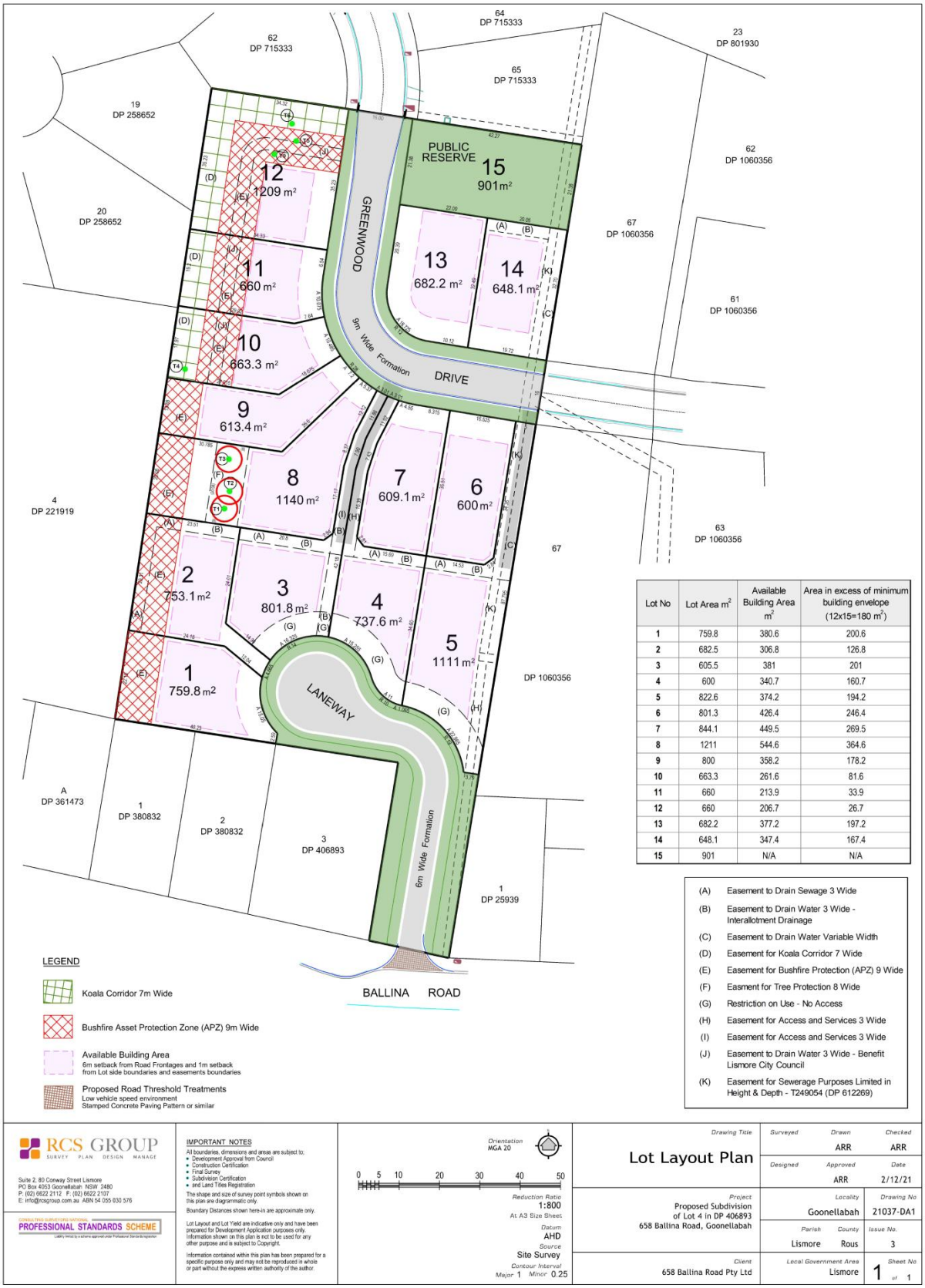
The proposal will contribute incrementally and cumulatively to the Key Threatening Process *Clearing of native vegetation*. The extent to which the proposed tree clearing contributes to this threatening process is, however, considered to be negligible considering the scale of proposed clearing, i.e. a single Tallowwood (17cm DBH), Forest Red Gum (10cm DBH) and an approximate 112m^2 area of juvenile sapling trees.

5.1. Test of Significance Conclusion

The proposal will impose some negative ecological effects associated with land subdivision; construction of dwellings and infrastructure; intensified human occupation; and clearing of koala habitat consisting of a single Tallowwood and Forest Red Gum and an approximate 112m^2 area of juvenile sapling trees. The vegetation is, however, considered to not be critical to the survival or recovery of the local Koala population.

The proposal is considered unlikely to significantly contribute to key threatening processes or significantly reduce habitat values for the Koala or other forest species, including foraging, movement, roosting, nesting, reproduction or sheltering values in the locality and beyond. The long-term koala survival and persistence in the local area is unlikely to be significantly affected by the proposal.

The proposed development is considered unlikely to place the local populations of any listed threatened species or endangered ecological community at significant risk of extinction or adversely affect the recovery of local populations, especially with effective implementation of proposed impact avoidance, minimisation and offset/ compensation measures outlined in **Sections 3 and 4**. Thus preparation of a biodiversity development assessment report by an accredited assessor is not necessary in relation to s.7.3 of the *NSW Biodiversity Conservation Act 2016*.



Lot No	Lot Area m²	Available Building Area m²	Area in excess of minimum building envelope (12x15=180 m²)
1	759.8	380.6	200.6
2	682.5	306.8	126.8
3	605.5	381	201
4	600	340.7	160.7
5	822.6	374.2	194.2
6	801.3	426.4	246.4
7	844.1	449.5	269.5
8	1211	544.6	364.6
9	800	358.2	178.2
10	663.3	261.6	81.6
11	660	213.9	33.9
12	660	206.7	26.7
13	682.2	377.2	197.2
14	648.1	347.4	167.4
15	901	N/A	N/A

Figure 1. Lot Layout Plan, source RCS Group.

APPENDIX C :

DAWE Summary of Key Risks to Koala in NSW and Queensland

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Table 4 Threats impacting the koala

Threat	Status and severity a	Evidence
Climate change driven processes and drivers		
Loss of climatically suitable habitat	• Status: current and future • Confidence: known • Consequence: severe • Trend: increasing • Extent: across the entire range	Areas that are climatically suitable for koalas are contracting (Adams- Hosking et al. 2011). Climate change predictions indicate drier, warmer conditions across the koala's range. Current and future climate change projections indicate a progressive eastward and southwards contraction in the koala's suitable climate envelope and consequent suitable habitat (Adams-Hosking et al. 2011). Modelled climatic suitability from 2010 to 2030 indicates a 38-52% reduction for the listed population (Adams-Hosking et al. 2011), and forecast a 62% decline in koala habitat by 2070. This represents a 79% loss in Queensland and 31% loss in New South Wales (Runge et al. 2021a). The effects of climate change may play out through increased mortality associated with heat wave events and droughts, declines in reproduction rates associated with changes in food quality and availability, changes to movement patterns, exposure to diseases and other factors, as well as effects of climate change on fire regimes (see below for further details on these mechanisms).
Increased intensity/frequency of drought	• Status: historical, current and future • Confidence: known • Consequence: severe • Trend: increasing • Extent: across part of its range	Over the last 21 years, South East Australia has experienced two of its worst droughts in the historical record: the Millennium Drought (2000-2009) and the Big Dry (2017-2019). Low rainfall has been linked with physiological stress to koalas due to low moisture levels, causing negative effects on population viability (Davies et al. 2013). These periods of abnormally low rainfall, particularly in the west, have been associated with the decline, and in some cases, the crash of koala populations, forcing population contraction to critical riparian areas in some areas (Seabrook et al. 2011; DPIE 2020). In extreme cases, e.g., Springsure in Central Queensland, the areas worst affected by drought were along creeks where extensive tree death (die back) occurred and negatively impacted koala populations (Ellis et al. 2010b).

Threat	Status and severity a	Evidence
		In the future, average winter and spring rainfall are predicted to continue to decline across the koala's range (BoM 2021a). By the late twenty-first century, the frequency of moderate, severe, extreme and exceptional terrestrial water storage droughts is projected to increase substantially due to a reduction in the frequency of near-normal and wet conditions in Australia (Pokhrel et al. 2021). Cumulative frequency of droughts across the koala range are projected to increase by 30% by 2100 under RCP6.0 (the climate pathway we are on) (NOAA 2021). The frequency of severe and extreme droughts (Drought Severity Index >-1.6) will increase from 2.7% to 19.5%. This suggests that koala habitat will be in drought half the time, and severe drought every 5 years, on average. This is an increase from the currently observed frequency of drought every 5 years and severe drought every 30 years. Droughts also interact with threats posed by inappropriate fire regimes.
Increased intensity/frequency of heatwaves	• Status: historical/current/future • Confidence: known • Consequence: severe • Trend: increasing • Extent: across the entire range	Heatwaves can be defined as ≥ 3 consecutive days of unusually high night-time and day-time temperature (BoM 2021b). Due to climate change, average temperatures across the koala's range will continue to increase across all seasons resulting in an increased frequency and intensity of heat stress days and heat wave episodes (BoM 2021a). Heat stress threats will synergistically interact with drought, further exacerbating the impacts of reduced water availability. During periods of extreme heat stress koalas are also known to stop eating and starve to death (K Youngentob, pers comm 22/3/21).
Increased intensity/frequency of bushfire	• Status: historical/current/future • Confidence: known • Consequence: severe • Trend: increasing • Extent: across part of its range	During the summer of 2019-2020, >3.5 million ha of koala habitat burnt across Queensland, New South Wales and the Australian Capital Territory (DAWE 2021a). Recent estimates suggest a population decline of 10% (or as much as 17%, with 80% confidence) one year after the 2019- 20 bushfires. Of this, a decline of 7.1% was directly caused by bushfires, the remaining 2.3% decline was due to ongoing and antecedent threats (Legge et al. 2021).

Threat	Status and severity a	Evidence
		The future legacy of the 2019-2020 bushfires, assuming no future extreme events over three generations (2021-2042), indicates a population decline of 3.9% caused by the fires; a further population decline of 21.9% is attributed to antecedent and ongoing threats (Legge et al. 2021). Koala monitoring records from north-east New South Wales following the 2019/2020 bushfires, indicate that sites characterised by high-severity fire (e.g., canopy scorch) had zero koala occupancy (i.e., zero return/recovery) immediately post fire. At sites where koalas have been detected following fire, refuge areas were present in the surrounding landscape, or fire severity was lower (NSW Government 2021b). While koala's have returned to bushfire impacted locations it is likely to take many years before populations are fully re- established. Australia will continue to experience a harsher fire-weather climate into the future (BoM 2019, 2021a). The fire season length is increasing and the number of catastrophic fire days will increase in the future by an estimated 15-70% by 2050 (Climate- Council 2019). A broad range of fire-related threats exist. These include high frequency fire, high severity fire, shifts in fire season, biodiversity loss, declining ecological mechanisms, shifts in biotic interactions including reproduction and fire-predator interactions, fire-drought interactions, fire-fragmentation interactions which can be amplified by land clearing and logging, fire- climate feedback (see above) (Bradshaw et al. 2018; Leavesley et al. 2020). All of these threats will have a significant impact on koala habitat and resident populations.
Declining nutritional value of foliage	• Status: historical/current/future • Confidence: suspected/known • Consequence: severe • Trend: increasing	In-situ carbon dioxide (CO2) manipulation experiments on amplifolia found elevated CO2 levels caused total nitrogen to decline in young eucalyptus leaves (Wujeska-Klause et al. 2019). However, increases in environmental temperature (eT), that will occur in parallel with elevated CO2 in the future, were not included in open air experiments and green house experiments suggest eT may compensate completely

Threat	Status and severity a	Evidence
	• Extent: across part of its range	for the negative impacts of CO2 on leaf nitrogen in the future (DeGabriel et al. 2009; Robinson et al. 2012). Although elevated CO2 can influence the production of some plant secondary metabolites such as tannins that may also impact the digestibility of leaves, the evidence for this in eucalypts is equivocal and further research is needed. Additional research is required to assess how elevated levels of CO2 affect nitrogen and available nitrogen (which integrates the effects of tannins) (DeGabriel et al. 2009). Bushfire effects on the nutritional value of eucalypt regrowth (e.g., epicormic growth) are unknown and research has been initiated. Physical disturbance (e.g., logging during forestry activities and/or fire) alters tree species composition and can favour tree species that do not support the koala's nutritional requirements (Au et al. 2019).
Human related activities		
Clearing and degradation of koala habitat	• Status: historical, current and future • Confidence: known • Consequence: severe • Trend: increasing • Extent: across the entire range	Human activities (e.g., deforestation and land clearance for grazing, agriculture, urbanisation, timber harvesting, mining and other activities) have resulted in habitat loss, fragmentation and degradation. Over 10,000 km2 of forest and woodland within the koala's range was cleared between 2000 and 2017 (Ward et al. 2019). The modelled koala distribution was revised in 2021 and the estimate of habitat loss would be expected to be higher if calculated using the new understanding of koala distribution. Clearing for grazing during this period was the major driver of loss of koala habitat, accounting for most of the deforestation within koala distribution (McAlpine et al. 2015; Evans 2016). Clearing for grazing has occurred across the range of the koala. Large areas of woodland have been lost since 2000 in western parts of the species range, including the Brigalow Belt, Mulga Lands, Darling Riverine Plains, Einasleigh Uplands and Desert uplands (Ward et al. 2019). These bioregions are home to large koala populations (Adams- Hosking et al. 2016). Most clearing has occurred on freehold

Threat	Status and severity a	Evidence
		or leasehold land (Ward et al. 2019). Land clearing continues to impact habitat across the koala's range (DES 2018). Clearing for mining and urbanisation has had localised impacts on the koala (Evans 2016; Ward et al. 2019). Urban expansion is concentrated along the eastern seaboard fringe of Queensland and NSW (Clark & Johnston 2016), which is also a stronghold of the koala. Low density and peri-urban development are expanding into forested and agricultural landscapes in these areas, while clearing for agriculture continues to occur across the koala's distribution. The expanding coal and coal seam gas developments of the past two decades and recent clearing for renewable energy projects represent additional but localised impacts to koalas (McAlpine et al. 2015). Land-use decisions affecting koalas have been influenced, both positively and negatively, by the policy environment and social attitudes around land-clearing (Heagney et al. 2021; Simmons et al. 2021).
Encounter mortality with vehicles and dogs	• Status: historical/current/future • Confidence: known • Consequence: severe • Trend: increasing • Extent: across part of its range	Vehicle related mortality occurs regularly on roads in close proximity to occupied koala habitat (Gonzalez- Astudillo 2018; Queensland- Government 2021). Dog attacks are also a significant cause of death and injury especially in areas within and adjacent to peri-urban and residential areas (DPIE 2020). Koalas are unable to adapt to these threats and as human activities continue to expand into koala habitat, trauma from these threats will continue. A large proportion of individuals killed by vehicles or dogs are otherwise healthy. This mortality has the potential to remove healthy breeding individuals from the population (Gonzalez-Astudillo 2018). Encounter mortality poses a significant threat during post- weaning dispersal, which occurs at a young age in both male and female koalas. Mature males are increasingly at risk as they have larger home ranges and increased mobility during the breeding season. Young males typically disperse more frequently and over larger distances than their female counterparts and the removal of subadult males by trauma has the potential to critically disrupt geneflow.

Threat	Status and severity a	Evidence
• **Disease and health**		
Koala retrovirus (KoRV) and Chlamydia (*Chlamydia percorum*)	• Status: historical/current/future • Confidence: known • Consequence: severe • Trend: increasing • Extent: unknown	Wild populations carry disease pathogens. Inadvertent spread of disease also occurred historically following koala translocations. Disease can be a major contributor to population decline and reduces population viability. Chlamydia causes infertility, blindness and death (Polkinghorne et al. 2013). The prevalence of disease (chlamydiosis) has been found to increase following extreme stress from hot weather, drought, habitat loss and fragmentation (Lunney et al. 2012; Davies et al. 2013).

Status—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species;

Consequence—identify the severity of the threat;

Trend—identify the extent to which it will continue to operate on the species;

Extent—identify its spatial content in terms of the range of the species.

Table 5 Risk matrix

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
Almost certain	Low risk	Very high risk: **Encounter mortality with vehicles and dogs**		Very high risk: **Clearing of koala habitat** **Koala retrovirus (KoRV) and Chlamydia.** **Increased frequency of drought.** **Increased frequency of heatwaves.** **Increasing frequency of high-intensity bushfire**	Very high risk: **Shrinking climate envelope resulting in habitat loss**
Likely	Low risk	Moderate risk	High risk	Very high risk	Very high risk
Possible	Low risk	Moderate risk	High risk	Very high risk	Very high risk
Unlikely	Low risk	Low risk	Moderate risk	High risk	Very high risk
Unknown	Low risk	Low risk	Moderate risk	High risk	Very high risk

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FIGURES

Figure 1 Aerial photograph of the subject land

Figure 2 Previous version of proposal that was the subject of a test of significance by Arbor Ecological

Figure 3 Current version of the proposal that is examined in the test of significance

Figure 4 Lismore Council mapping that map core koala habitat on and adjacent to the subject land

Figure 5 Aerial photograph of subject land and surrounds, showing wider context for koala habitat in the locality

Legend

Subject Land

Image Source:
NearMap
(dated 26-05-2021)

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Lismore LGA

Coordinate System: MGA Zone 56 (GDA 94)

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I:\...\21135\Figures\RP1\20220314\Figure 1. Subject Land

Figure 1. Aerial photograph of the subject land

0 25 50 m

Lot No	Lot Area m²	Available Building Area m²	Area in excess of minimum building envelope (12x15=180 m²)
1	759.8	380.6	200.6
2	682.5	306.8	126.8
3	605.5	381	201
4	600	340.7	160.7
5	822.6	374.2	194.2
6	801.3	426.4	246.4
7	844.1	449.5	269.5
8	1211	544.6	364.6
9	800	358.2	178.2
10	663.3	261.6	81.6
11	660	213.9	33.9
12	660	206.7	26.7
13	682.2	377.2	197.2
14	648.1	347.4	167.4
15	901	N/A	N/A

I:\...\21135\Figures\RP1\20220314\Figure 2. Previous Layout

Figure 2. Previous version of proposal that was the subject of a test of significance by Arbor Ecological

Image Source: RCS Group

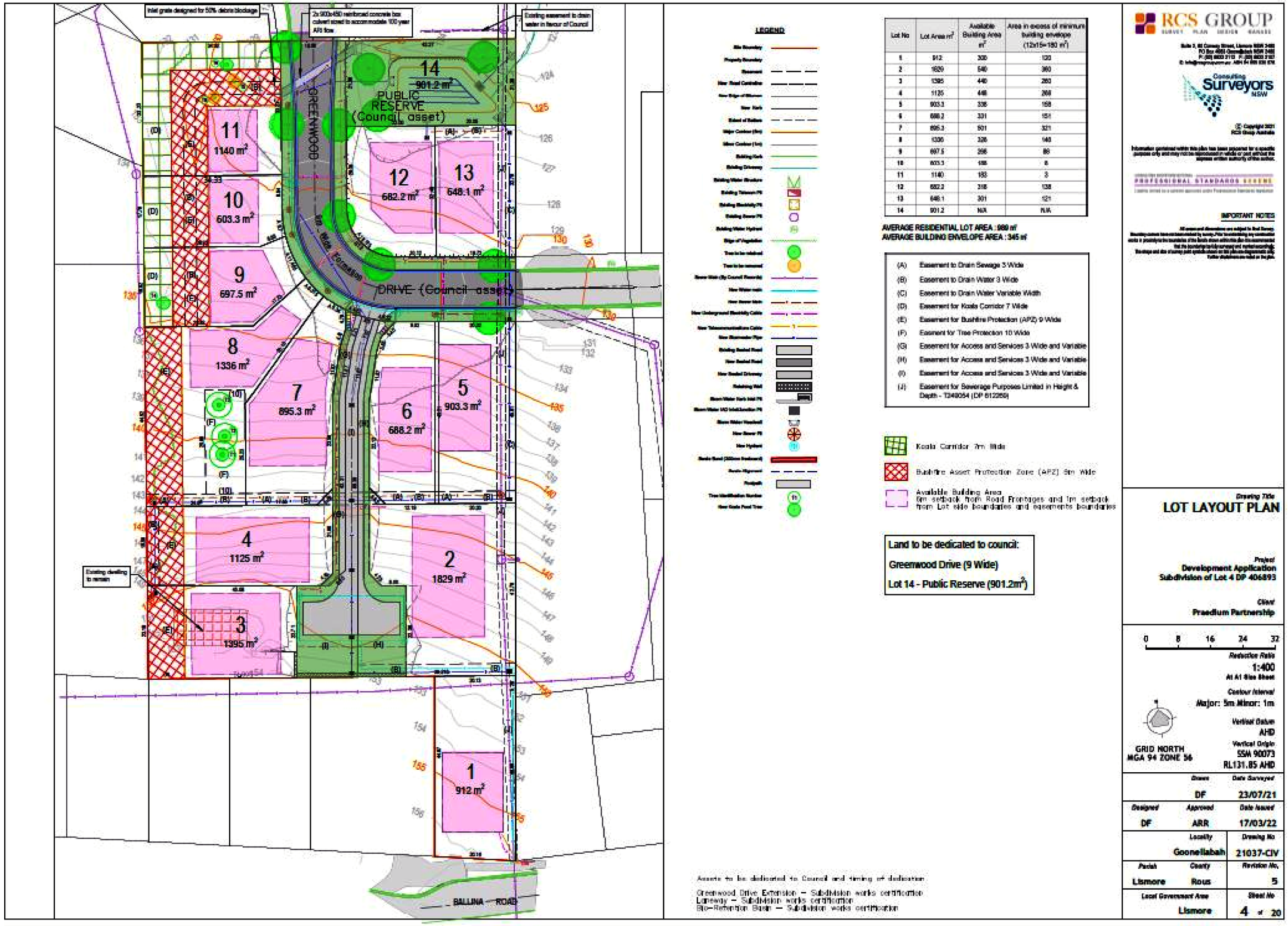

Figure 3. Current version of the proposal that is examined in the test of significance for this report

Image Source: RCS Group

I:\...\RP1\Figures\RP1\20220320\Figure 3. Current Layout

Legend

Subject Land

Koala Habitat Veg Mapping

Primary

Image Source:
Lismore City Council GIS.
Online Mapping Portal.

