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SITE SPECIFIC DESIGN CRITERIA ANALYSIS

Prepared for:
Robert Stutsel
426 The Driftway
Londonderry NSW 2753

Supplier:
Wide Span Sheds

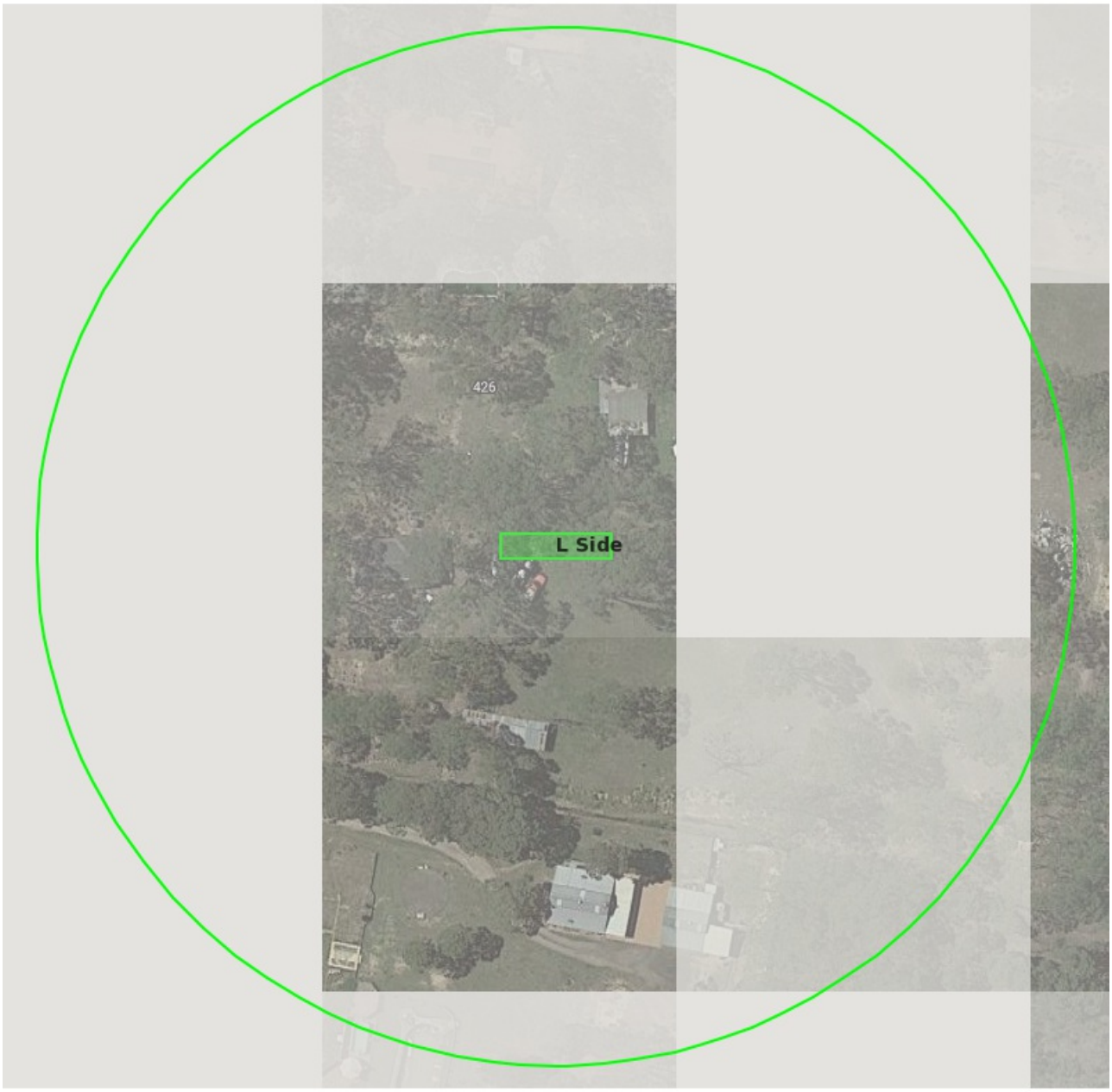
Assessment Ref:
STX21060815MD

Issued:
26/06/2021

Building Details:
Span: 4.5
Length: 20
Avg. Height: 4.666

Certified by:

J. Ronaldson
for and on behalf of
Apex Engineering Group PTY LTD
(ACN 632 588 562)
Member Institution of Engineers (Aust.), CPEng (NER Structural) Regn. No. 5276680
Registered Professional Engineer (Structural) - Queensland: Regn. No. 24223
Registered Professional Engineer (Structural) - Victoria: Regn. No. EC67493
Registered Building Designer & Professional Engineer (Structural) - Tasmania: Regn. No. 185770492



Site Location:
Geographic coordinates of
-33.62534,150.73013
Generally described as:
426 The Driftway Londonderry NSW 2753

Executive Summary - Site Specific Analysis

The design analysis of the building has not been considered for each of the 4 orthogonal directions. Hence the maximum wind speed in any of the 8 cardinal directions has been used as the design wind speed. This is a conservative approach.

