

Appendix 16

Arboricultural Impact Assessment (AIA) 31 July
2025

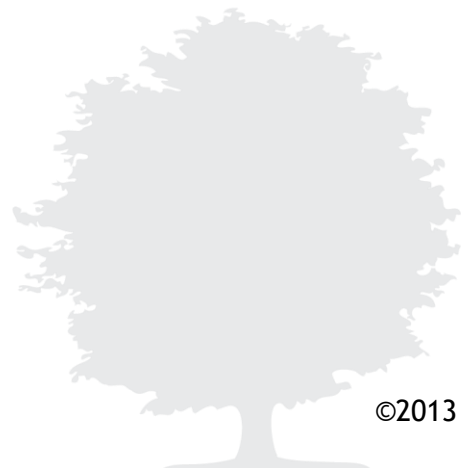


Arboricultural Impact Assessment

172 Russell Street, Emu Plains

Prepared for Glenstone Group
1/124 Russell Street, Emu Plains
NSW 2750

Prepared by Isaac Dale on February 5th, 2025



Document Information

Report Title:	172 Russell Street, Emu Plains – AIA20250118/03
Report Type:	Arboricultural Impact Assessment (AIA)
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Document Status	Date	Description
Draft V1.0	5/2/2025	Draft version for client review
Final V1.0	28/2/2025	Final version post client review
Final V1.1	24/6/2025	Amended as per council RFI
Final V1.2	31/7/2025	Reduced NRZ incursions to match civil drawings

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1.0 Scope

1.0.1 Concept Arbor Consulting was engaged by Glenstone Group to provide an arboricultural impact assessment of a stand of trees at 172 Russell Street, Emu Plains, with regards to the proposed removal of soil stockpiles either side of Lapstone Creek.

2.0 Method

2.0.1 All tree data contained within this report is based on observations by the author obtained during the site inspection conducted on January 23rd, 2025. The subject trees were inspected visually (VTA¹), from ground level only.

2.0.2 Information in this report is limited to the subject trees and reflects their condition at the time of inspection only. Tree locations were surveyed using a Trimble DA2 GNSS receiver & mobile data collection application & their positions (GNSS accuracy to <5cm at the time of inspection) are plotted on an aerial image, listed below as Figure 02.

2.0.3 Tree height was measured using a Nikon Forestry Pro 2; canopy spread is visually estimated. Trunk diameter was measured at standard height (DSH), which is defined as 1.4m above ground level or 1.4m from the uphill side of a slope. Trunk diameter was also measured above the root flare and is expressed as ØRF. Setbacks were measured using a Bosch GLM 100-25 C professional laser distance metre and/or obtained digitally from the site survey.

2.0.4 The identification of genus and species is based on broad features, visible from ground level at the time of inspection only and has not been compared to an herbarium specimen.

2.1 Documents & plans cited

2.1.1 Copies of the following plans and documents were provided and have been used to determine the scope of works:

- Plan of Detail & Levels Over Existing Stockpiles on Lot 2 in DP 1273251, Russell Street, Emu Plains, sheet 1 of 1, revision A, prepared by Richard Hogan & Co. (RHCO), dated 22/10/2024.

2.2 Legislation & regulations

2.2.1 In preparation of this arboricultural impact assessment, the following regulatory documentation has been considered:

- *Penrith Development Control Plan 2014* (PDCP 2014).
- *Penrith Local Environmental Plan 2010* (PLEP 2010).
- *State Environmental Planning Policy (Biodiversity and Conservation) 2021*.
- *Environmental Planning & Assessment Act 1979*.
- *Biodiversity and Conservation Act 2016*.
- *Biodiversity Conservation Regulation 2017*.
- *Threatened Species Conservation Act 1995*.
- *Biosecurity Act 2015*.

¹ VTA is a commonly used method of assessing trees, it is accepted by the ISA (International Society of Arboriculture) and is described by Claus Mattheck in *The body language of trees - A handbook for failure analysis* (1994). Pages 144-145. The Stationary Office. London.

- Penrith City Council – Exempt Tree Species List, document version 4, November 2020².

2.2.2 The Australian Standard AS 4970 – 2025 Protection of trees on development sites has been used to determine notional root zones (NRZ), structural root zones (SRZ) and provide guidance on tree protection matters.