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Lismore LGA

Coordinate System: MGA Zone 56 (GDA 94)

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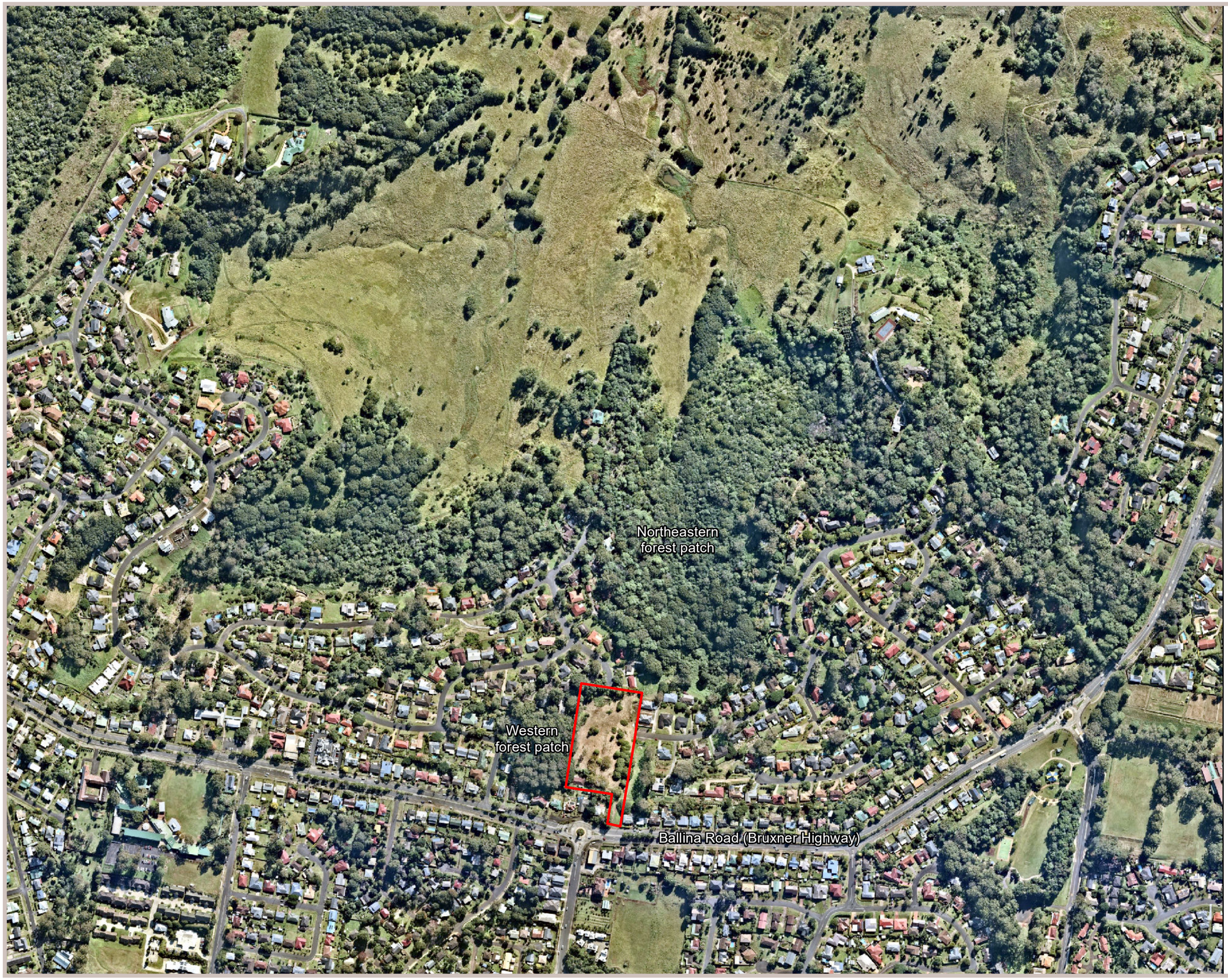
I:\...\21135\Figures\RP1\20220314\Figure 4. Core Koala Habitat

Figure 4. Lismore Council mapping that map core koala habitat on and adjacent to the subject land

0 25 50 75 m



Legend

Subject Land

Image Source:
NearMap
(dated 26-05-2021)

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Lismore LGA

Coordinate System: MGA Zone 56 (GDA 94)

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I:\...\21135\Figures\RP1\20220314\Figure 5. Aerial_Subject Land and Surrounds

Figure 5. Aerial photograph of subject land and surrounds, showing wider context for koala habitat in the locality

0 50 100 150 200 m

Additional information – addressing requirements of the Lismore Comprehensive Koala Plan of Management

Proposed residential subdivision at 658 Ballina Road, Goonellabah

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Prepared for: Praedium Pty Ltd
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Document history and status

Revision	*Date*	*Description*	*Author*	*Review*
Rev 0	13/07/2021	Version 1 report	Tom Pollard	Client
Rev 1	20/07/2021	Final report	Tom Pollard	n/a

1. Introduction

1.1 Background

As requested by Lismore City Council this report provides additional information to supplement that found in the Koala Habitat Assessment Report prepared for the proposed development (North Coast Environmental Services 2018). In particular, this report address sections 4.3.1.1a, 4.3.1.3b and 4.3.1.3c of the Comprehensive Koala Plan of Management for southeast Lismore (CKPoM) (Lismore City Council 2013).

1.2 Field survey

As is required by section 4.3.1.1a of the CKPoM 'any food trees greater than or equal to 100 mm diameter at breast height over bark (dbhob) that occurs within the *development footprint* of the proposed *development* must be assessed for evidence of koala activity in accordance with the spot assessment technique (SAT) approach, as described in Appendix 3 (Phillips & Callaghan 2011; p.775-776)'.

Seven Koala food trees were assessed within the development site for evidence of koala activity as described above (refer to Figure 1.1 and Table 1.1). No scats were recorded around the base of any of these trees and therefore none of these trees were classified as core koala habitat (according to the definition within 4.3.1.2a of the CKPoM.

1.3 Koala Habitat Assessment Report – additional information

Section 4.3.1.3 of the CKPoM details the following content guidelines for a small impact development Koala Habitat Assessment Report:

- a table detailing the species, diameter at breast height over bark (dbhob) and the unique identifier of all trees proposed to be removed, lopped or isolated from koala use (Section 4.3.1.3b of the CKPoM).
- a summary table detailing the species, size class (<100 mm dbhob, 100-300 mm dbhob and >300 mm dbhob) and number of *food trees* proposed to be removed, lopped or isolated from koala use' (section 4.3.1.3c of the CKPoM).

Refer to Table 1.2 which details 54 trees (42 of which are exotic species) that are proposed for removal for the development (addressing section 4.3.1.3b of the CKPoM).

Refer to Table 1.3 which details 3 koala food trees, all of which are less than 200 mm dbhob, that are proposed for removal for the development (addressing section 4.3.1.3c of the CKPoM).

Figure 1.1 Location of koala food trees on the development site

Table 1.1 Summary results of koala food tree scat searches at the site

Unique Identifier	*Species*	*Diameter at breast height over bark (dbhob) (mm)*	*Coordinates (UTM, zone 56)*	*Koala scats found (yes/no)?*
T1	Forest Red Gum (*Eucalyptus tereticornis*)	260	532091, 6812287	no
T2	Forest Red Gum (*Eucalyptus tereticornis*)	255	532088, 6812291	no
T3	Forest Red Gum (*Eucalyptus tereticornis*)	70	532087, 6812283	no
T4	Forest Red Gum (*Eucalyptus tereticornis*)	160	532071, 6812194	no
T5	Tallowwood (*Eucalyptus microcorys*)	170	532071, 6812200	no
T6	Forest Red Gum (*Eucalyptus tereticornis*)	165	532071, 6812205	no
T9	Forest Red Gum (*Eucalyptus tereticornis*)	100	532064, 6812234	no

Table 1.2 Trees proposed to be removed, lopped or isolated from koala use

Unique Identifier	*Species (exotic – marked with *)*	*Diameter at breast height over bark (dbhob) (mm)*
T3	Forest Red Gum (*Eucalyptus tereticornis*)	70
T5	Tallowwood (*Eucalyptus microcorys*)	170
T9	Forest Red Gum (*Eucalyptus tereticornis*)	100
T10	Umbrella Tree (*Schefflera actinophylla*)*	150
T11	Camphor Laurel (*Cinnamomum camphora*)*	150
T12	Pecan (*Carya illinoinensis*)* - possibly dead	500
T13	Blackwood (*Acacia melanoxylon*)	60
T14	Blackwood (*Acacia melanoxylon*)	70
T15	Blackwood (*Acacia melanoxylon*)	80
T16	Blackwood (*Acacia melanoxylon*)	100
T17	Blackwood (*Acacia melanoxylon*)	100
T18	Blackwood (*Acacia melanoxylon*)	80
T19	Pecan (*Carya illinoinensis*)*	250 (multiple stems)
T20	Mango (*Mangifera indica*)*	270
T21	Camphor Laurel (*Cinnamomum camphora*)*	240
T22	Camphor Laurel (*Cinnamomum camphora*)*	160
T23	Camphor Laurel (*Cinnamomum camphora*)*	190 (multiple stems)
T24	Camphor Laurel (*Cinnamomum camphora*)*	110
T25	Camphor Laurel (*Cinnamomum camphora*)*	90
T26	Celery Wood (*Polyscias elegans*)	120
T27	Pecan (*Carya illinoinensis*)*	450

Unique Identifier	*Species (exotic – marked with *)*	*Diameter at breast height over bark (dbhob) (mm)*
T28	Mango (*Mangifera indica*)*	320 (multiple stems)
T29	Mango (*Mangifera indica*)*	220 (multiple stems)
T30	Pecan (*Carya illinoinensis*)*	490
T31	Pecan (*Carya illinoinensis*)*	220
T32	Camphor Laurel (*Cinnamomum camphora*)*	150 (multiple stems)
T33	Pecan (*Carya illinoinensis*)*	430
T34	Rough-shelled Bush-nut (*Macadamia tetraphylla*)	210 (multiple stems)
T35	Mango (*Mangifera indica*)*	500
T36	Mango (*Mangifera indica*)*	380
T37	Mango (*Mangifera indica*)*	230 (multiple stems)
T38	Pecan (*Carya illinoinensis*)*	330
T39	Mango (*Mangifera indica*)*	340
T40	Pecan (*Carya illinoinensis*)*	500
T41	Macadamia (*Macadamia integrifolia* cv.)	140
T42	Mango (*Mangifera indica*)*	180 (multiple stems)
T43	Mango (*Mangifera indica*)*	270 (multiple stems)
T44	Mango (*Mangifera indica*)*	340 (multiple stems)
T45	Mango (*Mangifera indica*)*	230 (multiple stems)
T46	Mango (*Mangifera indica*)*	250 (multiple stems)
T47	Mango (*Mangifera indica*)*	190 (multiple stems)
T48	Mango (*Mangifera indica*)*	320
T49	Mango (*Mangifera indica*)*	210 (multiple stems)
T50	Mango (*Mangifera indica*)*	290
T51	Mango (*Mangifera indica*)*	300 (multiple stems)
T52	Mango (*Mangifera indica*)*	260 (multiple stems)

Unique Identifier	*Species (exotic – marked with *)*	*Diameter at breast height over bark (dbhob) (mm)*
T53	Mango (*Mangifera indica*)*	420
T54	Mango (*Mangifera indica*)*	440
T55	Mango (*Mangifera indica*)*	420 (multiple stems)
T56	Mango (*Mangifera indica*)*	520
T57	Mango (*Mangifera indica*)*	450 (multiple stems)
T58	Mango (*Mangifera indica*)*	280 (multiple stems)
T59	Mango (*Mangifera indica*)*	290
T60	Mango (*Mangifera indica*)*	350 (multiple stems)

Table 1.3 Summary of Koala Food trees proposed for removal

Unique Identifier	*Species*	*Size Class (dbhob)*		
		<100 mm	*100-300 mm*	*>300 mm*
T3	Forest Red Gum (*Eucalyptus tereticornis*)	✓		
T5	Tallowwood (*Eucalyptus microcorys*)		✓	
T9	Forest Red Gum (*Eucalyptus tereticornis*)		✓	
Total number of koala food trees proposed for removal		1	2	0

Certification

This report addresses a request for additional information from Lismore City Council relating to meeting the requirements of specific sections of the Comprehensive Koala Plan of Management for South-east Lismore (LCC 2013) (sections 4.3.1.1a, 4.3.1.3b and 4.3.1.3c). This report should be read in conjunction with the Koala Habitat Assessment Report prepared by North Coast Environmental Services (2018).

Conflict of Interest

To the best of my knowledge and belief, I, Tom Pollard, have no past, present or future relationship to stakeholders or decision-makers connected to this project that might be regarded as an actual, perceived or potential conflict of interest with my professional responsibilities and duties as a consultant.

Dr Tom Pollard

Ecologist

Birdwing Ecological Services

Date: 20 July 2021

References

Lismore City Council (2013). *Comprehensive Koala Plan of Management for south-east Lismore.* Lismore City Council, Lismore, NSW.

North Coast Environmental Services (2018). *Koala Habitat Assessment Report – Small Impact Development (V1), LOT 4 DP406893 658 Ballina Road, Goonellabah.* Unpublished report to CLA Consultants. North Coast Environmental Services, Pacific Paradise Qld.

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Transport Planning, Traffic Impact Assessments, Road Safety Audits, Expert Witness

18 March 2022 Reference: 210927.01FC

GM Project Development and Management
43 Beaumont Drive,
East Lismore NSW 2480
Attention: Bribie Stansfield

LETTER OF RESPONSE TO CONTENTIONS
FOR THE
NSW LAND AND ENVIRONMENT COURT PROCEEDING

GRAHAM PETER MEINKE T/AS GM PROJECT DEVELOPMENT AND MANAGEMENT
-ATS-
LISMORE CITY COUNCIL
CASE NO. 2021/00044443

REGARDING THE PROPOSED SUBDIVISON
AT LOT 4 DP 406893 (658 BALLINA ROAD, GOONELLABAH)

Dear Bribie,

Reference is made to your request to provide response to the relevant traffic and parking related Contentions as outlined in the Statement of Facts and Contentions for Case No. 2021/00044443 filed on 9 June 2021. The response provided to the relevant contentions is with respect to the revised design and lot layout plans as dated 17 March 2022 (as provided in **Annexure A**) for the proposed subdivision of Lot 4 DP 406893 commonly known as 658 Ballina Road, Goonellabah. The comments made by Council relevant to traffic and parking are shown below (*italicised*) with *M^C^Laren Traffic Engineering*'s (**MTE**) response thereafter.

> *6.(a) Insufficient information has been provided to confirm that acceptable road design, lot access and lot servicing arrangements are proposed in accordance with the requirements of LDCP 2012 and the Australian Standards.*

MTE Response: The revised road design and lot access arrangements are provided in accordance with the requirements of the Lismore Development Control Plan 2012 (LDCP 2012) and the relevant Australian Standards. Refer to **Annexure B** providing a summary of the revised design's compliance with LDCP 2012.

It is relevant to note, that the June 2021 contentions with respect to vehicular access are related to an earlier lot layout with more than one lot being accessed directly from Ballina Road. Since that time, the lot layout has been significantly altered to limit the number of lots with direct access from Ballina Road, to only one (1) lot, consistent with the current conditions.

6. (b) The maximum gradient for domestic driveways is 25% in accordance with Australian Standard AS 2890.1. The development application proposes accessways at the maximum gradient permitted, however, the plans do not show appropriate transitions (grade changes) to the public road across the footpath area which are required to be 5% in order to ensure no vehicle scrappage.

MTE Response: The revised plans provide appropriate transitions to the public across the footpath area, not exceeding 5%. Vertical (ground) clearance testing of the proposed vehicular access handle from Greenwood Drive has been undertaken to confirm compliance with respect to ground clearance of a B99 Design Car [AS2890.1:2004 compliant], with the results provided in **Annexure C**. In relation to fire appliance vehicles, these vehicles have a greater clearance than a B99 Design Car and a longer wheelbase.

6.(c) On 31 January 2020, the NSW Rural Fire Service issued general terms of approval which contain design requirements for public road access. It has not been demonstrated that the proposed roads comply with the design requirements set out in the GTAs issued by the RFS.

MTE Response: The revised plans demonstrate that the requirements set out in the GTAs issued by the RFS are achieved. **Annexure D** provides a summary of the proposal's compliance with the relevant sections of Planning for Bush Fire Protection 2019 (PBP 2019). Swept path testing of the standard fire truck design vehicle circulating the access roads have been conducted and proven successful, with the results provided in **Annexure E** for reference.

6.(d) Road A extends towards the site's western boundary however terminates short of the boundary line. Road A should extend to the western boundary to facilitate its connection to future development to the west in an orderly manner.

MTE Response: This contention is no longer applicable to current revised plans.

6.(e) The proposed design of Road A will not facilitate access to future development of the adjoining lot to the west, which is currently undeveloped. The width of Road A should be consistent with the width of Greenwood Drive in circumstances where it is likely to become a feeder road to Hillcrest Avenue. Alternatively, the Applicant should demonstrate how the western property will not be prejudiced by the approval of the proposed subdivision layout.

MTE Response: This contention is no longer applicable to current revised plans.

6.(f) Passing bays should be provided in accordance with the design requirements set out in Chapter 5A of LDCP 2012, having regard to the length of the access handle to proposed Lots 1,2 and 4.

MTE Response: Contention no longer applicable to current revised plans. Revised plans provide an access handle to lots 2, 3 and 4 which has a total width of 9m comprising of a carriageway width of 6m and two 1.5m wide verges that facilitate separate pedestrian access. In relation to the access handle serving lots 2, 3 and 4, separated 1.5m wide verges are provided that will facilitate safe pedestrian access inclusive of steps and handrails where the gradient exceeds 12.5% (1:8). The revised plan are compliant with respect to the relevant requirements set out in the LDCP 2012 with a summary of compliance provided in **Annexure B**.