Each cardinal direction has been considered and the results are summarised below

Factor	N	NE	E	SE	S	SW	W	NW
Wind Region	A3							
Importance level (IL)	2							
Regional Wind Speed (Vr)	45.0							
Terrain Category (TC)	2.55	2.53	2.5	2.71	2.94	2.77	2.5	2.5
Terrain Category Multiplier (Mz)	0.87	0.87	0.87	0.85	0.83	0.85	0.87	0.87
Shielding Multiplier (Ms)	1	1	1	1	1	1	1	1
Topographic Multiplier (Mt)	1	1	1	1	1	1	1	1
Wind Direction Multiplier 1 (Md1)	0.85	0.8	0.8	0.8	0.8	0.85	0.9	1
Site specific design wind speed (Vsite1)	33.1	31.2	31.3	30.7	30.1	32.5	35.2	39.2

Wind Direction Multiplier 2 (Md2)	0.85	0.8	0.8	0.8	0.8	0.85	0.9	1
Site specific design wind speed (Vsite2)	33.1	31.2	31.3	30.7	30.1	32.5	35.2	39.2

Design Wind Speed (Vsite1)	39.2 m/s	for the resultant forces and overturning moments on the complete building and wind actions on major structural elements.
Design Wind Speed (Vsite2)	39.2 m/s	for all other cases, including cladding and immediate supporting members (Purlins and Girts)
Snow Load	Nil	
Seismic Factor	Nil	
Durability Alert	No	

The following pages detail how these results were obtained.

This report details how the Site Specific Design Criteria has been determined. Specifically, the following is detailed

1. Site Specific Design Wind Speed
    a. Importance Level
    b. Wind Region
    c. Annual Probability of Exceedance
    d. Wind Direction Multiplier – Md
    e. Regional Wind Speed – Vr
    f. Terrain category & Terrain Category Factor – Mzcat
    g. Shielding Multiplier – Ms
    h. Topographic Factor – Mt
2. Ground Snow load- Sg
3. Earthquake Probability & Hazard Factor – Kp & Z
4. Durability

1.a Importance Level - 2

We have confirmed with the client that an Importance Level of 2 is appropriate based on the building types given in the NCC Vol 1 table B1.2a , and the NCC Guide to Vol 1 where it lists examples of building types for various Importance Levels and also the consideration of hazard to human life combined with impact on the public as per table B1.2

Should the certifiers come across any information that may challenge this, then please contact us so that we can discuss and reassess if necessary.

A generalised description of Importance Levels is given in table B1.2a of the NCC 2019 BCA - Volume One.

Importance Level	
1	Buildings or structures presenting a low degree of hazard to life and other property in the case of failure
2	Buildings or structures not included in Importance Level 1, 3 or 4
3	Buildings or structures that are designed to contain a large number of people.
4	Buildings or structures that are essential to post-disaster recovery or associated with hazardous facilities

1 b. Wind Region - A3

The wind regions for Australia are given in figure 3.1 (A) of AS/NZS 1170.2:2011 - Structural design actions. Part 2: Wind actions plus amendments (herein after referenced as AS/NZS 1170.2)