2.3 Tree preservation order

2.3.1 The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (SEPP) along with the *Biodiversity Conservation Act 2016* and the *Local Land Services Act 2013*, provides the legislative framework for managing & protecting vegetation across NSW. Chapter 02 (Vegetation in Non-Rural Areas) of the SEPP outlines the rules around clearing vegetation on land zoned for urban and environmental purposes, that is not linked to a development application (DA).

2.3.2 The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* has replaced the provisions of clause 5.9 of the local environmental planning instrument (i.e., Local Environmental Plan, LEP). Part 2.3 of the SEPP applies to vegetation declared in a development control plan (DCP) to require a permit to clear and is reliant on definitions contained within the local development control plan; therefore, for the purposes of part 2.3 of the SEPP the *Penrith Development Control Plan 2014* (PDCP 2014), Section C2 Vegetation Management, clause C 2(a), defines prescribed vegetation as follows...

“a) Prescribed trees or other vegetation covered by this section of the Plan includes:

- i) Any native tree (both living and dead) or other vegetation that is on land zoned E2 Environmental Conservation in the Penrith LEP 2010 Land Zoning Map, or on natural resources sensitive land identified in the Penrith LEP 2010 Natural Resources Sensitivity Land Map.*
- ii) In all areas, any native vegetation community including remnant native vegetation.*
- iii) In all areas, any tree or other vegetation whether native or introduced having a height of 3.5 metres or more or a trunk diameter exceeding 100mm at 1400mm above ground level.*
- iv) Any tree or other vegetation that is, or forms part of, a heritage item or is within a heritage conservation area.*
- v) Any tree or other vegetation that is culturally, socially or biologically significant or a unique specimen and has been formally recognised by an appropriate government authority (e.g. a significant tree or vegetation register)”.*

3.0 Observations

3.0.1 The subject site is identified as 172 Russell Street, Emu Plains; formally defined as lot 2 DP1273251. Lot 2 is zoned DM – Deferred matter pursuant to *Penrith Local Environmental Plan 2010*, map amendment number 04. The site is not mapped as heritage or environmentally sensitive (terrestrial biodiversity) under PLEP 2010. The area of works to which this document relates is included on the NSW Biodiversity Values (BV) mapping and is mapped as bush fire prone land. The plant community type (PCT) is mapped as Cumberland Red Gum Riverflat Forest (PCT ID: 4025); the majority of the subject trees are characteristic species of this PCT.

² Non-legislative document.

3.0.2 The proposal entails removing eight (8) mounds of excavated soil stockpiled on the northern & southern sides of Lapstone Creek, as part of the proposed rezoning of lot 2. A total of forty-five (45) trees were identified as having potential to be impacted, for the purpose of this document they shall be referred to as the subject trees, their details are outlined in the tree schedule listed below as Table 01.



Figure 01: PCT 4025 – Cumberland Red Gum Riverflat Forest³.