6.(g)Table 1 – Street network characteristics in Chapter 5A of LDCP 2012 requires access to be a minimum width of 6m. Clarification is required in relation to whether the access handles to Lots 6 and 7 have a width of 6m as required by LDCP 2012. The access handle to Lots 1 and 2 is less than 6m wide, which fails to comply with the requirements of LDCP 2012

MTE Response: This contention is no longer applicable to current revised plans. The access handle provided within the revised plans provide a minimum carriageway width of 6m and a total width of 9m, achieving compliance with the requirements outlined in Table 1 of Chapter 5A of the LDCP 2012. **Annexure B** summarises the compliance of the revised plans to the LDCP 2012, for reference.

6.(h) Details have not been provided in relation to the proposed future location of mailboxes for battle aces allotments

MTE Response: A matter for others to address.

6.(i) Insufficient information have been provided to understand and assess how waste is proposed to be collected from lots with an access handle, given their length and grade.

MTE Response: Waste collection will be conducted from Greenwood Drive, such that waste collection vehicles are not required to access the access handle. The storage location for the waste bins are identified on the revised plans at the interface of the access handle and Greenwood Drive.

6.(j) Insufficient information has been provided to confirm whether the roads are proposed to be dedicated to the Respondent as local roads as part of the development application. Where dedication is not proposed, the development application will not facilitate orderly development of the locality, particularly in circumstances where Greenwood Drive is proposed to facilitate access to adjoining lots to the north and east.

MTE Response: A matter for others to address.

6.(k) Ballina Road (also known as the Bruxner Highway) is a classified road. The development application form nominated the development as 'integrated' under section 138 of the Roads Act 1993, however, the as the referral fee was not paid by the Applicant the development application was not referred to TfNSW. On 19 April 2021 the Respondent lodged the referral to TfNSW on the Planning Portal, to enable the referral fee to be paid by the Applicant and for the development application to thereafter be referred to TfNSW.

MTE Response: A matter for others to address.

6.(l)The development application should not be approved unless and until TfNSW has reviewed the development application and provided General Terms of Approval

MTE Response: A matter for others to address.

The revised plans have been reviewed and assessed against the relevant design requirements of the LDCP 2012 and the PBP 2019, with this assessment provided in **Annexure B** and **Annexure D** for reference. The revised plans are compliant with all the relevant requirements of both the LDCP 2012 and PBP 2019, and where an acceptable "deemed to comply" alternative exists, these have been noted in the comment column within the relevant annexure. Swept path testing has been undertaken on the revised plans with the results provided in **Annexure E** for reference.

For the above reasons, it is considered that the revised plans for the proposed subdivision are considered to functional, safe and fit for purpose. The revised plans are fully supportable in terms of their traffic impacts, road safety outcomes and road design attributes.

Please contact the undersigned on 9521 7199 should you require further information or assistance.

Yours faithfully,
M^c^Laren Traffic Engineering

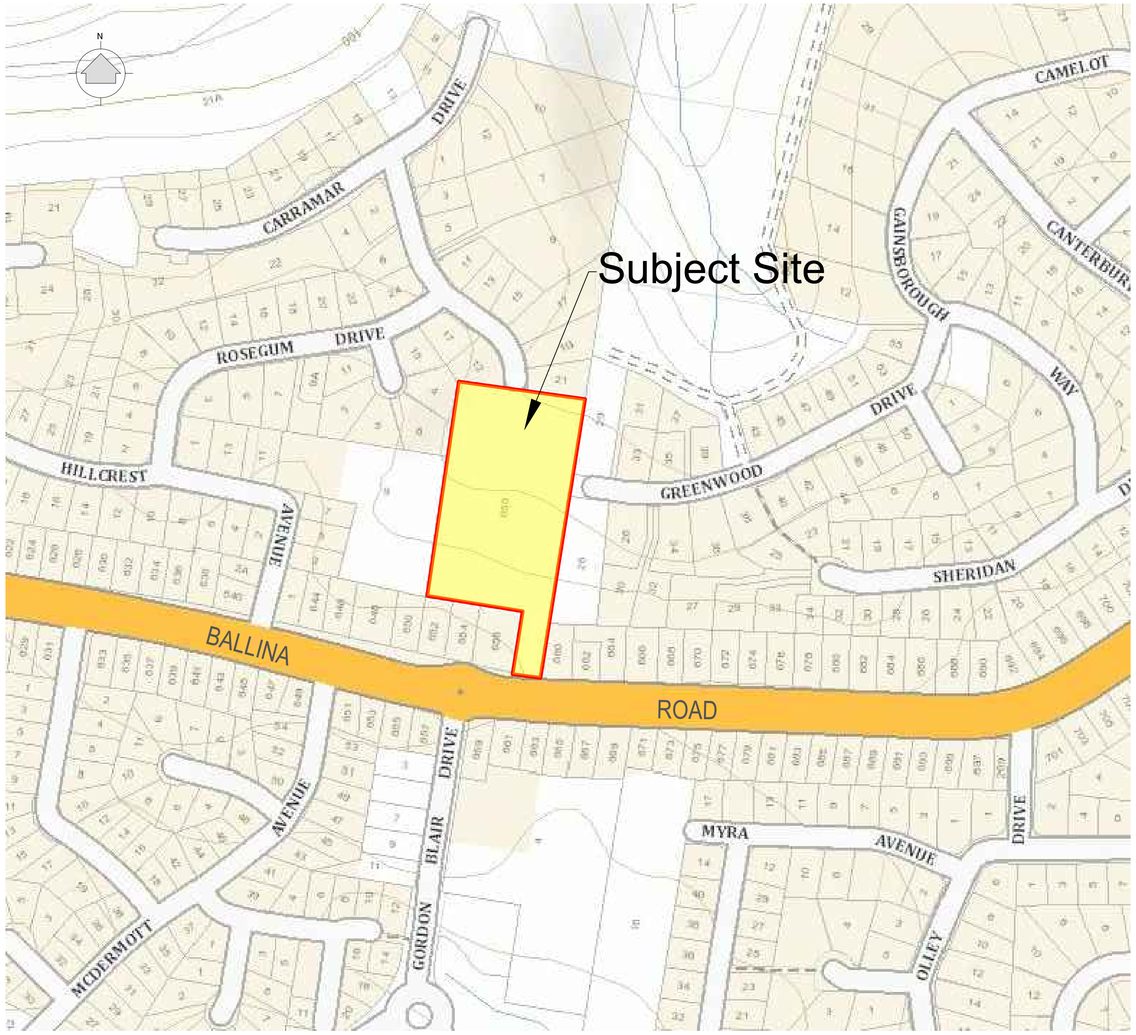
Craig M^C^Laren
Director
BE Civil, Grad Dip (Transport Engineering), MAITPM, MITE
RPEQ 19457
RMS Accredited Level 3 Road Safety Auditor [1998]
RMS Accredited Traffic Management Plan Designer [2018]

ANNEXURE A: REVISED PLANS

(13 SHEETS)

Development Application - Engineering Design Plans

658 Ballina Road, Goonellabah , NSW
Subdivision of Lot 4 in DP406893



File Ref: 21037-26.dwg

Title	Sheet No.	Rev No.
Title Page	1	5
Site Layout Existing - Overview	2	5
Site Layout Proposed - Overview	3	5
Lot Layout	4	5
Greenwood Drive Layout	5	5
Greenwood Drive Longitudinal Section	6	5
Greenwood Drive Cross Sections	7 - 9	5
Shared Driveway Layout (Lots 2, 3 & 4)	10	5
Shared Driveway Longitudinal Section	11	5
Shared Driveway Cross Sections	12 - 13	5
Electricity and Telecom Layout Plan	14	5
Sewer and Water Reticulation Layout Plan	15	5
Stormwater Drainage Layout Plan	16	5
Stormwater Basin Layout	17	5
Stormwater Basin Sections	18	5
Asset Protection Zone Sections	19	5
Bulk Earthworks Plan	20	5

Issue #	Changes	Drawn	Approved	Date
5	Additional notation added	DF	ARR	17/03/22
4	Amended design to suit revised lot layout	DF	ARR	25/02/22
3	Further amendments to address respondents feedback	DF	ARR	5/11/21
2	Amendments to address respondents feedback	DF	ARR	28/10/21
1	Original	DF	ARR	5/10/21

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E: info@surveyor.com.au ABN 54 055 030 576

LEGEND

- Site Boundary
- Property Boundary
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Bank Change of Grade
- Top of Bank
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- Existing Sealed Road

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Drawing Title
EXISTING LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	Date Surveyed
	DF	23/07/21
Designed	Approved	Date Issued
DF	ARR	17/03/22
	Locality	Drawing No
	Goonellabah	21037-CIV
Parish	County	Revision No.
Lismore	Rous	5
Local Government Area		Sheet No
Lismore		2 of 20

LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title

PROPOSED LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

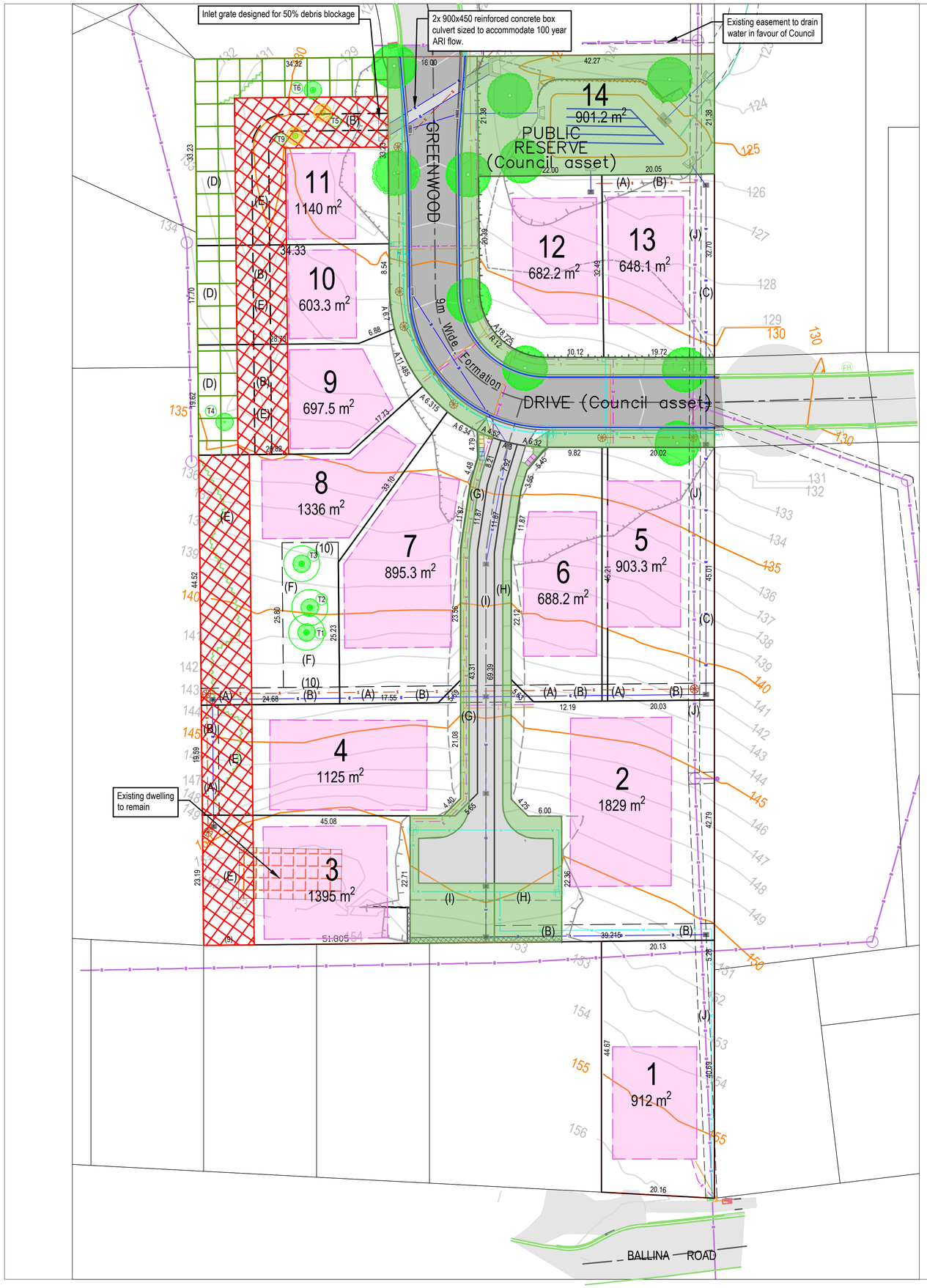
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

N
GRID NORTH
MGA 94 ZONE 56

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**3** of **20**



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Tree to be retained
- Tree to be removed
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- New Hydrant
- Swale Bund (300mm freeboard)
- Swale Alignment
- Footpath
- Tree Identification Number
- New Koala Food Tree

Lot No	Lot Area m²	Available Building Area m²	Area in excess of minimum building envelope (12x15=180 m²)
1	912	300	120
2	1829	540	360
3	1395	440	260
4	1125	448	268
5	903.3	338	158
6	688.2	331	151
7	895.3	501	321
8	1336	326	146
9	697.5	268	88
10	603.3	188	8
11	1140	183	3
12	682.2	318	138
13	648.1	301	121
14	901.2	N/A	N/A

AVERAGE RESIDENTIAL LOT AREA : 989 m²
AVERAGE BUILDING ENVELOPE AREA : 345 m²

(A)	Easement to Drain Sewage 3 Wide
(B)	Easement to Drain Water 3 Wide
(C)	Easement to Drain Water Variable Width
(D)	Easement for Koala Corridor 7 Wide
(E)	Easement for Bushfire Protection (APZ) 9 Wide
(F)	Easment for Tree Protection 10 Wide
(G)	Easement for Access and Services 3 Wide and Variable
(H)	Easement for Access and Services 3 Wide and Variable
(I)	Easement for Access and Services 3 Wide and Variable
(J)	Easement for Sewerage Purposes Limited in Height & Depth - T249054 (DP 612269)

Koala Corridor 7m Wide

Bushfire Asset Protection Zone (APZ) 9m Wide

Available Building Area
6m setback from Road Frontages and 1m setback from Lot side boundaries and easements boundaries

Land to be dedicated to council:

Greenwood Drive (9 Wide)

Lot 14 - Public Reserve (901.2m²)

Assets to be dedicated to Council and timing of dedication

Greenwood Drive Extension – Subdivision works certification
Laneway – Subdivision works certification
Bio-Retention Basin – Subdivision works certification

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Drawing Title
LOT LAYOUT PLAN

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 8 16 24 32

Reduction Ratio
1:400
At A1 Size Sheet

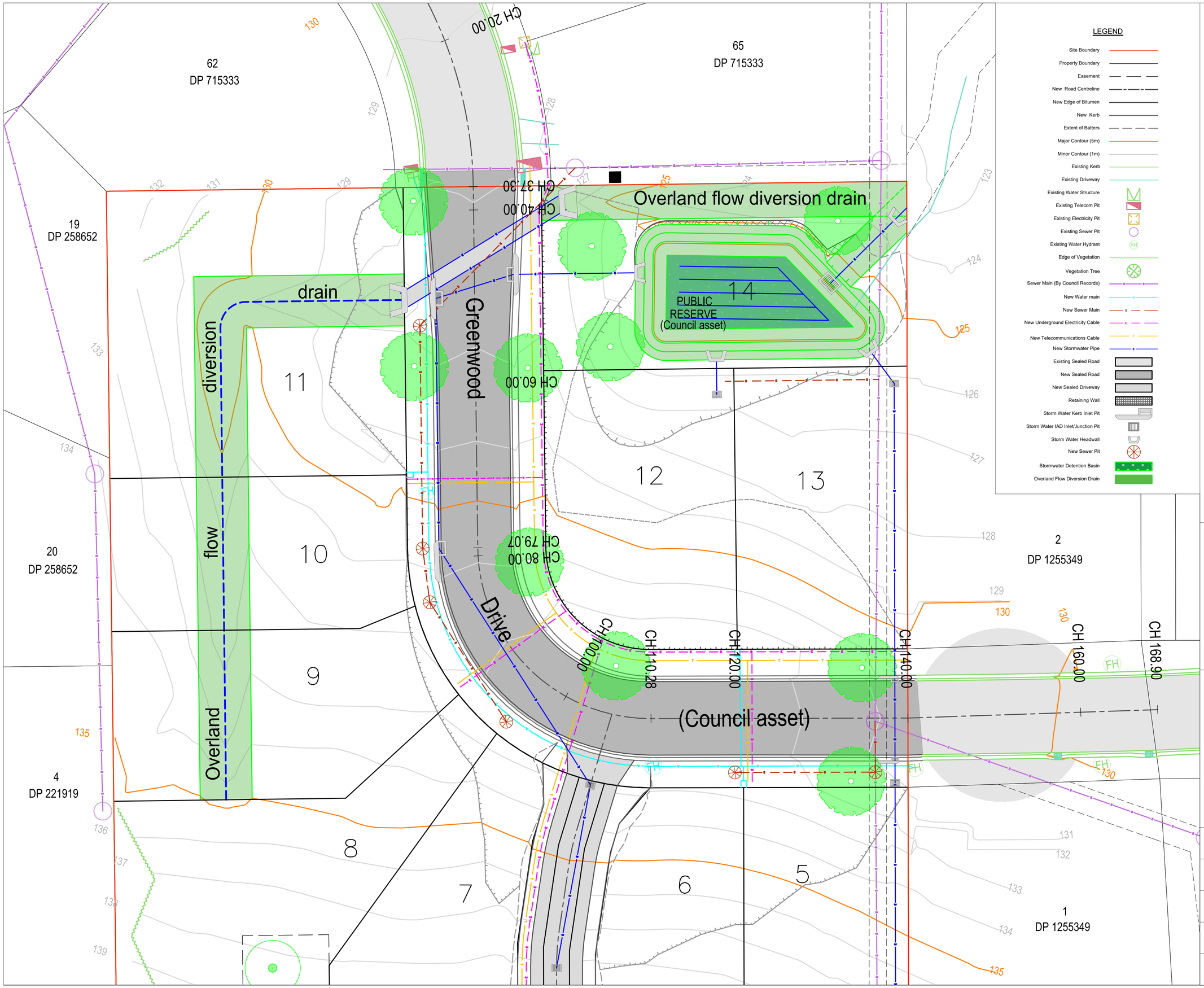
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn DF	*Date Surveyed* 23/07/21
Designed DF	*Approved* ARR	*Date Issued* 17/03/22
	Locality Goonellabah	*Drawing No* 21037-CIV
Parish Lismore	*County* Rous	*Revision No.* 5
Local Government Area Lismore		*Sheet No* 4 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
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- Existing Sealed Road
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- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Stormwater Detention Basin
- Overland Flow Diversion Drain

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Drawing Title
GREENWOOD DRIVE LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

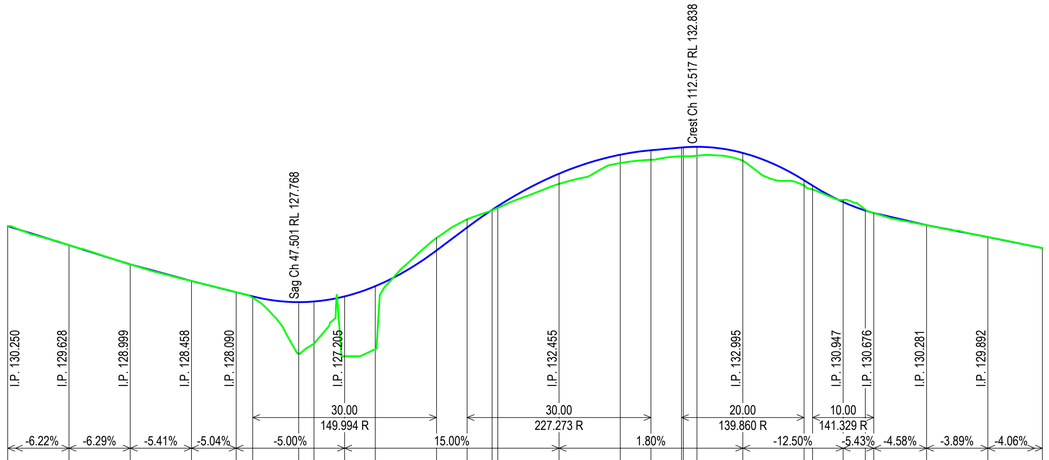
Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