Based on the Wind Region Map below, the site is located in Wind Region A3

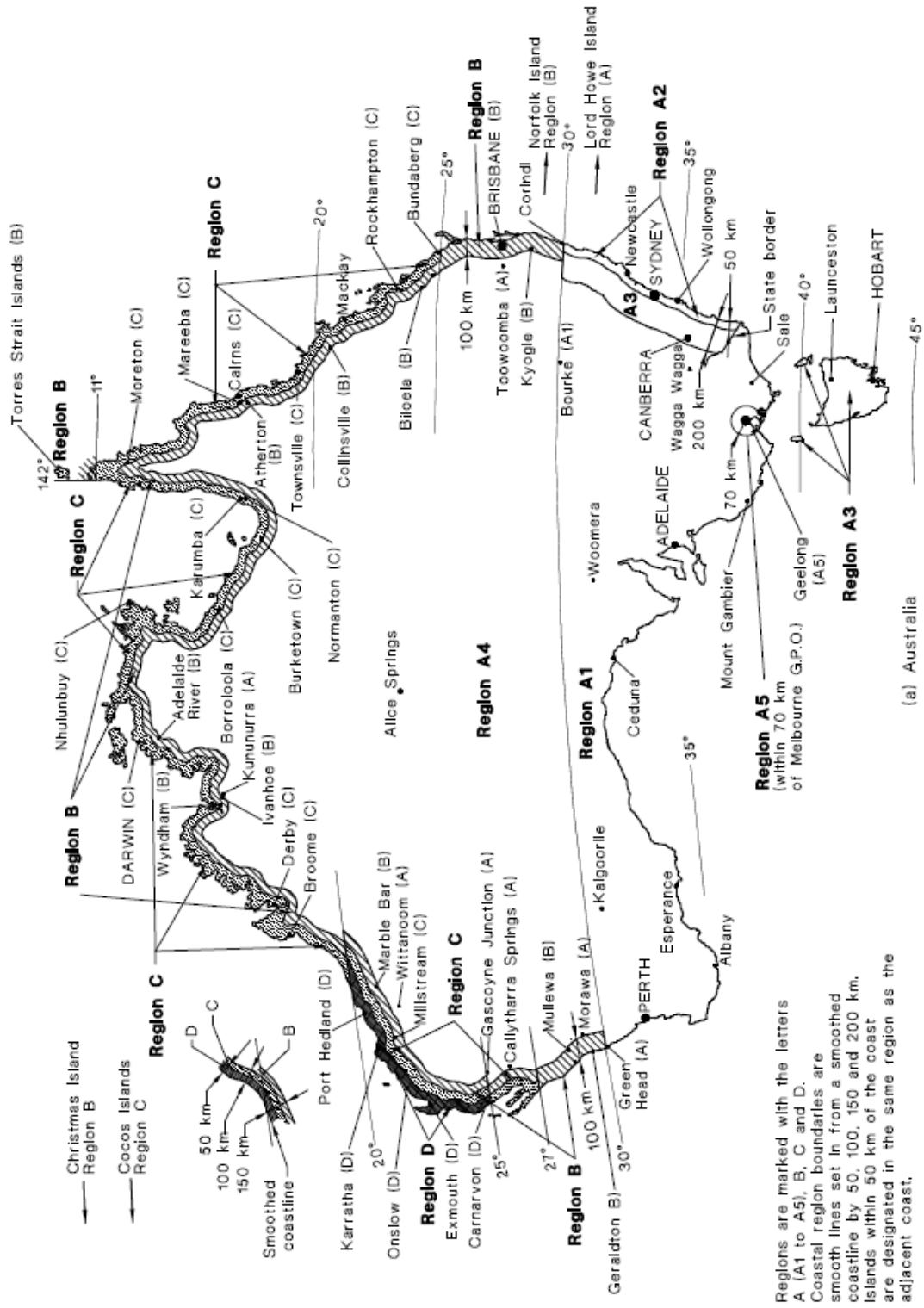


FIGURE 3.1(A) WIND REGIONS

1 c. Annual Probability of Exceedance - 1:500

Table B1.2b - Design Events for Safety of the NCC 2019 BCA - Volume 1 gives the annual probability of exceedance.

Importance Level	Annual probability of exceedance			
	Wind		Snow	Earthquake
	Non Cyclonic	Cyclonic		
1	1 : 100	1 : 200	1 : 100	1 : 250
2	1 : 500	1 : 500	1 : 150	1 : 500
3	1 : 1000	1 : 1000	1 : 200	1 : 1000
4	1 : 2000	1 : 2000	1 : 250	1 : 1500

1 d. Wind Direction Multiplier - Md

Table 3.2 of AS/NZS 1170.2 gives the relevant factors for Region A3 in all 8 Cardinal directions

TABLE 3.2

WIND DIRECTION MULTIPLIER (M_d)

Cardinal directions	Region A1	Region A2	Region A3	Region A4	Region A5	Region A6	Region A7
N	0.90	0.80	0.85	0.90	1.00	0.85	0.90
NE	0.80	0.80	0.80	0.85	0.85	0.95	0.90
E	0.80	0.80	0.80	0.90	0.80	1.00	0.80
SE	0.80	0.95	0.80	0.90	0.80	0.95	0.90
S	0.85	0.90	0.80	0.95	0.85	0.85	0.90
SW	0.95	0.95	0.85	0.95	0.90	0.95	0.90
W	1.00	1.00	0.90	0.95	1.00	1.00	1.00
NW	0.95	0.95	1.00	0.90	0.95	0.95	1.00
Any direction	1.00	1.00	1.00	1.00	1.00	1.00	1.00

1 e. Regional Wind Speed Vr = 45.0 m/s

From Table 3.1 of AS/NZS 1170.2 for Region A3 and an Annual Probability of Exceedance of 1:500 gives a Regional Wind speed of 45.0 m/s (V_r)

Also from table 3.1 the serviceability of wind speed for a Annual Probability of Exceedance of 1:20 gives a wind speed of 37m/s.

TABLE 3.1

REGIONAL WIND SPEEDS

Regional wind speed (m/s)	Region				
	Non-cyclonic			Cyclonic	
	A (1 to 7)	W	B	C	D
V_1	30	34	26	$23\times F_C$	$23\times F_D$
V_5	32	39	28	$33\times F_C$	$35\times F_D$
V_{10}	34	41	33	$39\times F_C$	$43\times F_D$
V_{20}	37	43	38	$45\times F_C$	$51\times F_D$
V_{25}	37	43	39	$47\times F_C$	$53\times F_D$
V_{50}	39	45	44	$52\times F_C$	$60\times F_D$
V_{100}	41	47	48	$56\times F_C$	$66\times F_D$
V_{200}	43	49	52	$61\times F_C$	$72\times F_D$
V_{250}	43	49	53	$62\times F_C$	$74\times F_D$
V_{500}	45	51	57	$66\times F_C$	$80\times F_D$
V_{1000}	46	53	60	$70\times F_C$	$85\times F_D$
V_{2000}	48	54	63	$73\times F_C$	$90\times F_D$
V_{2500}	48	55	64	$74\times F_C$	$91\times F_D$
V_{5000}	50	56	67	$78\times F_C$	$95\times F_D$
V_{10000}	51	58	69	$81\times F_C$	$99\times F_D$
V_R ($R \geq 5$ years)	$67–41R^{-0.1}$	$104–70R^{-0.045}$	$106–92R^{-0.1}$	F_C $(122–104R^{-0.1})$	F_D $(156–142R^{-0.1})$

1 f. Terrain Category & Terrain/Height Multiplier - Mz

AS/NZS 1170.2 Section 4.2.1 details the types of terrain categories that are applicable. These are:

Terrain Category 1 (TC 1) : Very exposed open terrain with few or no obstructions and enclosed, limited sized water surfaces at serviceability and ultimate wind speeds in all wind regions, e.g. flat, treeless, poorly grassed plains; rivers, canals and lakes; and enclosed bays extending less than 10km in the wind direction.

Terrain Category 1.5 (TC 1.5) : Open water surfaces subjected to shoaling waves at serviceability and ultimate wind speeds in all wind regions, e.g. near-shore ocean water; large unenclosed bays on seas and oceans; lakes; and enclosed bays extending greater than 10km in the wind direction

Terrain Category 2 (TC 2) : Open terrain, including grassland, with well scattered obstructions having heights generally from 1.5m to 5m, with no more than two obstructions per hectare, e.g. farmland and cleared subdivisions with isolated trees and uncut grass.

Terrain Category 2.5 (TC 2.5) : Terrain with a few or isolated obstructions. This category is intermediate between TC 2 and TC 3 and represents the terrain in developing outer urban areas with scattered houses, or large acreage developments with fewer than 10 buildings per hectare.

Terrain Category 3 (TC 3) : Terrain with numerous closely spaced obstructions having heights generally from 3 to 10m. The minimum density of obstructions shall be at least the equivalent of 10 house-size obstructions per hectare. e.g. suburban housing, light industrial estates.

Terrain Category 4 (TC 4) : Terrain with numerous large high (10m to 30m tall) and closely spaced obstructions, such as large city centres and well developed industrial complexes.