GRID NORTH
MGA 94 ZONE 56

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**5** of **20**



R.L. 122.0

Cut / Fill	+0.00	+0.00	+0.00	+0.00	+0.00	+0.05	+1.69	+1.38	+1.96	+2.06	-0.40	-0.26	+0.02	+0.05	+0.33	+0.27	+0.32	+0.29	+0.29	+0.29	+0.26	+0.16	+0.13	-0.06	-0.02	+0.00	+0.00	+0.00	+0.00
Design	130.25	129.63	129.00	128.46	128.09	127.96	127.77	127.79	127.96	128.29	129.46	130.21	130.78	130.90	131.96	132.58	132.73	132.82	132.82	132.84	132.64	131.75	131.57	131.04	130.76	130.68	130.28	129.89	129.53
Existing	130.25	129.63	129.00	128.46	128.09	127.91	126.08	126.41	126.00	126.23	129.86	130.47	130.76	130.85	131.63	132.31	132.41	132.53	132.53	132.55	132.38	131.58	131.44	131.10	130.78	130.68	130.28	129.89	129.53
Chainage	0.00	10.00	20.00	30.00	37.30	40.00	47.50	50.00	55.00	60.00	70.00	75.00	79.07	80.00	90.00	100.00	105.00	110.00	110.28	112.52	120.00	130.00	131.38	136.38	140.00	141.38	150.00	160.00	168.90

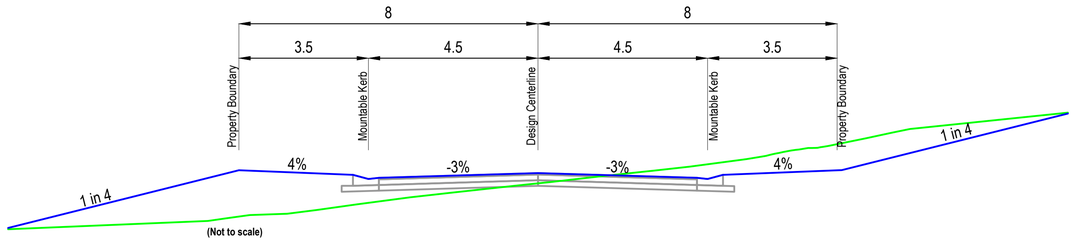
Horizontal Geometry

L=37.30 R=48.00 | L=41.77 B=188°42'00" | L=31.21 R=20.00 | L=29.72 B=99°17'03" | L=28.90 B=97°29'15"

H 1:500
V 1:100

Greenwood Drive - Ch.0.00 to Ch.168.90

Typical Section - Greenwood Drive (16 wide)



(Not to scale)

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Drawing Title

GREENWOOD DRIVE LONGITUDINAL SECTION

Project
Development Application
Subdivision of Lot 4 DP 406893

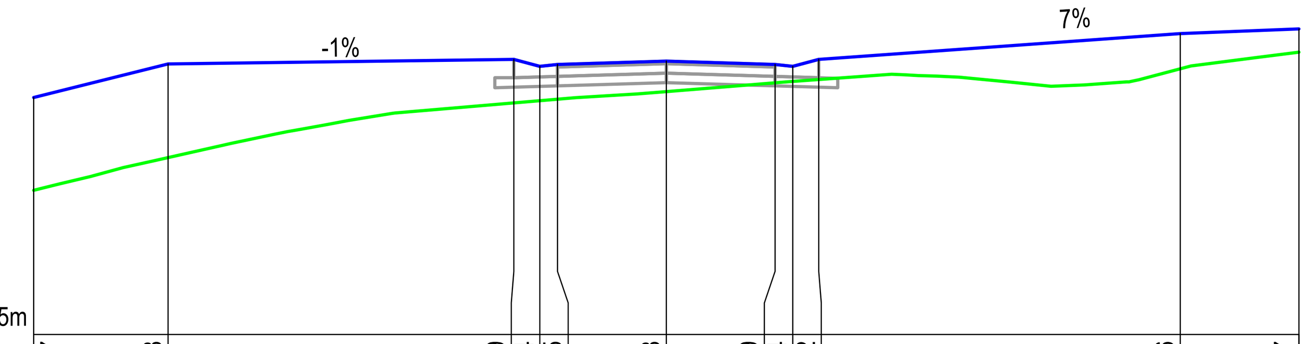
Client
Praedium Partnership

0 10 20 30 40

Reduction Ratio
1:500
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**6** of **20**



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DESIGN	127.251	127.782	127.855	127.745	127.775	127.826	127.775	127.745	127.855	128.262	128.337
EXISTING	125.783	126.300	127.166	127.201	127.225	127.345	127.485	127.507	127.537	127.705	127.968
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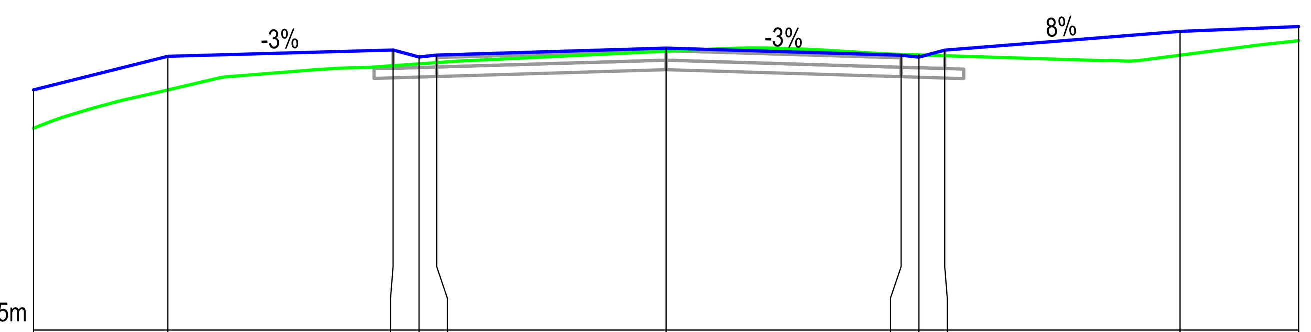
Ch 43.30 m



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DESIGN	127.295	127.827	127.926	127.816	127.846	127.955	127.844	127.814	127.924	128.221	128.296
EXISTING	126.687	127.294	127.679	127.707	127.727	127.907	127.857	127.849	127.836	127.843	128.074
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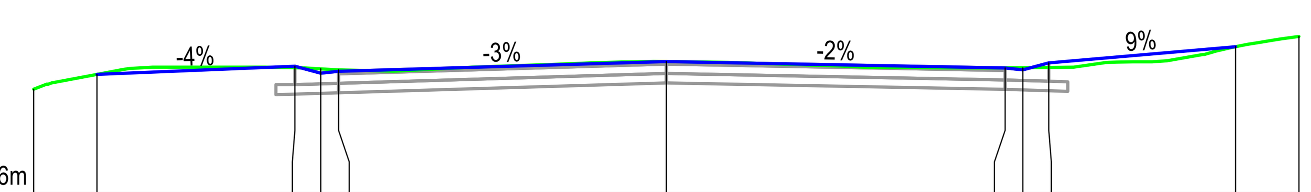
Ch 40.00 m



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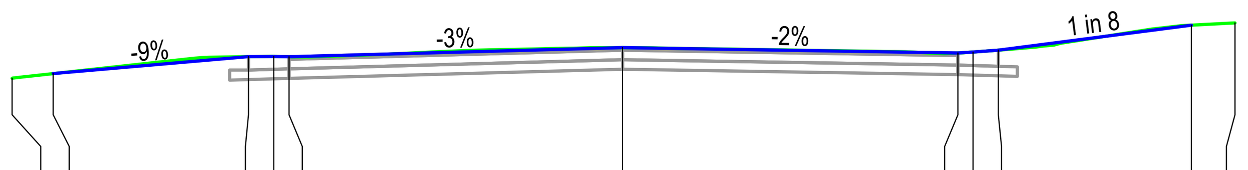
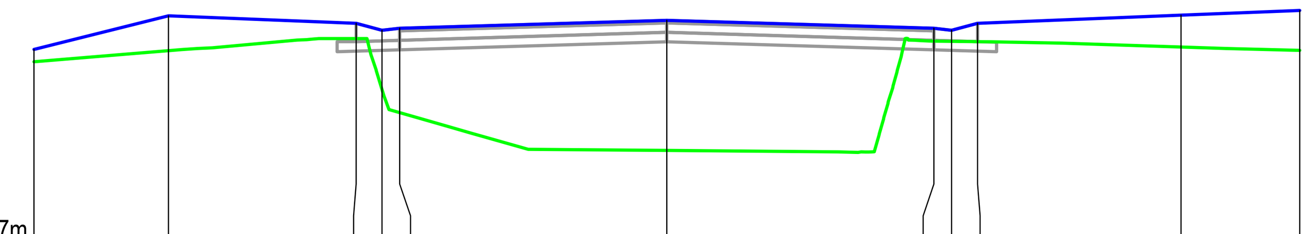
EXISTING	127.652	127.885	127.991	127.974	127.958	128.090	127.988	127.991	127.995	128.325	128.487
OFFSET	-10.00	-9.00	-5.87	-5.46	-5.18	0.00	5.36	5.64	6.05	9.00	10.00

Ch 37.30 m



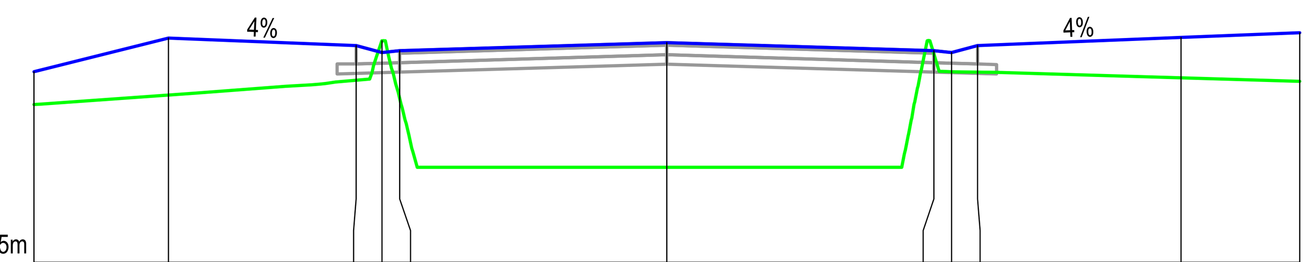
Ht Difference			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
DESIGN			128.050	128.316	128.320	128.314	128.458	128.374	128.389	128.418	128.812		
EXISTING		127.977	128.050	128.316	128.320	128.314	128.458	128.374	128.389	128.418	128.812	128.849	
OFFSET	-10.00	-9.65	-9.00	-5.91	-5.51	-5.27	0.00	5.30	5.54	5.94	9.00	9.69	10.00

Ch 30.00 m
Greenwood Drive



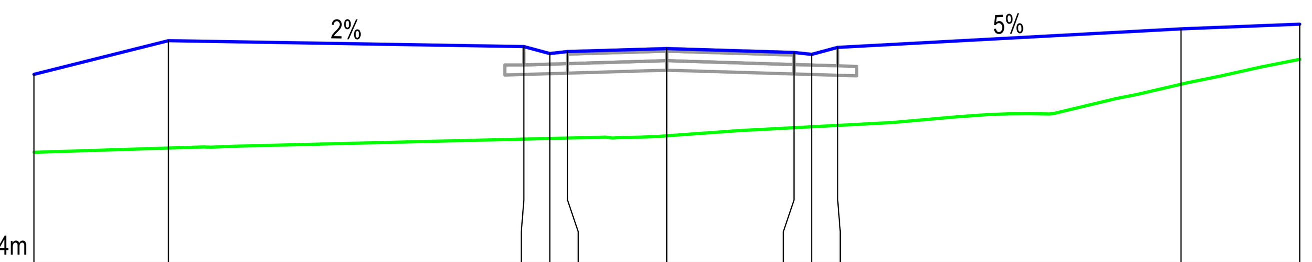
Ht Difference	0.20	0.55	0.24	0.94	1.33	2.06	0.20	0.18	0.29	0.50	0.63
DESIGN	127.829	128.360	128.242	128.132	128.162	128.288	128.162	128.132	128.242	128.370	128.445
EXISTING	127.633	127.809	128.000	127.196	126.829	126.232	127.959	127.956	127.951	127.866	127.814
OFFSET	-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	10.00

Ch 60.00 m



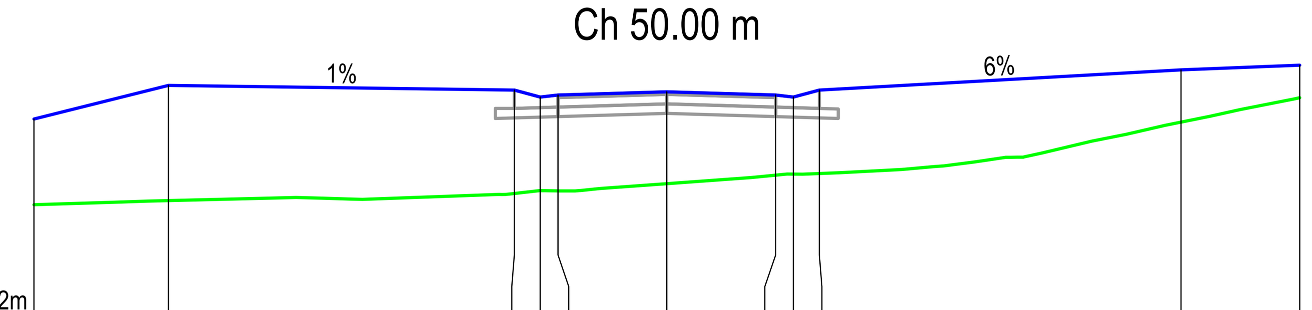
Ht Difference	0.52	0.90	0.55	-0.19	0.76	1.97	0.05	0.30	0.42	0.64	0.77
DESIGN	127.511	128.042	127.924	127.814	127.844	127.970	127.844	127.814	127.924	128.052	128.127
EXISTING	126.992	127.143	127.376	128.000	127.084	126.000	127.792	127.510	127.504	127.415	127.360
OFFSET	-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	10.00

Ch 55.30 m



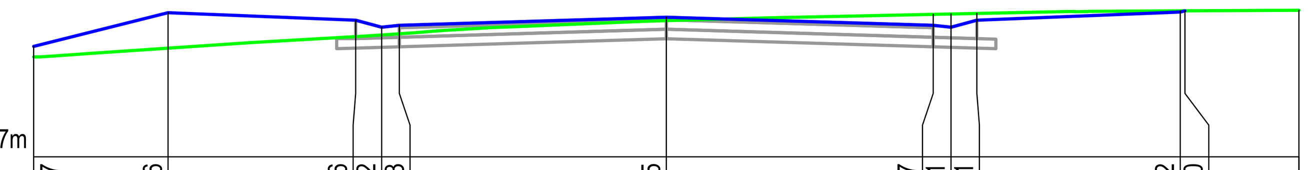
Ht Difference	1.23	1.69	1.46	1.34	1.36	1.38	1.19	1.14	1.23	0.87	0.56
DESIGN	127.382	127.914	127.821	127.711	127.741	127.788	127.728	127.698	127.808	128.100	128.175
EXISTING	126.154	126.221	126.361	126.371	126.377	126.413	126.541	126.555	126.577	127.227	127.620
OFFSET	-10.00	-7.87	-2.26	-1.85	-1.57	0.00	2.01	2.29	2.70	8.13	10.00

Ch 50.00 m



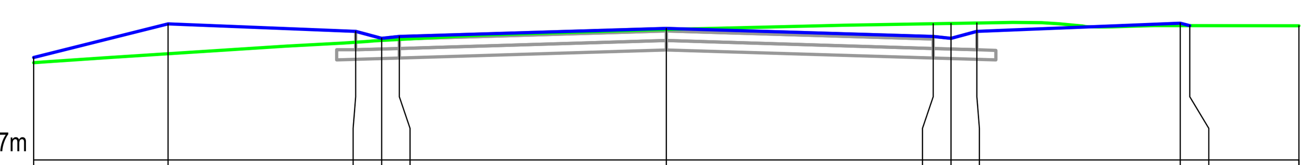
Ht Difference	1.35	1.82	1.64	1.48	1.51	1.45	1.27	1.22	1.32	0.82	0.51
DESIGN	127.348	127.880	127.807	127.697	127.727	127.778	127.727	127.697	127.807	128.125	128.200
EXISTING	125.994	126.059	126.171	126.217	126.212	126.327	126.462	126.479	126.488	127.300	127.686
OFFSET	-10.00	-7.87	-2.41	-2.00	-1.72	0.00	1.72	2.00	2.41	8.13	10.00

Ch 49.30 m



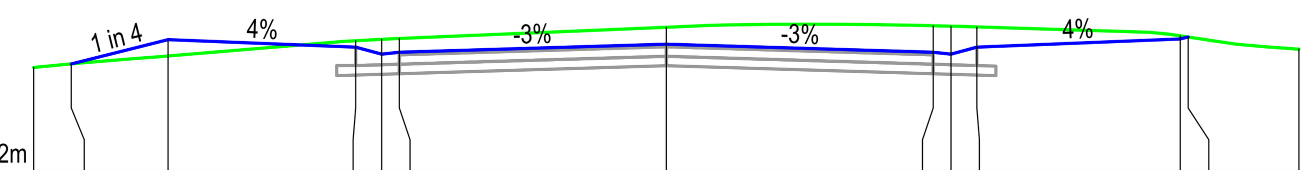
Ht Difference	0.17	0.56	0.26	0.12	0.13	0.05	-0.17	-0.21	-0.11	-0.02	0.00	
DESIGN	130.441	130.972	130.853	130.743	130.773	130.900	130.773	130.743	130.853	130.982	131.000	
EXISTING	130.274	130.413	130.594	130.620	130.639	130.846	130.946	130.952	130.960	131.000	131.000	131.010
OFFSET	-10.00	-7.88	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.12	8.20	10.00

Ch 80.00 m



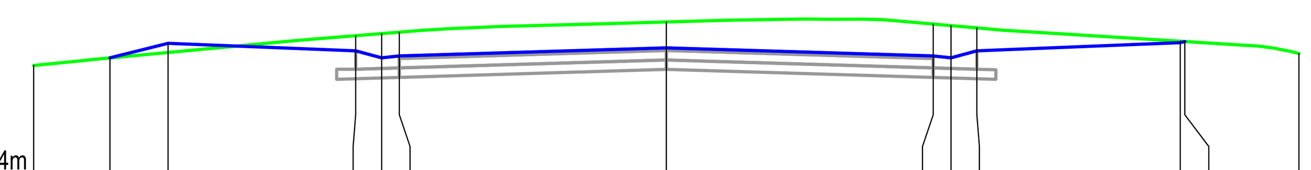
Ht Difference	0.08	0.47	0.17	0.03	0.05	0.02	-0.20	-0.24	-0.13	0.04	0.00	
DESIGN	130.320	130.851	130.732	130.622	130.652	130.779	130.652	130.622	130.732	130.861	130.824	
EXISTING	130.236	130.379	130.561	130.590	130.605	130.762	130.853	130.858	130.865	130.824	130.824	130.822
OFFSET	-10.00	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.27	10.00

Ch 79.07 m



Ht Difference		0.00	0.26	-0.10	-0.23	-0.22	-0.27	-0.42	-0.44	-0.32	-0.05	0.00	
DESIGN		129.894	130.277	130.158	130.048	130.078	130.205	130.078	130.048	130.158	130.287	130.318	
EXISTING	129.838	129.894	130.020	130.260	130.282	130.295	130.472	130.495	130.488	130.476	130.337	130.318	130.129
OFFSET	-10.00	-9.41	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.25	10.00

Ch 75.00 m



Ht Difference		0.00	0.14	-0.24	-0.38	-0.37	-0.41	-0.50	-0.51	-0.36	-0.02	0.00	
DESIGN		129.297	129.527	129.408	129.298	129.328	129.455	129.328	129.298	129.408	129.537	129.555	
EXISTING	129.177	129.297	129.383	129.647	129.679	129.702	129.864	129.829	129.805	129.769	129.559	129.555	129.366
OFFSET	-10.00	-8.79	-7.87	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.13	8.20	10.00