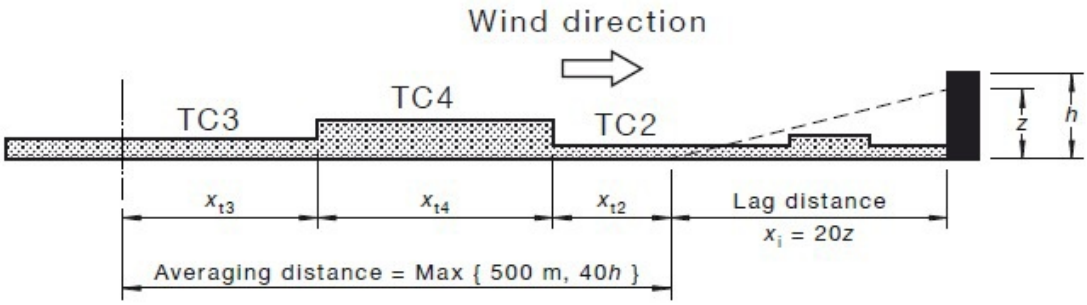
TABLE 4.1
TERRAIN/HEIGHT MULTIPLIERS FOR GUST WIND SPEEDS IN FULLY DEVELOPED TERRAINS—ALL REGIONS

Height (z) m	Terrain/height multiplier ($M_{z,cat}$)			
	Terrain category 1	Terrain category 2	Terrain category 3	Terrain category 4
≤3	0.99	0.91	0.83	0.75
5	1.05	0.91	0.83	0.75
10	1.12	1.00	0.83	0.75
15	1.16	1.05	0.89	0.75
20	1.19	1.08	0.94	0.75
30	1.22	1.12	1.00	0.80
40	1.24	1.16	1.04	0.85
50	1.25	1.18	1.07	0.90
75	1.27	1.22	1.12	0.98
100	1.29	1.24	1.16	1.03
150	1.31	1.27	1.21	1.11
200	1.32	1.29	1.24	1.16

Note: For intermediate values of height and terrain category, use liner interpolation.

AS/NZS 1170.2 Section 4.2.3 goes on to describe the averaging of terrain categories and terrain height multipliers.

The Lag distance (in this case equivalent to the shielding zone) has been ignored when considering the terrain category.



$$M_{z,cat} = \frac{M_{z,cat2}\,x_{t2} + M_{z,cat4}\,x_{t4} + M_{z,cat3}\,x_{t3}}{x_{t2} + x_{t4} + x_{t3}}$$ for the case illustrated

NOTE: The terrain within the lag distance, x_i, is ignored when averaging terrain-height multipliers.

FIGURE 4.1 EXAMPLE OF AVERAGING OF TERRAIN-HEIGHT MULTIPLIERS

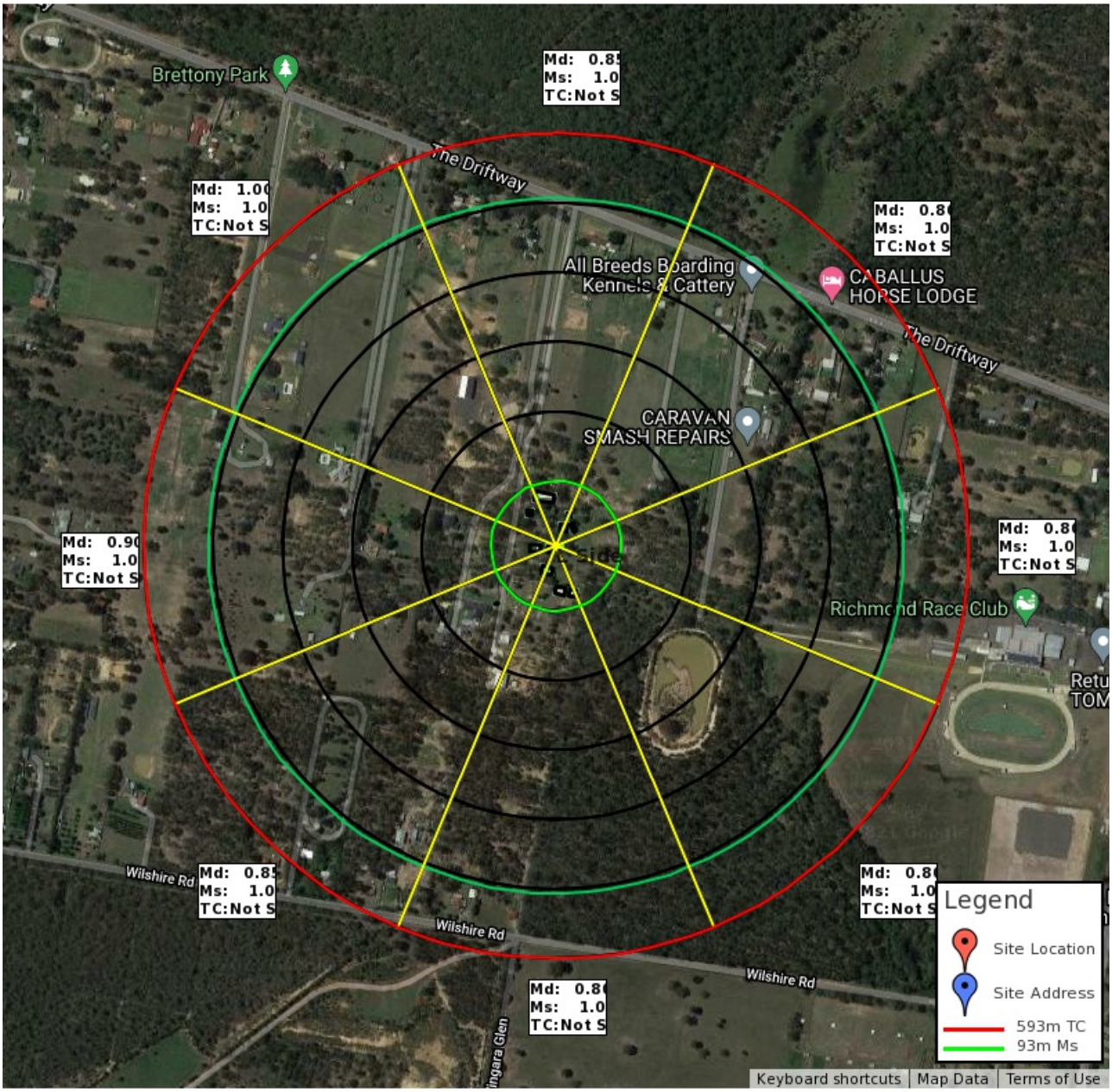
Further to this averaging process is the need to often consider various changes in Terrain Category other than the simple case of changes occurring as the distance is fanned out from the site.