Ch 70.00 m

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Consulting Surveyors NSW

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Drawing Title

GREENWOOD DRIVE CROSS SECTIONS (Sheet 1 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

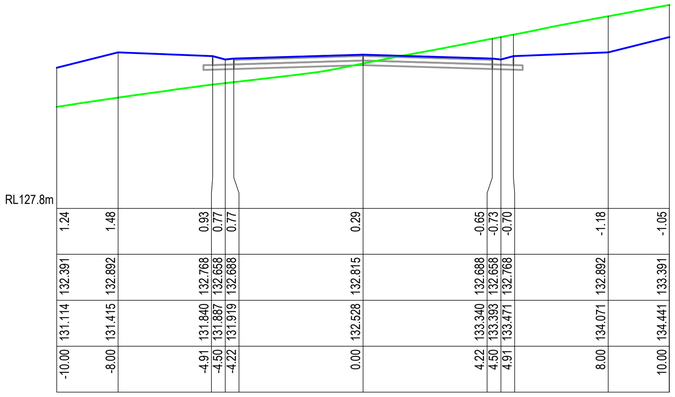
0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

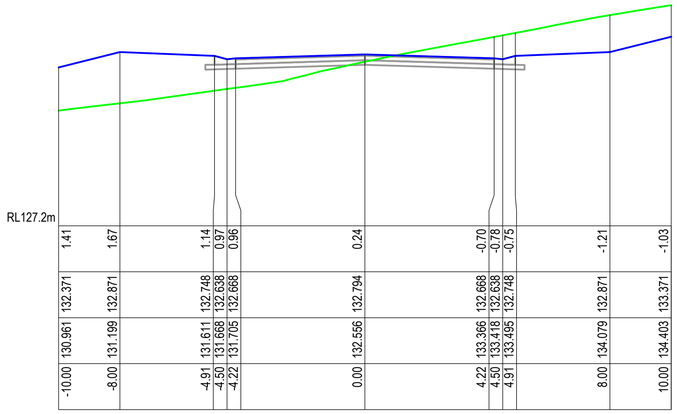
Designed	Drawn	Date Surveyed
	DF	23/07/21
DF	Approved: ARR	Date Issued: 17/03/22

Locality: Goonellabah	Drawing No: 21037-CIV
Parish: Lismore / County: Rous	Revision No.: 5
Local Government Area: Lismore	Sheet No: 7 of 20



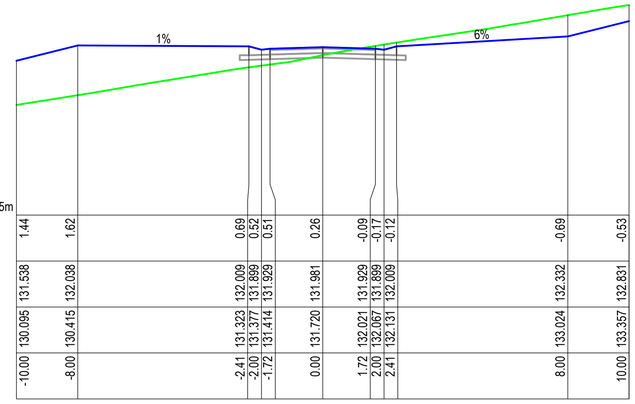
	1.24	1.48	0.93	0.77	0.77	0.29	-0.65	-0.73	-0.70	-1.18	-1.05
	132.391	132.892	132.768	132.658	132.688	132.815	132.688	132.658	132.768	132.892	133.391
	131.114	131.415	131.840	131.887	131.919	132.528	133.340	133.393	133.471	134.071	134.441
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 110.00 m



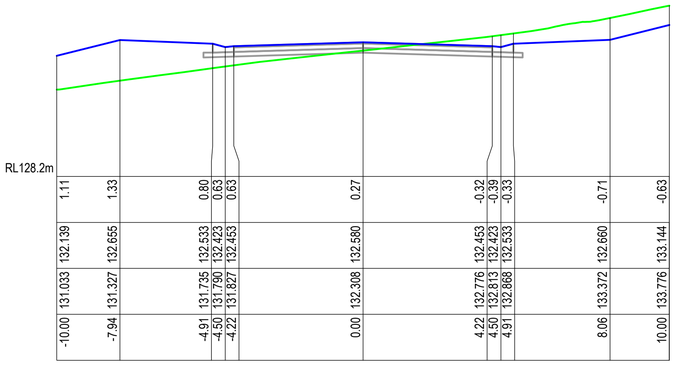
	1.41	1.67	1.14	0.97	0.96	0.24	-0.70	-0.76	-0.75	-1.21	-1.03
	132.371	132.871	132.748	132.638	132.668	132.794	132.668	132.638	132.748	132.871	133.371
	130.961	131.199	131.611	131.668	131.705	132.556	133.366	133.418	133.495	134.079	134.403
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 116.00 m



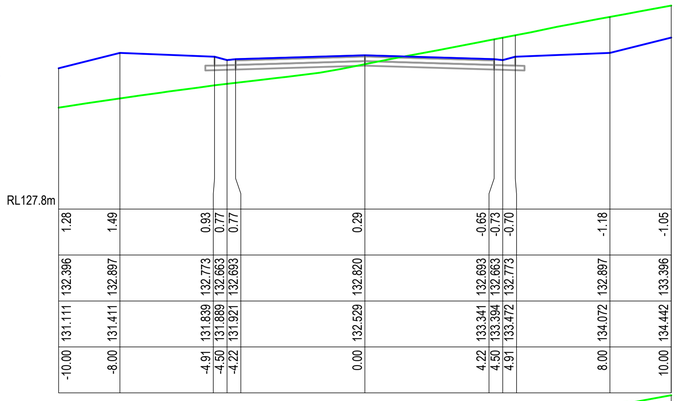
	1.44	1.62	0.69	0.52	0.51	0.26	-0.09	-0.17	-0.12	-0.69	-0.53
	131.538	132.038	132.009	131.899	131.929	131.981	131.929	131.869	132.009	132.332	132.831
	130.095	130.415	131.323	131.377	131.414	131.720	132.021	132.067	132.131	133.024	133.357
	-10.00	-8.00	-2.41	-2.00	-1.72	0.00	1.72	2.00	2.41	8.00	10.00

Ch 128.00 m



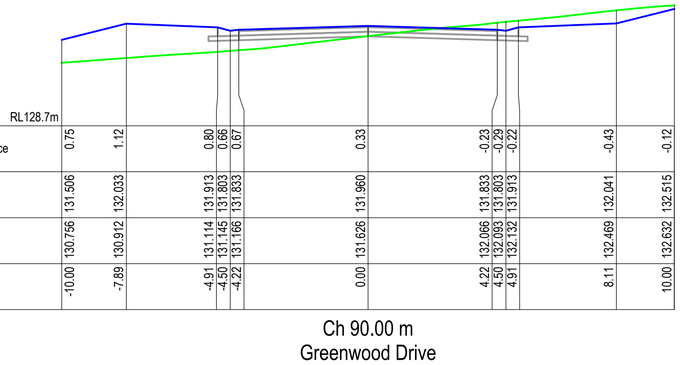
	1.11	1.33	0.80	0.63	0.63	0.27	-0.32	-0.39	-0.33	-0.71	-0.63
	132.139	132.655	132.533	132.423	132.453	132.580	132.453	132.423	132.533	132.660	133.144
	131.033	131.327	131.735	131.790	131.827	132.308	132.776	132.813	132.868	133.372	133.776
	-10.00	-7.94	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.06	10.00

Ch 100.00 m



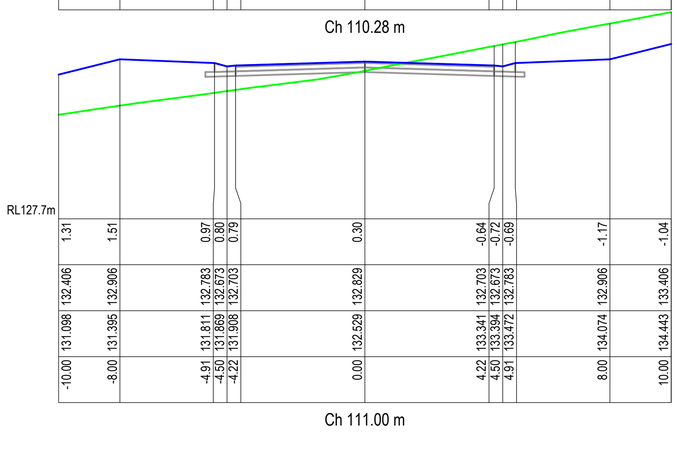
	1.28	1.49	0.93	0.77	0.77	0.29	-0.65	-0.73	-0.70	-1.18	-1.05
	132.396	132.897	132.773	132.663	132.693	132.820	132.693	132.663	132.773	132.897	133.396
	131.111	131.411	131.839	131.888	131.921	132.529	133.341	133.394	133.472	134.072	134.442
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 110.28 m



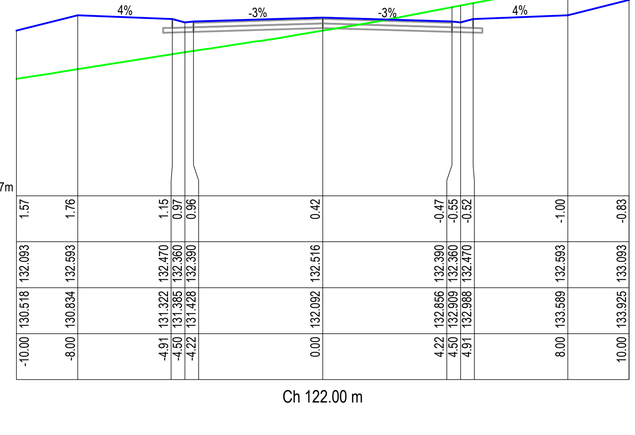
Ht Difference	0.75	1.12	0.80	0.66	0.67	0.33	-0.23	-0.29	-0.22	-0.43	-0.12
DESIGN	131.506	132.033	131.913	131.803	131.833	131.960	131.833	131.803	131.913	132.041	132.515
EXISTING	130.756	130.912	131.114	131.145	131.166	131.626	132.066	132.093	132.132	132.469	132.632
OFFSET	-10.00	-7.89	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.11	10.00

Ch 90.00 m
Greenwood Drive



	1.31	1.51	0.97	0.80	0.79	0.30	-0.64	-0.72	-0.69	-1.17	-1.04
	132.406	132.906	132.783	132.673	132.703	132.829	132.703	132.673	132.783	132.906	133.406
	131.098	131.395	131.811	131.869	131.908	132.529	133.341	133.394	133.472	134.074	134.443
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 111.00 m



	1.57	1.76	1.15	0.97	0.96	0.42	-0.47	-0.55	-0.52	-1.00	-0.83
	132.093	132.593	132.470	132.360	132.390	132.516	132.390	132.360	132.470	132.593	133.093
	130.518	130.834	131.322	131.385	131.428	132.092	132.866	132.909	132.988	133.589	133.925
	-10.00	-8.00	-4.91	-4.50	-4.22	0.00	4.22	4.50	4.91	8.00	10.00

Ch 122.00 m

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Consulting Surveyors NSW

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Drawing Title

GREENWOOD DRIVE CROSS SECTIONS (Sheet 2 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

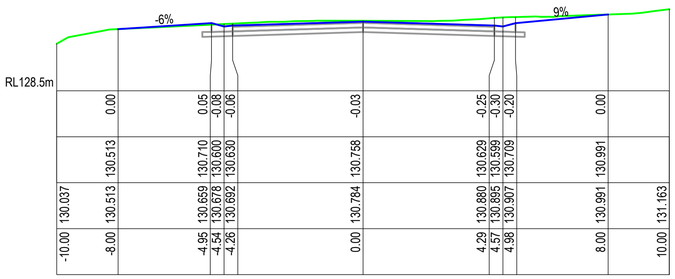
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

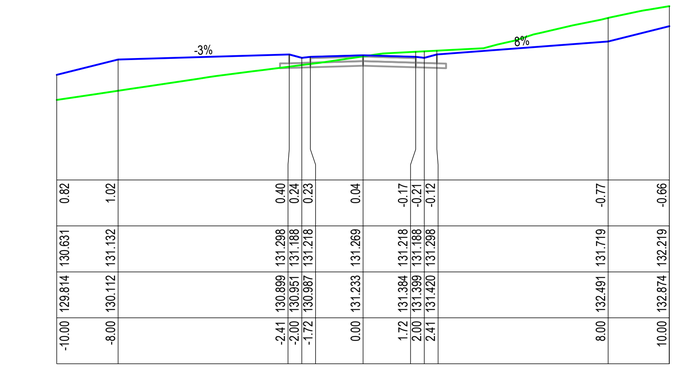
Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	8 of 20



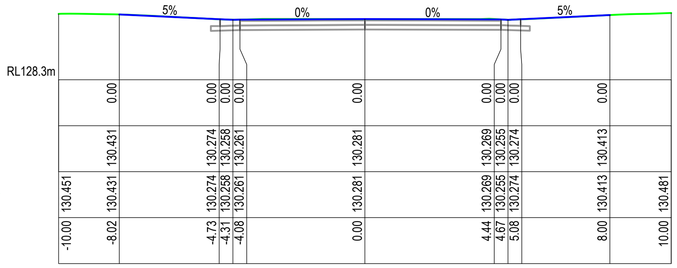
	0.00		0.05	-0.08	-0.06		-0.03		-0.25	-0.30	-0.20		0.00					
	130.513		130.710	130.600	130.630		130.758		130.629	130.599	130.709		130.991					
130.037	130.513		130.659	130.678	130.692		130.784		130.880	130.895	130.907		130.991		131.163			
-10.00	-8.00		-4.95	-4.54	-4.26		0.00		4.29	4.57	4.98		8.00		10.00			

Ch 140.00 m



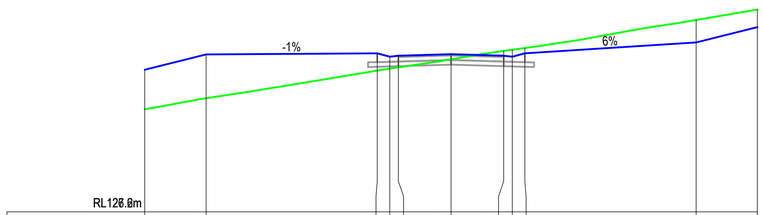
0.82	1.02		0.40	0.24	0.23		0.04		-0.17	-0.21	-0.12		-0.77		-0.66			
130.631	131.132		131.298	131.188	131.218		131.269		131.218	131.188	131.298		131.719		132.219			
129.814	130.112		130.899	130.951	130.987		131.233		131.394	131.399	131.420		132.491		132.874			
-10.00	-8.00		-2.41	-2.00	-1.72		0.00		1.72	2.00	2.41		8.00		10.00			

Ch 134.00 m



	0.00		0.00	0.00	0.00		0.00		0.00	0.00	0.00		0.00					
	130.431		130.274	130.258	130.261		130.281		130.269	130.255	130.274		130.413					
130.451	130.431		130.274	130.258	130.261		130.281		130.269	130.255	130.274		130.413		130.481			
-10.00	-8.02		-4.73	-4.33	-4.08		0.00		4.44	4.67	5.08		8.00		10.00			

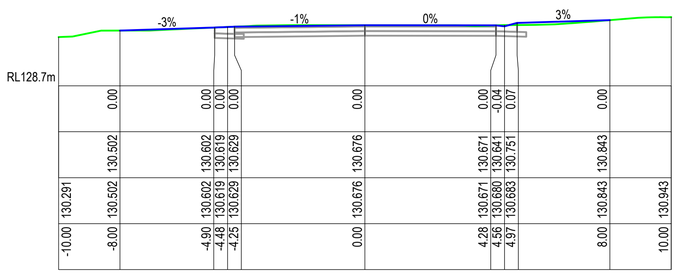
Ch 150.00 m



Ht Difference	1.29	1.43		0.56	0.39	0.38		0.17		-0.16	-0.23	-0.17		-0.73		-0.57		
DESIGN	131.237	131.737		131.773	131.663	131.693		131.745		131.693	131.663	131.773		132.129		132.629		
EXISTING	129.948	130.306		131.209	131.273	131.314		131.578		131.851	131.890	131.946		132.861		133.203		
OFFSET	-10.00	-8.00		-2.41	-2.00	-1.72		0.00		1.72	2.00	2.41		8.00		10.00		

Ch 130.00 m

Greenwood Drive



	0.00		0.00	0.00	0.00		0.00		0.00	-0.04	0.07		0.00					
	130.502		130.602	130.619	130.629		130.676		130.671	130.641	130.751		130.843					
130.291	130.502		130.602	130.619	130.629		130.676		130.671	130.680	130.683		130.843		130.943			
-10.00	-8.00		-4.90	-4.48	-4.25		0.00		4.28	4.56	4.97		8.00		10.00			

Ch 141.38 m

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Drawing Title

GREENWOOD DRIVE CROSS SECTIONS (Sheet 3 of 3)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

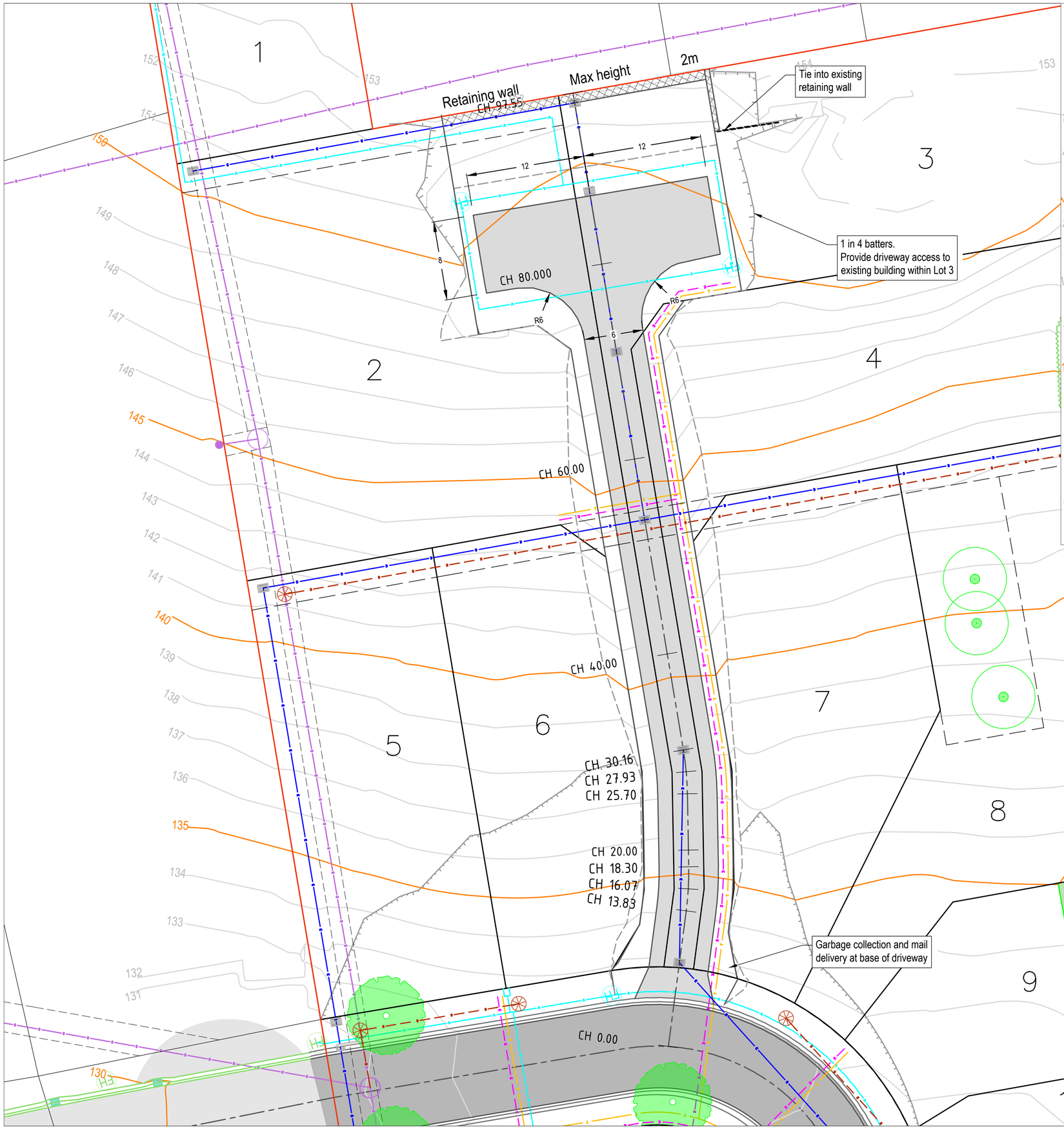
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	9 of 20



LEGEND

- Site Boundary
- Property Boundary
- Easement
- New Road Centreline
- New Edge of Bitumen
- New Kerb
- Extent of Batters
- Major Contour (5m)
- Minor Contour (1m)
- Existing Kerb
- Existing Driveway
- Existing Water Structure
- Existing Telecom Pit
- Existing Electricity Pit
- Existing Sewer Pit
- Existing Water Hydrant
- Edge of Vegetation
- Vegetation Tree
- Sewer Main (By Council Records)
- New Water main
- New Sewer Main
- New Underground Electricity Cable
- New Telecommunications Cable
- New Stormwater Pipe
- Existing Sealed Road
- New Sealed Road
- New Sealed Driveway
- Retaining Wall
- Storm Water Kerb Inlet Pit
- Storm Water IAD Inlet/Junction Pit
- Storm Water Headwall
- New Sewer Pit
- Overland Flow Diversion Drain

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Drawing Title
SHARED DRIVEWAY LAYOUT

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

Contour Interval
Major: 5m Minor: 1m

Vertical Datum
AHD

Vertical Origin
SSM 90073
RL131.85 AHD

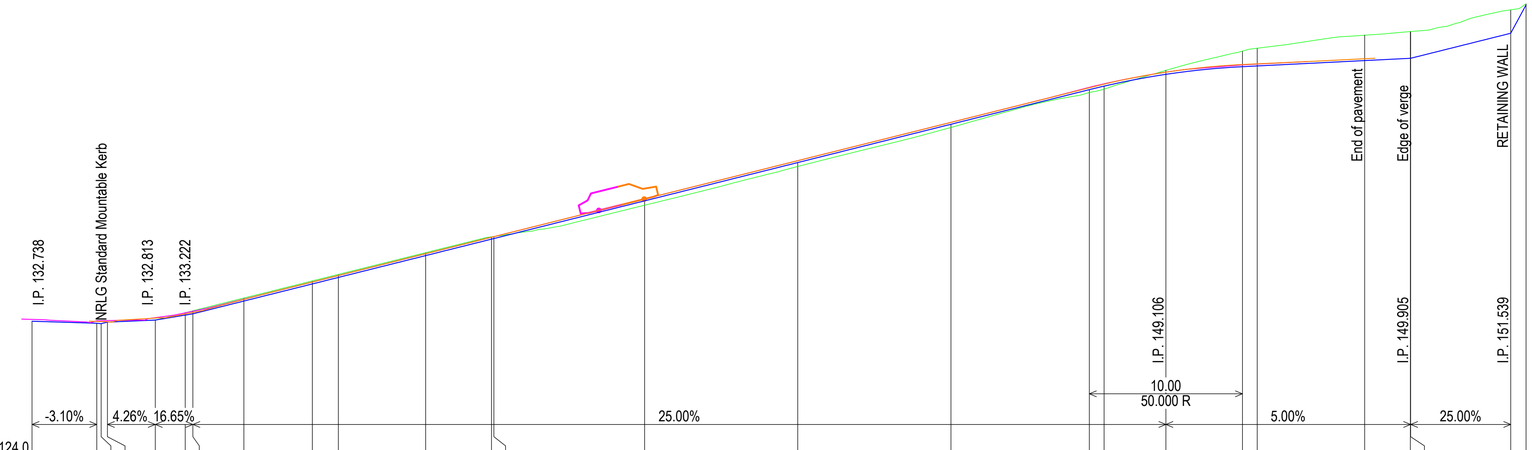
GRID NORTH
MGA 94 ZONE 56

	Drawn	*Date Surveyed*
	DF	**23/07/21**
Designed	*Approved*	*Date Issued*
DF	**ARR**	**17/03/22**
	Locality	*Drawing No*
	Goonellabah	**21037-CIV**
Parish	*County*	*Revision No.*
Lismore	**Rous**	**5**
Local Government Area		*Sheet No*
Lismore		**10** of **20**

B99 Standard Vehicle Clearance Test

Front Clearance

Rear Clearance



R.L. 124.0

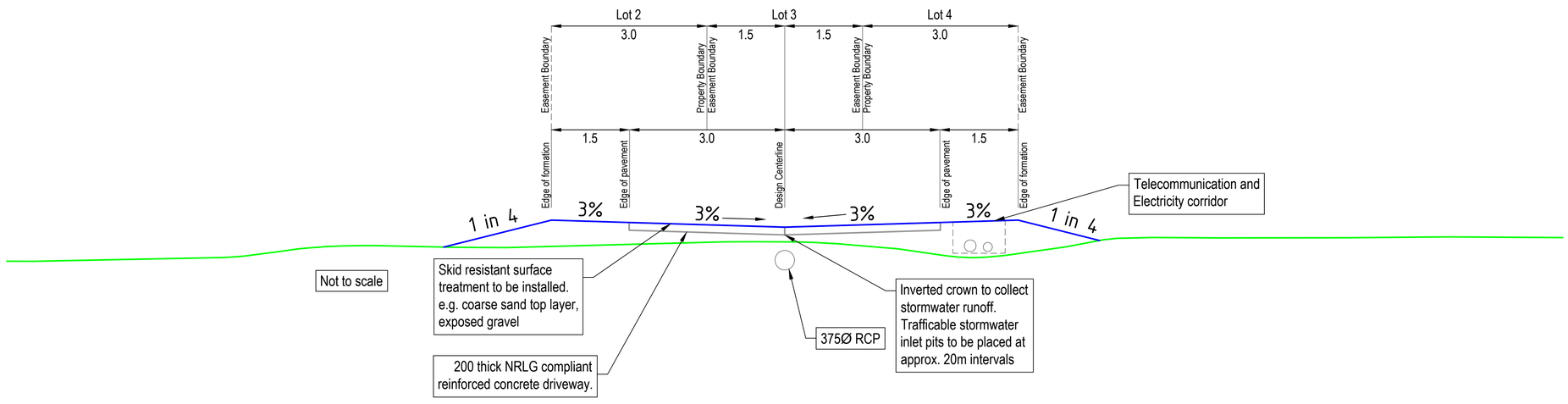
Cut / Fill	+0.00	+0.00	+0.00	-0.01	+0.00	-0.16	-0.20	-0.19	-0.20	-0.19	-0.20	-0.15	-0.13	+0.29	+0.26	+0.21	+0.19	+0.20	-0.26	-1.01	-1.16	-1.65	-1.75	-1.74	-1.53
Design	132.74	132.61	132.58	132.88	132.81	133.14	133.22	134.06	135.17	135.60	137.02	138.10	138.14	140.60	143.10	145.60	147.86	148.09	148.86	149.36	149.40	149.76	149.90	149.91	151.54	153.39
Existing	132.74	132.61	132.58	132.89	132.81	133.30	133.42	134.25	135.37	135.79	137.22	138.25	138.27	140.31	142.84	145.39	147.67	147.89	149.12	150.37	150.56	151.41	151.65	151.65	153.07	153.47
Chainage	0.00	4.23	4.51	4.92	8.04	10.00	10.50	13.83	18.30	20.00	25.70	30.00	30.16	40.00	50.00	60.00	69.04	70.00	74.04	79.04	80.00	87.02	90.00	90.02	96.55	97.55

Horizontal Geometry: L=13.83 B=206°20'22"; L=4.47 R=30.00; L=7.39 B=197°48'15"; L=4.46 R=30.00; L=67.39 B=189°17'03"

H 1:200
V 1:200

Shared Driveway - Lots 2, 3 & 4 - Ch.0.00 to Ch. 97.55

Typical Section - Shared Driveway - Lots 2, 3 & 4 (9 wide)



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Drawing Title
SHARED DRIVEWAY LONGITUDINAL SECTION

Project
Development Application
Subdivision of Lot 4 DP 406893

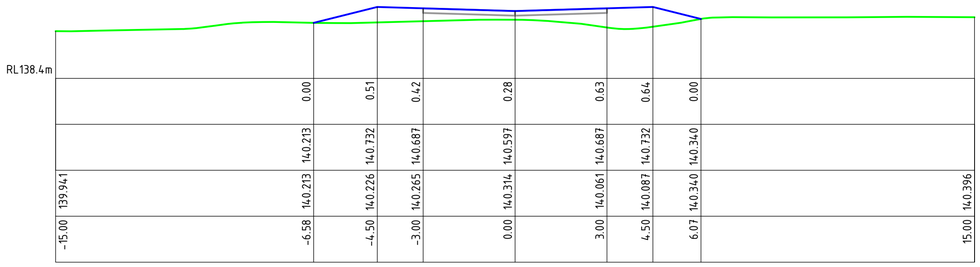
Client
Praedium Partnership

0 4 8 12 16

Reduction Ratio
1:200
At A1 Size Sheet

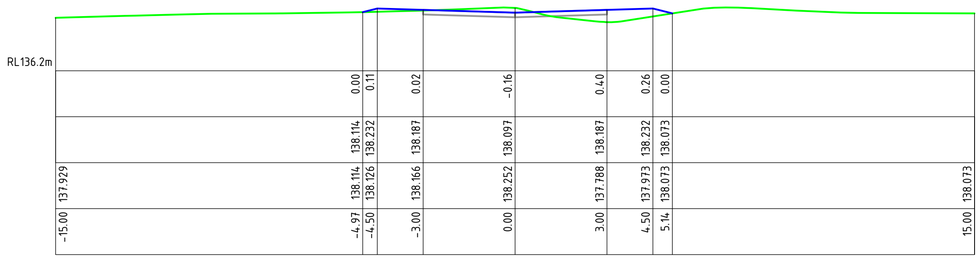
Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

	Drawn **DF**	*Date Surveyed* **23/07/21**
Designed **DF**	*Approved* **ARR**	*Date Issued* **17/03/22**
	Locality **Goonellabah**	*Drawing No* **21037-CIV**
Parish **Lismore**	*County* **Rous**	*Revision No.* **5**
Local Government Area **Lismore**		*Sheet No* **11** of **20**



		0.00	0.51	0.42	0.28	0.63	0.64	0.00	
	140.213	140.213	140.732	140.687	140.597	140.687	140.732	140.340	
139.941	140.213	140.226	140.265	140.314	140.061	140.087	140.340		140.396
-15.00	-6.58	-4.50	-3.00	0.00	3.00	4.50	6.07		15.00

Ch 40.00 m



		0.00	0.11	0.02	-0.16	0.40	0.26	0.00	
		138.114	138.232	138.187	138.097	138.187	138.232	138.073	
137.929		138.114	138.126	138.166	138.252	137.788	137.973	138.073	138.073
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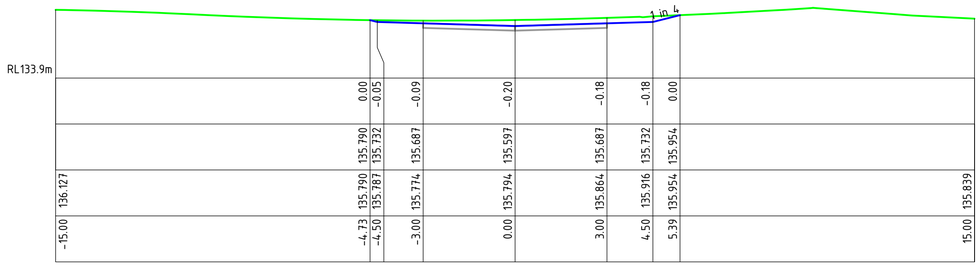
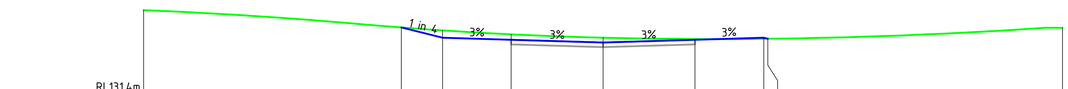
Ch 30.00 m



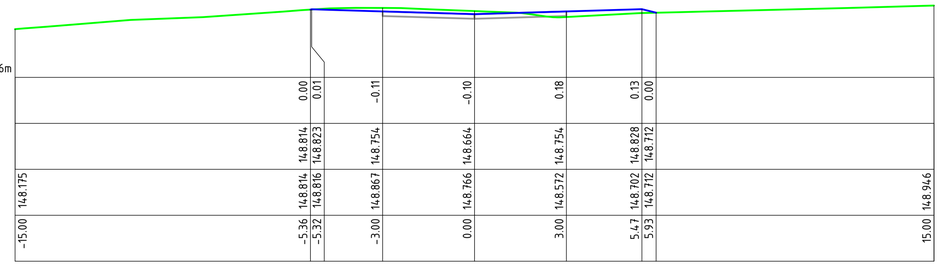
		0.00	-0.05	-0.09	-0.20	-0.18	-0.18	0.00	
		135.790	135.732	135.687	135.597	135.687	135.732	135.954	
136.127		135.790	135.787	135.774	135.794	135.864	135.916	135.954	135.839
-15.00		-4.73	-4.50	-3.00	0.00	3.00	4.50	5.39	15.00

Ch 20.00 m



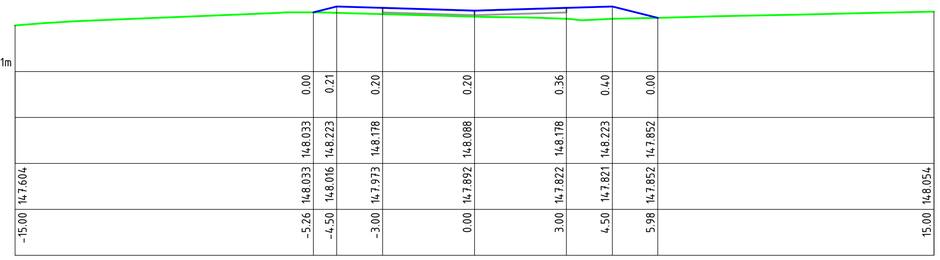
Ht Difference		0.00	-0.24	-0.18	-0.16	-0.02	0.03	0.00	
DESIGN		133.633	133.296	133.229	133.139	133.229	133.296	133.264	
EXISTING	134.197	133.633	133.536	133.406	133.297	133.253	133.262	133.264	133.619
OFFSET	-15.00	-6.59	-5.24	-3.00	0.00	3.00	5.25	5.38	15.00

Ch 10.00 m
Shared Driveway



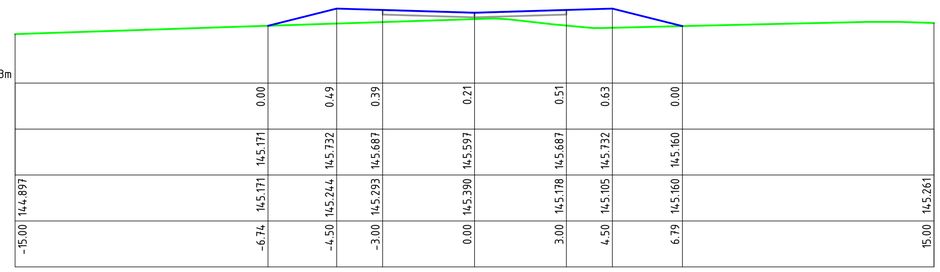
		0.00	0.01	-0.11	-0.10	0.18	0.13	0.00	
	148.814	148.814	148.823	148.754	148.664	148.754	148.828	148.712	
148.175	148.814	148.816	148.867	148.766	148.572	148.702	148.712		148.946
-15.00	-5.36	-5.32	-3.00	0.00	3.00	5.47	5.93		15.00

Ch 72.85 m



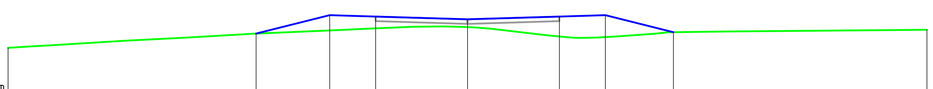
		0.00	0.21	0.20	0.20	0.36	0.40	0.00	
		148.033	148.223	148.178	148.088	148.178	148.223	147.852	
147.604		148.033	148.016	147.973	147.892	147.822	147.821	147.852	148.054
-15.00		-5.26	-4.50	-3.00	0.00	3.00	4.50	5.98	15.00

Ch 70.00 m



		0.00	0.49	0.39	0.21	0.51	0.63	0.00	
		145.171	145.732	145.687	145.597	145.687	145.732	145.160	
144.897		145.171	145.244	145.293	145.390	145.178	145.105	145.160	145.261
-15.00		-6.74	-4.50	-3.00	0.00	3.00	4.50	6.79	15.00

Ch 60.00 m



		0.00	0.50	0.39	0.25	0.65	0.71	0.00	
		142.631	143.232	143.187	143.097	143.187	143.232	142.677	
142.166		142.631	142.733	142.802	142.843	142.536	142.518	142.677	142.755
-15.00		-6.90	-4.50	-3.00	0.00	3.00	4.50	6.72	15.00

Ch 50.00 m

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Drawing Title

SHARED DRIVEWAY CROSS SECTIONS (Sheet 1 of 2)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8

Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

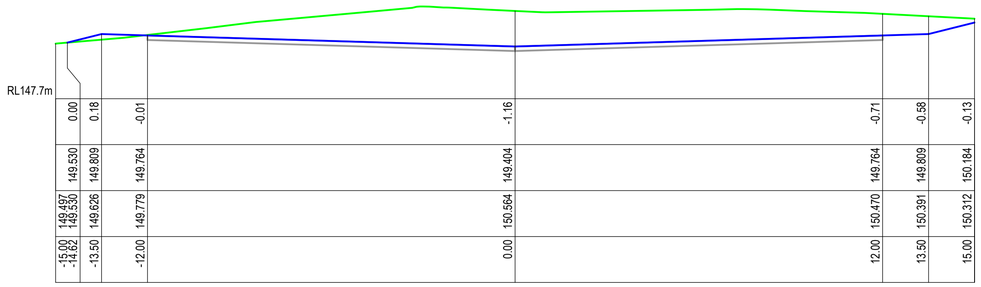
Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

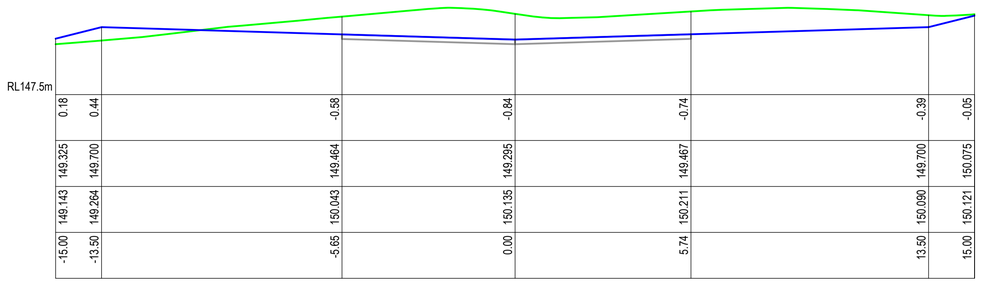
Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	12 of 20