Where appropriate, a method of considering 100m sectors within each cardinal direction and then averaging the terrain category within each sector based on area has been adopted.

Assessment has also taken into account the probable future development 5 years after construction of the building. The result of this assessment is:

Within the terrain category zone the satellite image shows the extent of current development and likely development within the next 5 years.

The image below shows the terrain category determined for each of the 8 cardinal directions.



The average height of the building is 4.666 meters. Using table 4.1 from AS/NZS 1170.2 the value of Mz can be interpolated

Factor	N	NE	E	SE	S	SW	W	NW
Terrain Category	2.55	2.53	2.5	2.71	2.94	2.77	2.5	2.5
Terrain Category Multiplier	0.87	0.87	0.87	0.85	0.83	0.85	0.87	0.87

1 g. Shielding Multiplier -Ms

As per AS/NZS 1170.2 clause 4.3.1 shielding from tress or vegetation has not been included.

Four (4) factors have to be considered:

1. Only buildings whose height is equal to or greater than the building being considered shall be deemed to provide shielding.
2. Shielding is considered only within the area of 20 times the average height of the building being considered.
3. Each 45 degree sector must be considered individually – 8 cardinal directions
4. If the slope of the terrain is greater than 0.2 (1:5), then no shielding is applicable. (100m rise or fall over 500m).

Assessment has also taken into account be the probable future development 5 years after construction of the building. The result of this assessment is:

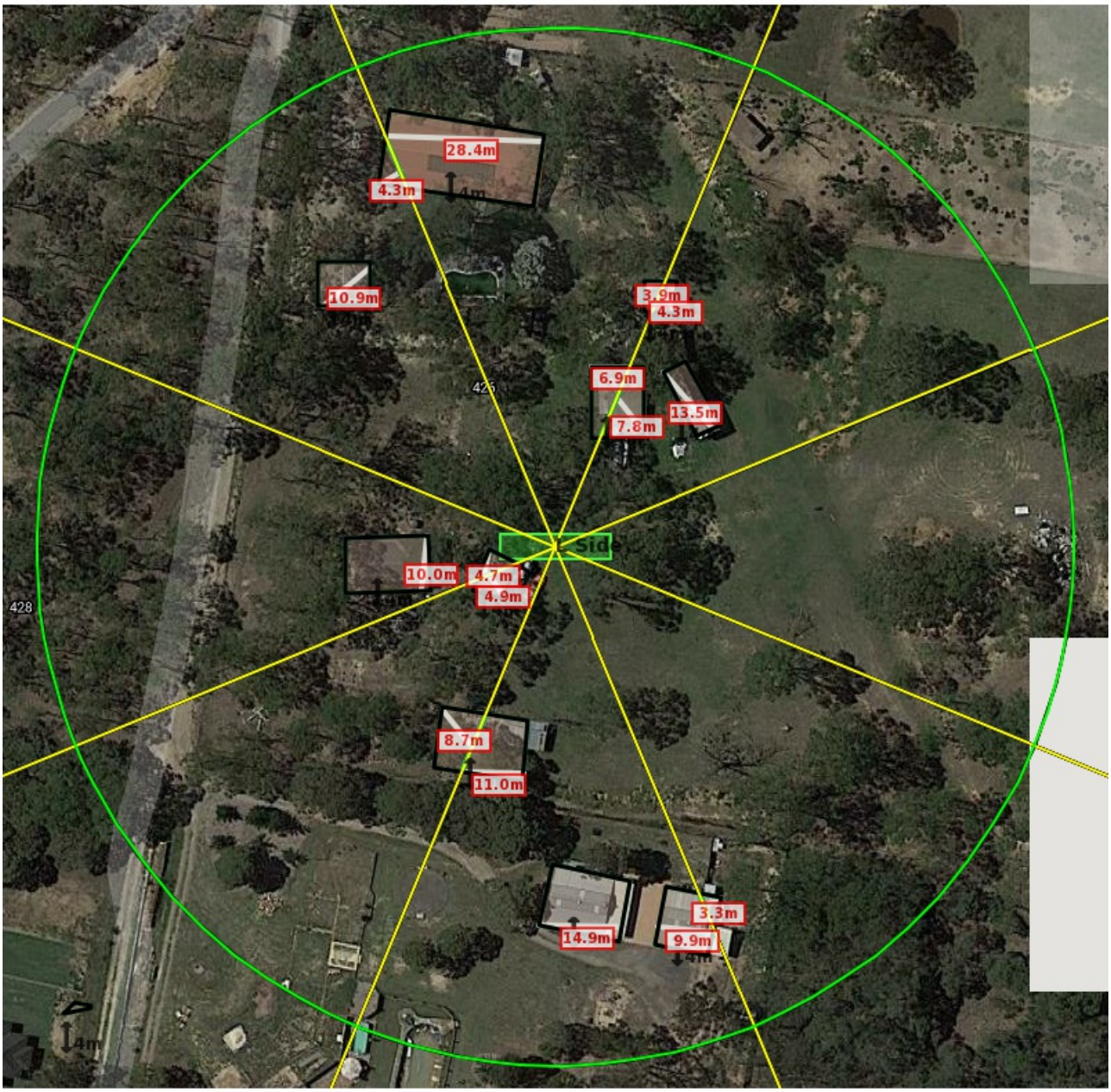
Within the shielding zone the satellite image shows the extent of current development and likely development within the next 5 years.

The shielding parameter(s) is calculated using formulae 4.3 (1) and 4.3 (2). The shielding multiplier can be interpolated from Table 4.3 of AS/NZS 1170.2

Factor	N	NE	E	SE	S	SW	W	NW
n_s	V/A	V/A	V/A	V/A	V/A	V/A	V/A	V/A
l_s	V/A	V/A	V/A	V/A	V/A	V/A	V/A	V/A
h_s	V/A	V/A	V/A	V/A	V/A	V/A	V/A	V/A
b_s	V/A	V/A	V/A	V/A	V/A	V/A	V/A	V/A
s	>=12	>=12	>=12	>=12	>=12	>=12	>=12	>=12
m_s	1	1	1	1	1	1	1	1

V/A = Visually Assessed

The image below shows the buildings in all 8 Cardinal directions.



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1 h. Topographic Multiplier - Mt

As per section 4.4 of AS/NZS 1170.2, the Topographic Factor is calculated.
Mh is calculated by evaluating all 8 cardinal direction and finding the relevant crest of hills and bottom of hills.

Mlee is always taken as 1.0
The values are then applied to the formula nominated in section 4.4 and are given in the table below.
In this case there is no Topographic Factor to consider in any direction. Mt = 1

Factor	N	NE	E	SE	S	SW	W	NW
Topographic Multiplier (Mt)	1	1	1	1	1	1	1	1

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Version: 1, Version Date: 30/08/2021

2. Ground Snow Load

The site is outside of the boundaries given in AS/NZS 1170.3:2003 - Structural design actions. Part 2: Snow and ice actions plus amendments (herein after referenced as AS/NZS 1170.3) for snow load regions. Hence no snow load is applicable.