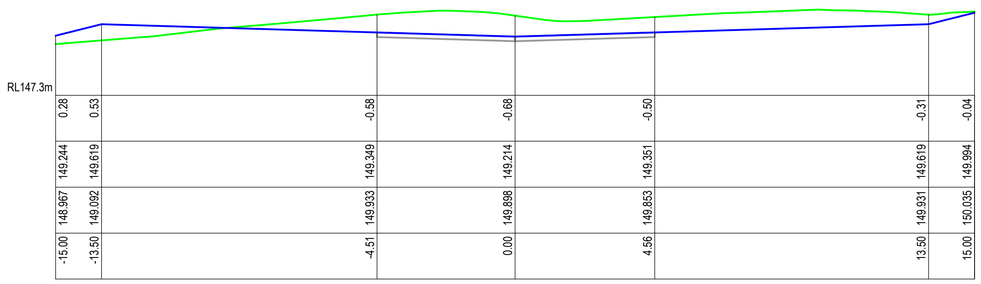
0.00	0.18	-0.01	-1.16	-0.71	-0.58	-0.13
149.530	149.809	149.764	149.404	149.764	149.809	150.184
149.497 149.530	149.626	149.779	150.564	150.470	150.391	150.312
-15.00 -14.62	-13.50	-12.00	0.00	12.00	13.50	15.00

Ch 80.00 m



0.18	0.44	-0.58	-0.84	-0.74	-0.39	-0.05
149.325	149.700	149.464	149.295	149.467	149.700	150.075
149.143	149.264	150.043	150.135	150.211	150.090	150.121
-15.00	-13.50	-5.65	0.00	5.74	13.50	15.00

Ch 78.02 m

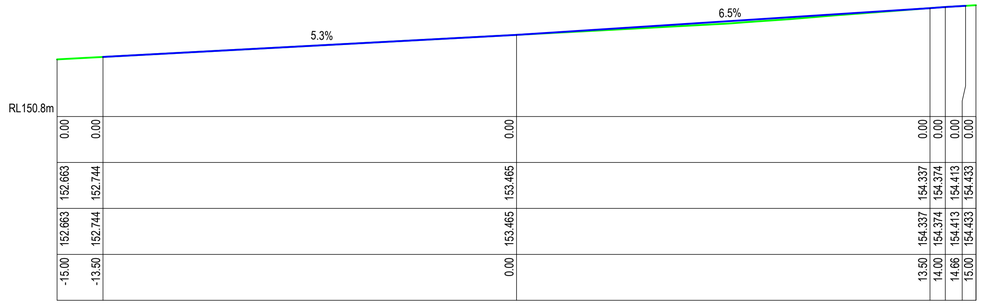


0.28	0.53	-0.58	-0.68	-0.50	-0.31	-0.04
149.244	149.619	149.349	149.214	149.351	149.619	149.994
148.967	149.092	149.933	149.898	149.853	149.931	150.035
-15.00	-13.50	-4.51	0.00	4.56	13.50	15.00

Ch 77.02 m

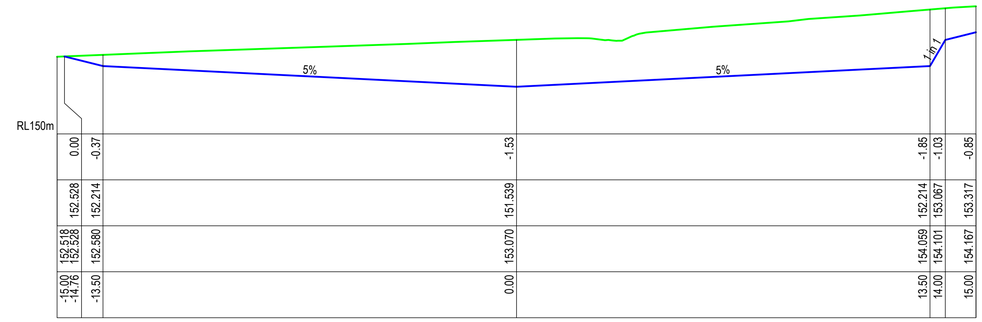
Ht Difference	0.40	0.67	-0.40	-0.41	-0.12	-0.14	0.00
DESIGN	149.001	149.400	149.099	148.998	149.100	149.403	149.527
EXISTING	148.604	148.731	149.499	149.408	149.224	149.540 149.527	149.502
OFFSET	-15.00	-13.40	-3.35	0.00	3.37	13.50 14.00	15.00

Ch 75.05 m
Shared Driveway



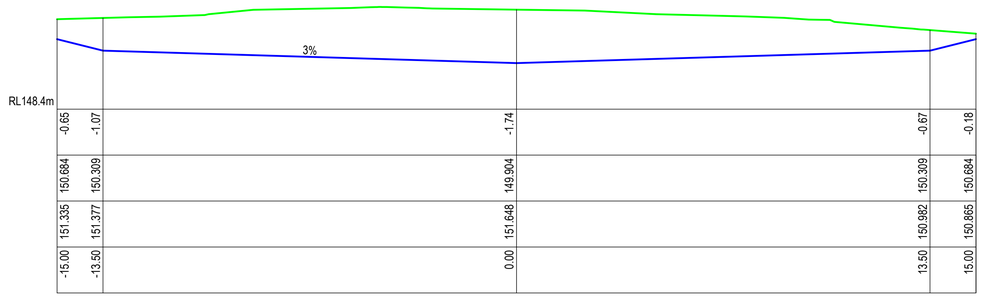
0.00	0.00	0.00	0.00	0.00	0.00	0.00
152.663	152.744	153.465	154.337	154.374	154.413	154.433
152.663	152.744	153.465	154.337	154.374	154.413	154.433
-15.00	-13.50	0.00	13.50	14.00	14.66	15.00

Ch 97.55 m



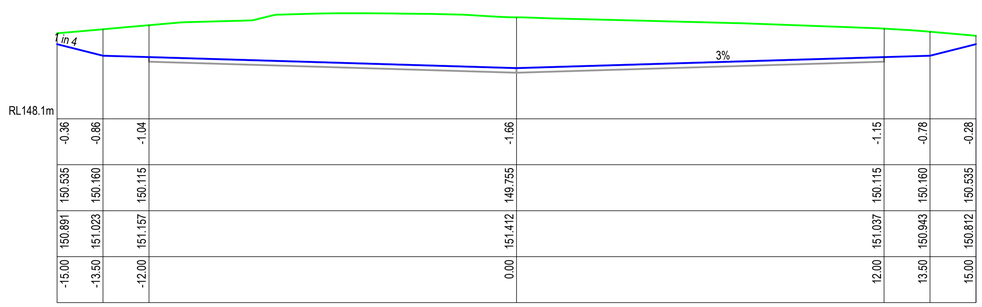
0.00	-0.37	-1.53	-1.85	-1.03	-0.85
152.528	152.214	151.539	152.214	153.067	153.317
152.518 152.528	152.580	153.070	154.099	154.101	154.167
-15.00 -14.76	-13.50	0.00	13.50	14.00	15.00

Ch 96.55 m



-0.65	-1.07	-1.74	-0.67	-0.18
150.684	150.309	149.904	150.309	150.684
151.335	151.377	151.648	150.982	150.865
-15.00	-13.50	0.00	13.50	15.00

Ch 90.00 m



-0.36	-0.86	-1.04	-1.66	-1.15	-0.78	-0.28
150.535	150.160	150.115	149.755	150.115	150.160	150.535
150.891	151.023	151.157	151.412	151.037	150.943	150.812
-15.00	-13.50	-12.00	0.00	12.00	13.50	15.00

Ch 87.02 m

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CONSULTING SURVEYORS NATIONAL
PROFESSIONAL STANDARDS SCHEME
Liability limited by a scheme approved under Prosessional Standards legislation

IMPORTANT NOTES

All areas and dimensions are subject to final Survey.
Boundary corners have not been marked by survey. Prior to undertaking any construction works in proximity to the boundaries of the land/s shown within this plan it is recommended that the boundaries be fully surveyed and marked accordingly.
The shape and size of survey point symbols shown on this plan are diagrammatic only.
Further disclaimers are noted on the plan.

Drawing Title
SHARED DRIVEWAY CROSS SECTIONS (Sheet 2 of 2)

Project
Development Application
Subdivision of Lot 4 DP 406893

Client
Praedium Partnership

0 2 4 6 8
Reduction Ratio
1:100
At A1 Size Sheet

Vertical Datum
AHD
Vertical Origin
SSM 90073
RL131.85 AHD

Drawn	Date Surveyed
DF	23/07/21

Designed	Approved	Date Issued
DF	ARR	17/03/22

Locality	Drawing No
Goonellabah	21037-CIV

Parish	County	Revision No.
Lismore	Rous	5

Local Government Area	Sheet No
Lismore	13 of 20

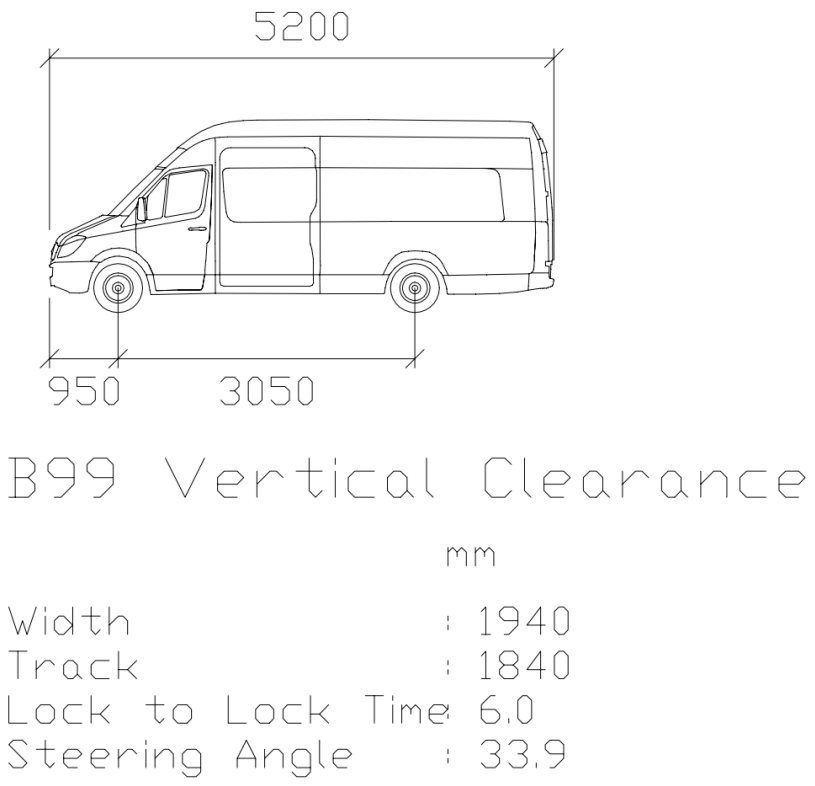
ANNEXURE B: DCP REQUIREMENTS

(2 SHEETS)

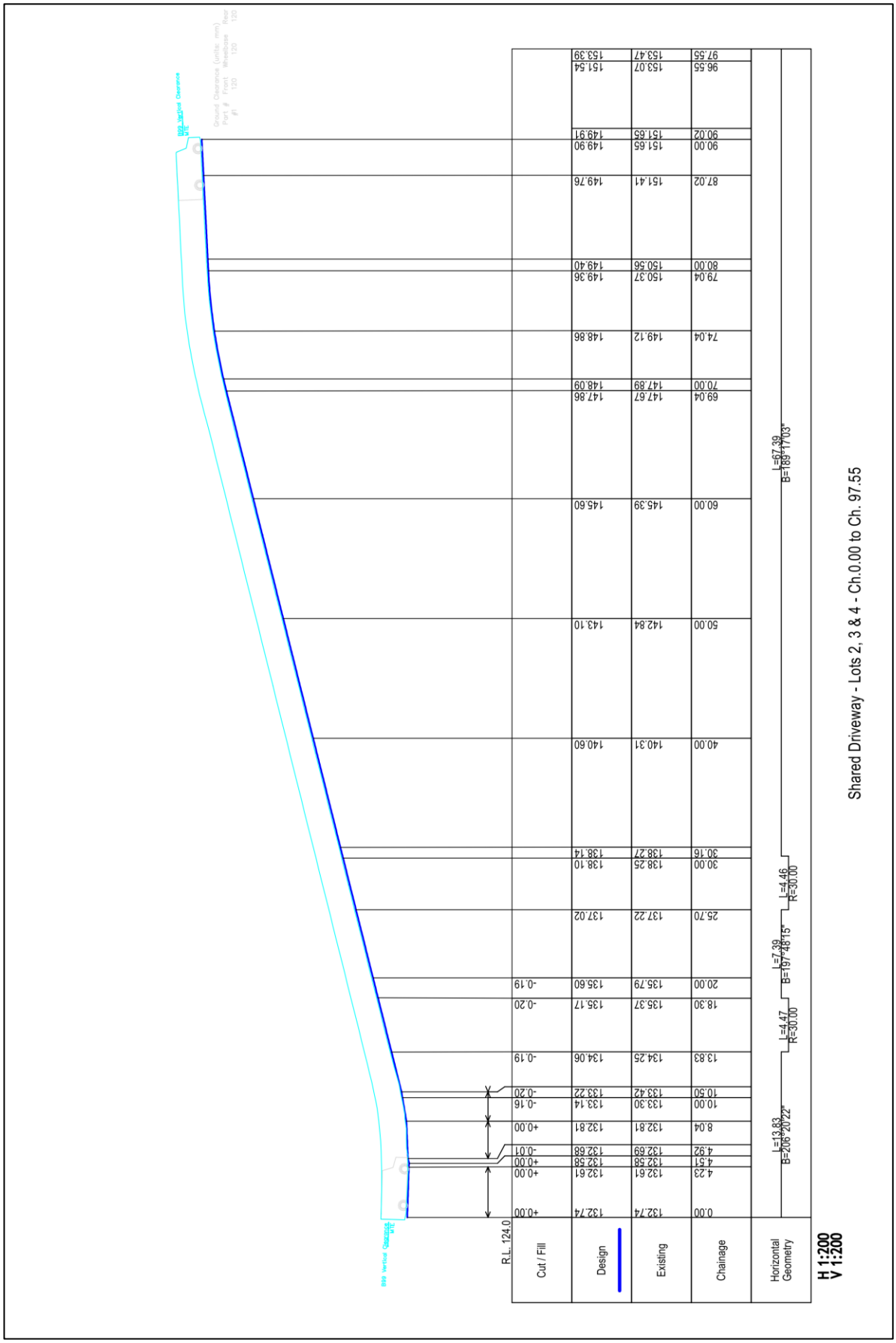
DCP Page and Clause	DCP Requirement	Compliance	Comment
Pg12, Clause P4	***Access*** *P4 Lot access is safe for pedestrians, cyclists and vehicles using the access*	Yes	In relation to the access handle serving lots 2, 3 and 4, separated 1.5m wide verges are provided that will facilitate safe pedestrian access inclusive of steps and handrails where the gradient exceeds 12.5% (1:8).
	Access *A4.1 Lot design precludes the need to reverse onto a Distributor Road.*	Yes	-
	A4.2. New lots shall front onto a designated public street. No new lots shall be created with sole access via Right of Carriageway.	No	Given the physical topography of the site an access handle is required and considered an acceptable solution.
	A4.3. Access handle width for battle-axe subdivision is:	Yes	-
	• *3.6 metres for one (1) lot;*	N/A	-
	• *Three (3) metres each for two (2) or more adjoining lots; or*	Yes	A 9m access handle is provided.
	• *Eight (8) metres for medium density development with three (3) or more dwellings.*	N/A	-
Pg15, Clause P10	***Safety and access*** *P10 Intersections along residential streets are spaces to create safe and convenient movements for motorists, cyclists and pedestrians*	Yes	-
Pg15, Clause P12.1	***Environmental Protection.*** *P12.1 Traffic generated by a development is within the acceptable capacity of the roads*	Yes	-
Pg15, Clause P12.2	*P12.2. The street network is designed to reduce traffic speeds and volumes to acceptable levels, with most dwellings fronting streets with low volumes*	Yes	-
Pg17, Clause P13	***Function and Width*** *P13 The width of the street reserve is sufficient to cater for all street functions, including:*	-	-
	• *Safe and efficient movement of all users;*	Yes	-
	• *Vehicle parking;*	Yes	-
	• *Landscaping;*	N/A	For others

DCP Page and Clause	DCP Requirement	Compliance	Comment
	• *Public utilities;*	N/A	For others
	• *Future carriage way widening;*	N/A	-
	• *Retaining walls;*	N/A	For others
	• *Cycle paths or overland drainage flow paths.*	N/A	For others
Pg17, Clause A13	***Function and Width*** *A13 The following street components are to be consistent with the requirements of Table 1:*	-	-
	• *Street reserve widths;*	Yes	-
	• *Carriageway widths;*	Yes	-
	• *Verge widths;*	No	3.5m verges provided along Greenwood Drive. Acceptable variance.
	• *Parking within the street reserve;*	Yes	-
	• *Kerb type;*	N/A	Others to address
	• *Pedestrian and cyclists facilities;*	Yes	-
	• *Number and desired lots the road is to service*	Yes	-
Pg17, Clause P14	***Designing for safety*** *P14The street design:* • *Provides for safe pedestrian use for people of all ages and levels of mobility* • *Includes speed reduction techniques to achieve desire speeds;* • *Achieves safe sight distances based on vehicle speed, exits from property access points, pedestrian and cyclist crossings and at junctions and intersections.*	Yes	-
Pg17, Clause P15.1	***Driveway access*** *P15.1 Carriageway and verge width allows unobstructed access to individual lots, even when a car is parked on the opposite side of the street.*	Yes	-
Pg17, Clause P15.2	*P15.2. Street and lot design ensures safe vehicle access to all lots (refer to Figure 15 for examples).*	Yes	-
Pg18, Clause P16.6	*Street and parking design enables adequate servicing of waste collection vehicles for all lots.*	Yes	-

ANNEXURE C: VERTICAL (GROUND) CLEARANCE TESTING
(2 SHEETS)



AUSTRALIAN STANDARD 99.8TH PERCENTILE SIZE VEHICLE (B99)



B99 Vertical (Ground) Clearance Test

Successful

ANNEXURE D: PLANNING FOR BUSH FIRE PROTECTION 2019 REQUIREMENTS

(3 SHEETS)

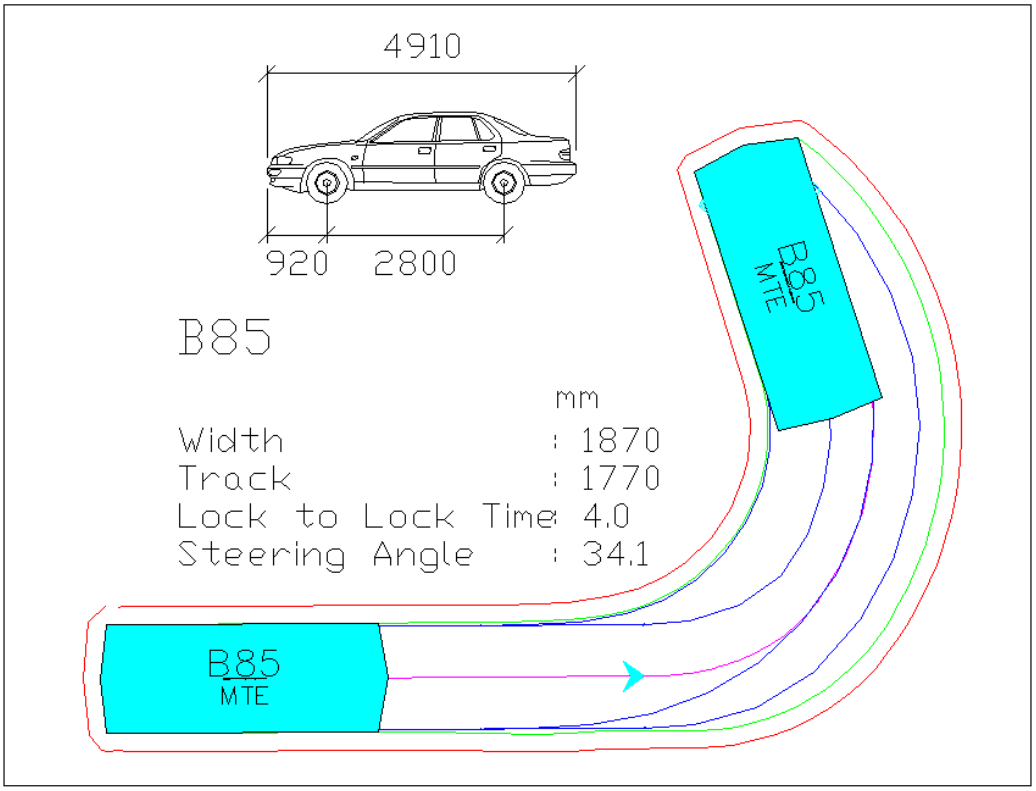
Performance Criteria	Acceptable Solutions	Provided	Comment
Firefighting vehicles are provided with safe, all weather access to structures	*Property access roads are two-wheel drive, all weather roads;*	Yes	-
	Perimeter roads are provided for residential subdivisions of three or more allotments'	N/A	-
	Subdivisions of three or more allotments have more than once access in and out of the development;	Yes	-
	Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient;	Yes	15 degrees converts to a 26.7% grade. 10 degrees converts to a 17.6% grade.
	All roads are through roads	Yes	Note: This relates to public roads
	Dead end roads are not recommended, but if unavoidable are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end;	N/A	No dead ends proposed
	Where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road;	N/A	-
	Where access/egress can only be achieved through forest, woodland and health vegetation, secondary access shall be provided to an alternative point on the existing public road system; and	N/A	-
	One way only public access roads are no less than 3.5m meters wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.	N/A	-
The capacity of access roads is adequate for firefighting vehicles.	*The capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/ causeways are to clearly indicate load rating*	N/A	For others to address