3. Earthquake Hazard Factor (Z)

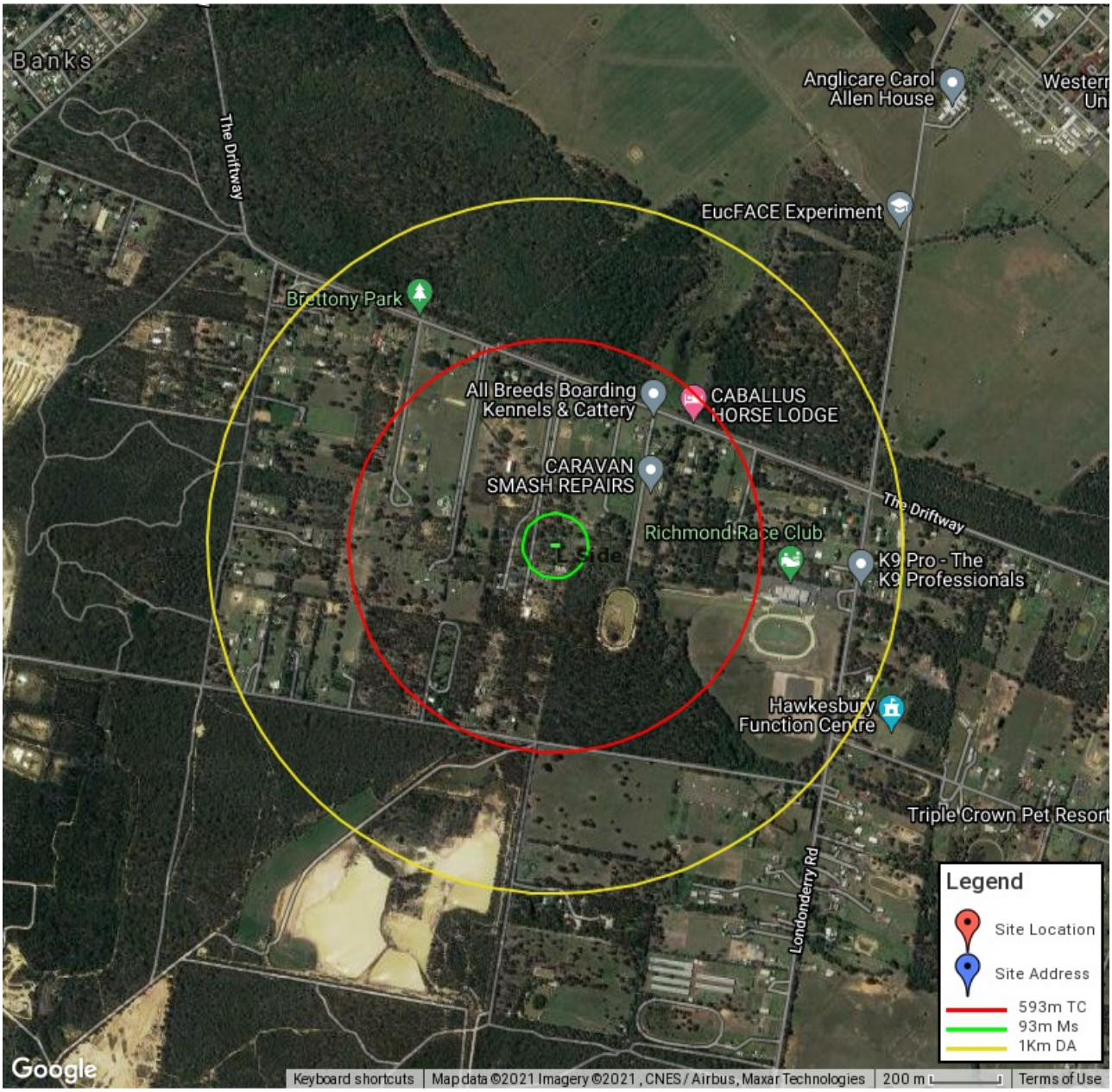
Due to the ducticle nature of the portal framed building, the imposed loads resulting from an earthquake on this building are by inspection, not critical cases in the design of the building.

4. Durability

From the site location and the usage information we have at hand, it is unlikely that the building is subject to a Marine or Industrial Influence.

This should be confirmed this by referencing the BlueScope Technical Bulletins (In particular TB 1A) and where necessary contacting BlueScope on 1800 800 789.

Technical Bulletin TB4 relates to on going maintenance of the building and should be noted to ensure that BlueScope warranties are maintained.



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