Performance Criteria	Acceptable Solutions	Provided	Comment
Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating	*Minimum 5.5m carriageway width kerb to kerb;*	Yes	
	Parking is provided outside of the carriageway width;	Yes	Incidents of- parking on the carriageway will be low.
	Hydrants are located clear of parking areas;	N/A	For others to address
	Roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m;	Yes	-
	Curves of roads have a minimum inner radius of 6m;	Yes	-
	The road crossfall does not exceed 3 degrees; and	Yes	3 degrees converts to a 5.24% grade.
	A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	Yes	Can be managed in practice
Firefighting vehicles can access the dwelling and exit the property safely	*There are no specific access requirements in an urban area where an unobstructed path (no greater than 70m) is provided between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles.*	No	-
	In circumstances where this cannot occur, the following requirements apply;		
	Minimum 4m carriageway width	Yes	-
	In forest, woodland and health situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m at the passing bay	N/A	Two-way passing is achieved along the entirety of the public road and access handle
	A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches;	Yes	Can be managed in practice

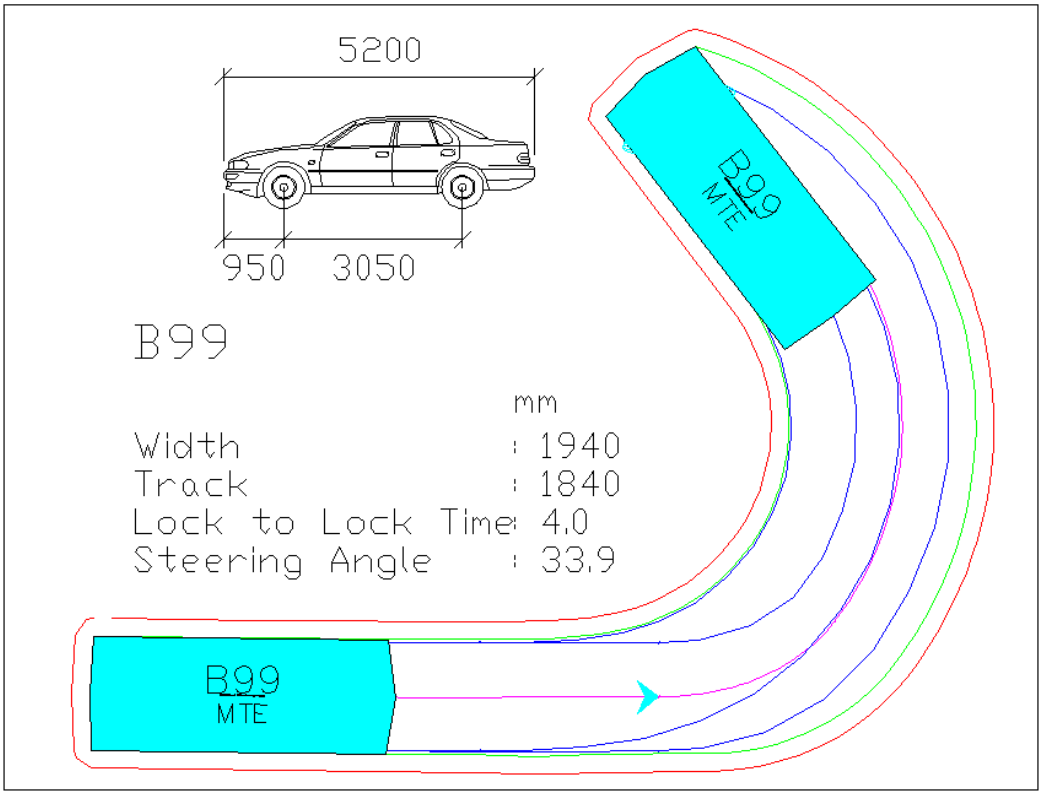
Performance Criteria	Acceptable Solutions	Provided	Comment
	Provided a suitable turning area in accordance with Appendix 3;	Yes	Generally, complies with Type B from Figure A3.3. of PBP 2019
	Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress;	Yes	-
	The minimum distance between inner and outer curves is 6m;	Yes	-
	The crossfall is not more than 10 degrees	Yes	10 degrees converts to a 17.6% grade.
	Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads; and	Yes	-
	A development comprising more than three dwellings has access by dedication of a road and not by right of way	Yes	-

ANNEXURE E: SWEPT PATH TESTING

(5 SHEETS)

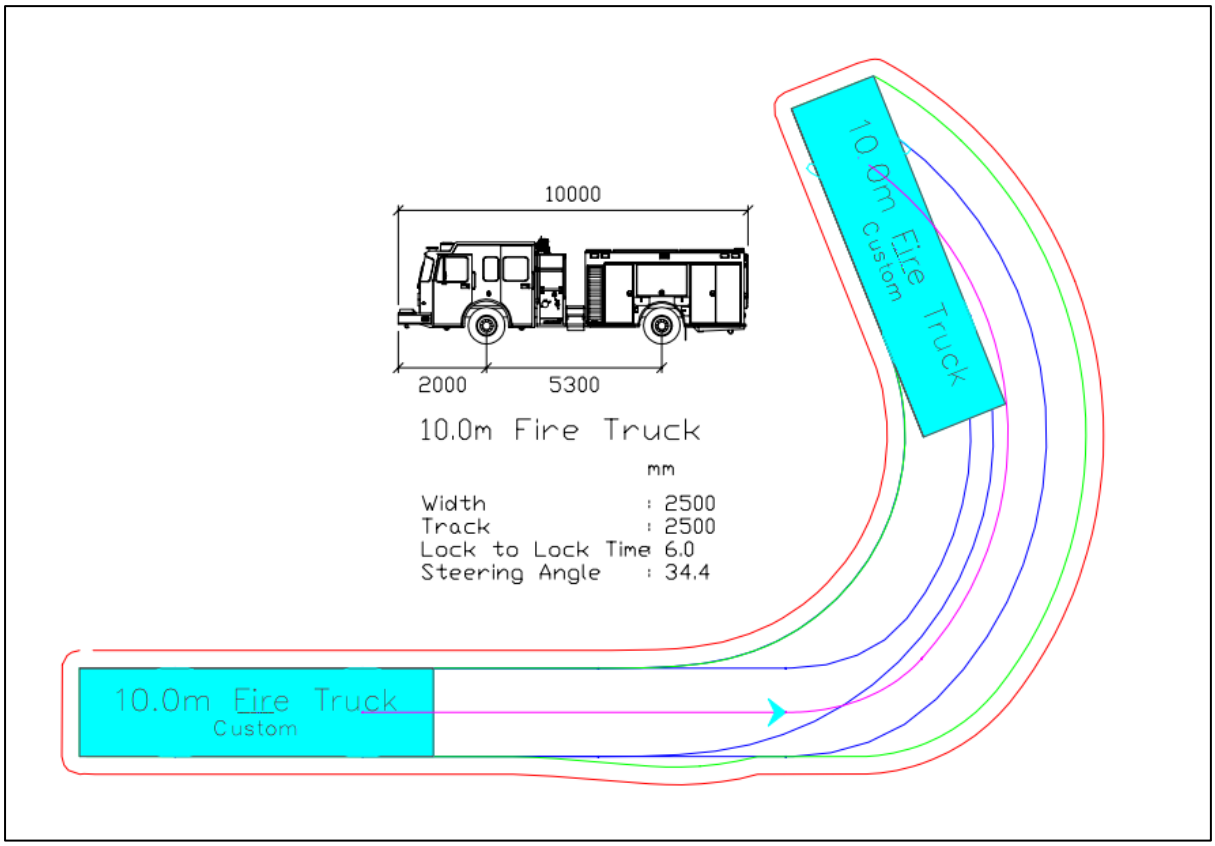


AUSTRALIAN STANDARD 85TH PERCENTILE SIZE VEHICLE (B85)



AUSTRALIAN STANDARD 99.8TH PERCENTILE SIZE VEHICLE (B99)

Blue – Tyre Path
Green – Vehicle Body
Red – 300mm Clearance

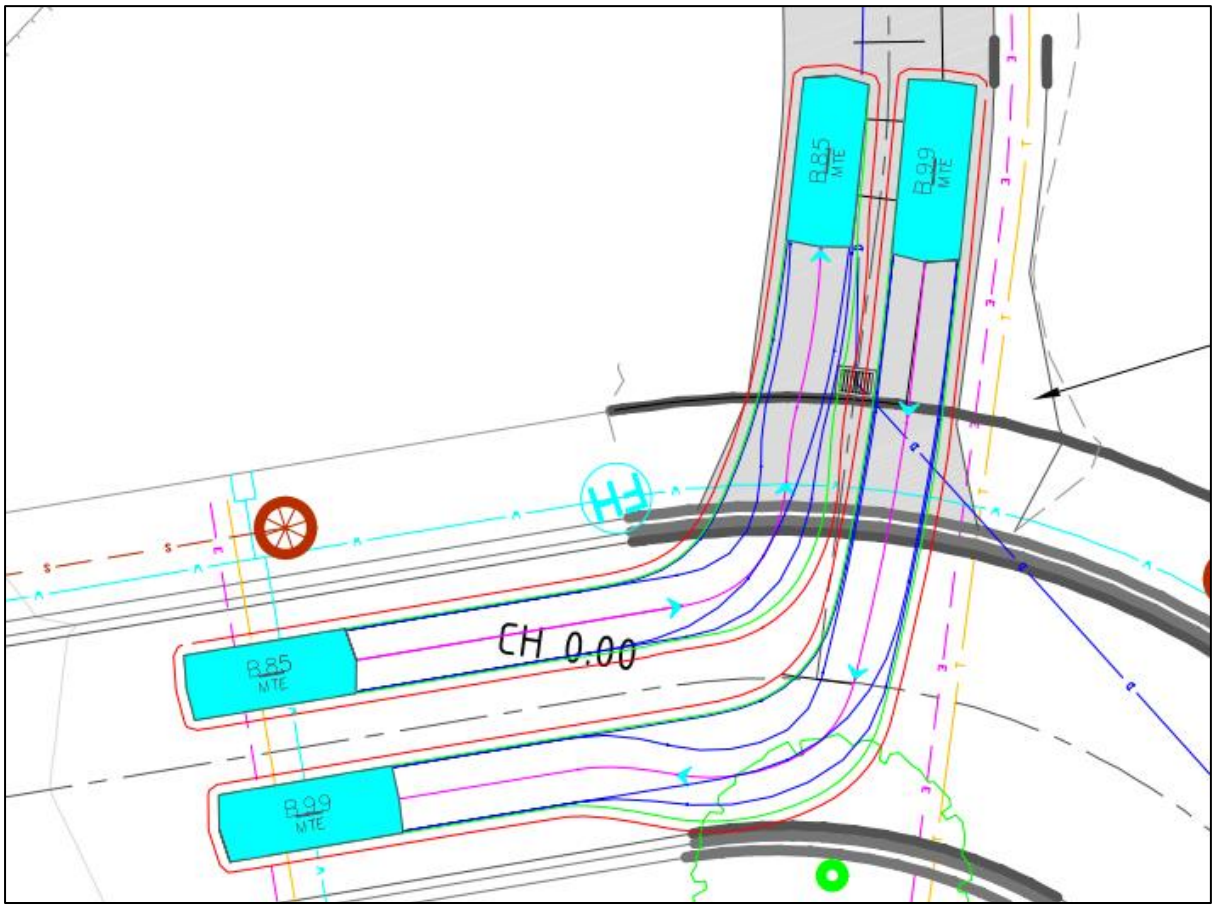


10.0M FIRE TRUCK

Blue – Tyre Path

Green – Vehicle Body

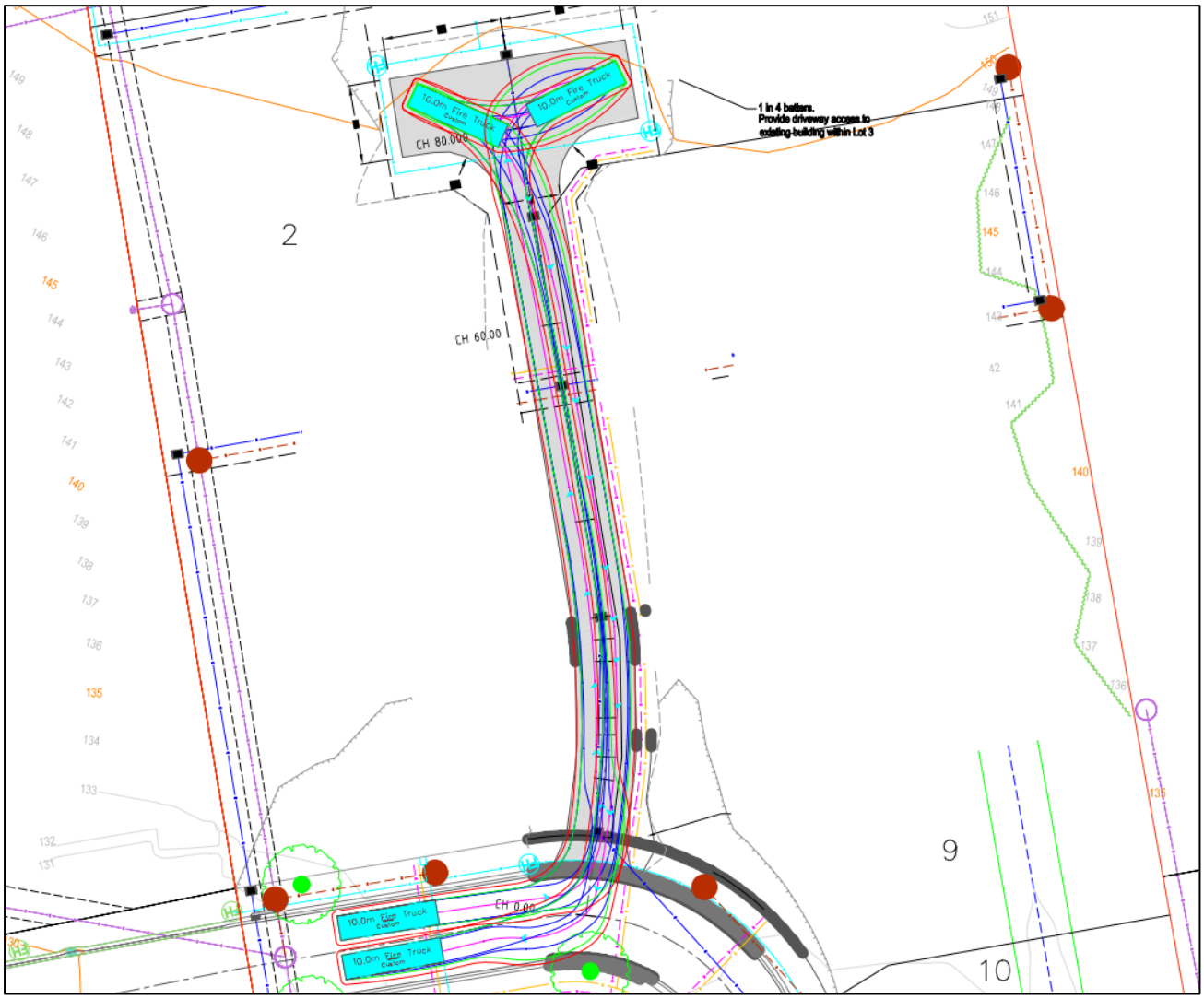
Red – 500mm Clearance



B85 and B99 Passing on the Driveway

Tested @ 5km/h

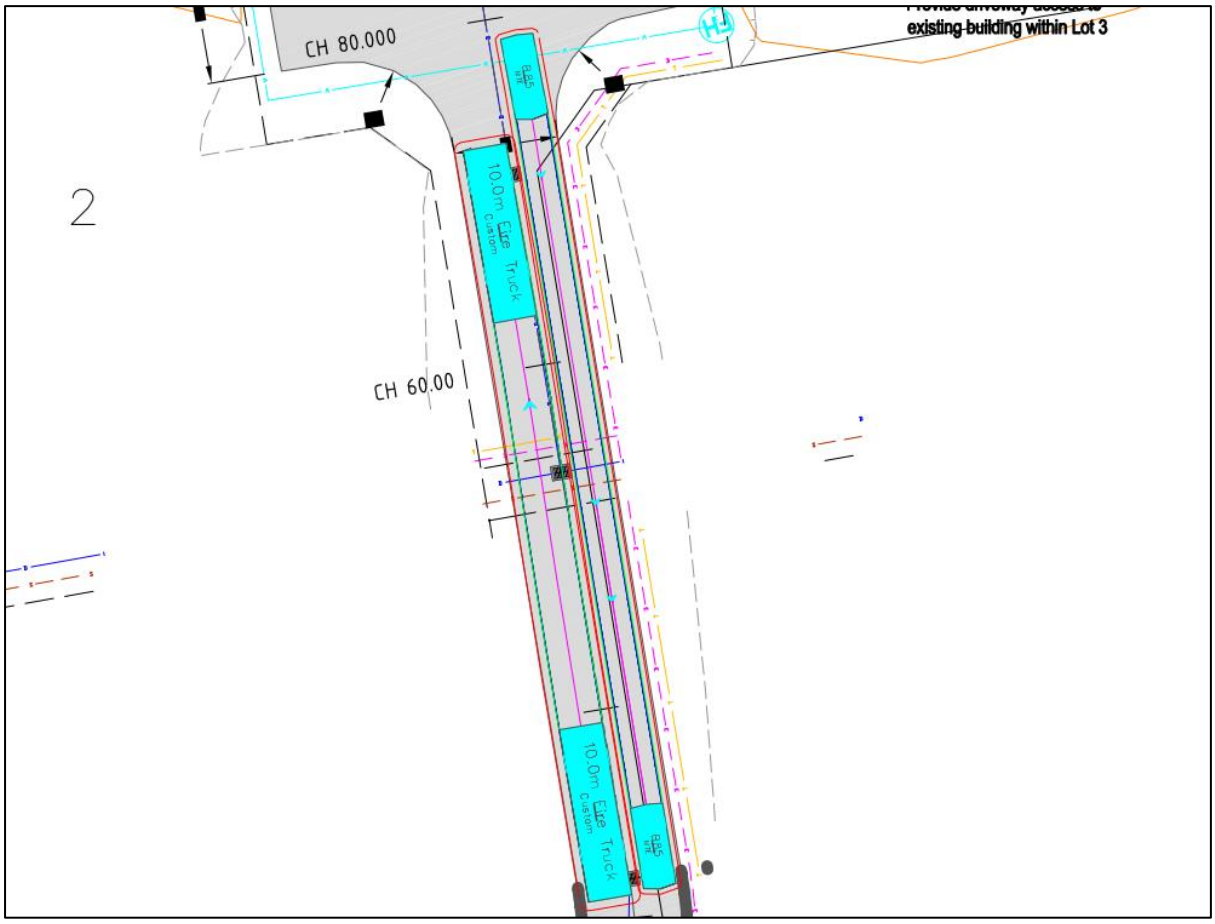
SUCCESSFUL



10m Fire Truck Circulation

Tested @ 5km/h

SUCCESSFUL



10m Fire Truck passing B85

Tested @ 5km/h

SUCCESSFUL