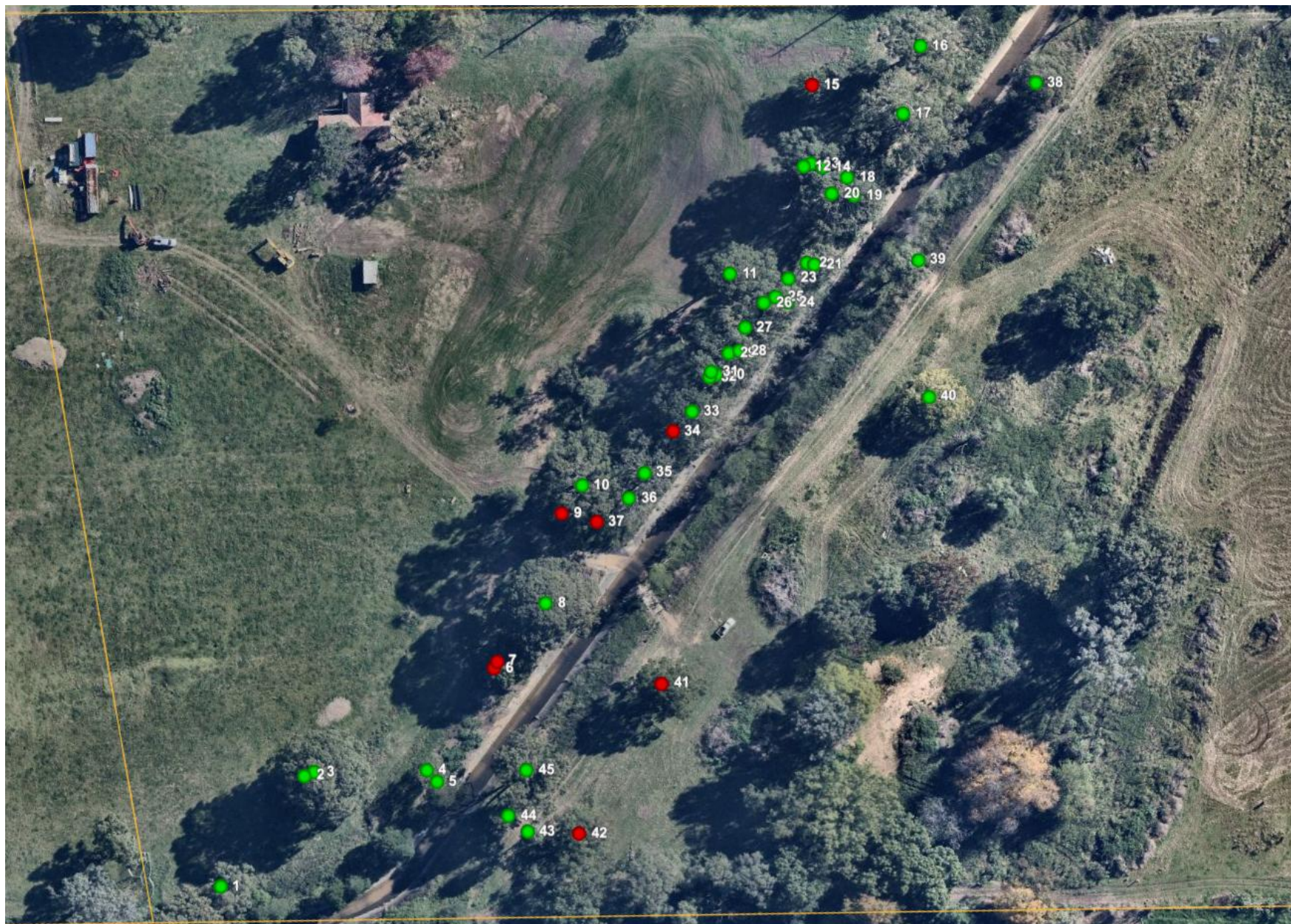


Figure 02: Tree Locations⁴

⁴ Nearmap, used under license. Image date 30/5/2025. CAC data overlay 24/6/2025.

Table 01: Tree schedule.

Hazard tree / unacceptable risk (H) or dead tree (D).						Trees with low retention values: senescence, developing defects or being non-prescribed exempt trees from LGA LEP, Tree Preservation Order (TPO) or SEPP.							
Tree No.	Botanical Name COMMON NAME	Height x spread (m)	DSH (mm)	ØRF (mm)	NRZ (m) SRZ (m)	Age	Health	Form	Distance from construction (if known)	SULE	Priority to retain or remove		
											Consider removal	Viable for retention	
01	Eucalyptus amplifolia Cabbage gum	13 x 12	700	700	8.40	SM	Good	Fair – Poor	-	3(a)	Viable for retention		
					2.85								
Notes: 1m from wire fence near eastern boundary. Split down primary junction.													
02	Carya illinoensis Pecan	15 x 12	570	660	6.84	M	Good	Good	-	1(a)	Viable for retention		
					2.78								
Notes: 1m from toe of stockpile batter.													
03	Eucalyptus amplifolia Cabbage gum	23 x 14	1320	1430	15.00	M	Good	Good	-	1(a)	Viable for retention		
					3.85								
Notes: 1.5m from toe of stockpile batter.													
04	Melia azedarach White cedar	8 x 6	300	350	3.60	SM	Good	Good	-	2(a)	Viable for retention		
					2.13								
Notes: On stockpile batter, 4.8m from edge of concrete drain.													
05	Acacia parramattensis Parramatta wattle	12 x 6	300	320	3.60	SM	Good	Fair	-	3(a)	Viable for retention		
					2.05								
Notes: 1.5m from toe of stockpile batter, 0.5m from edge of concrete drain.													
06	Cinnamomum camphora Camphor laurel	14 x 6	520	650	6.24	SM	Good	Good	Footprint	2(a)	Consider removal		
					2.76								
Notes: Declared weed species under the Biosecurity Act 2015; species <8m in height are listed as an exempt species in Penrith LGA. On stockpile batter.													
07	Cinnamomum camphora Camphor laurel	13 x 7	500	630	6.00	SM	Good	Good	Footprint	2(a)	Consider removal		
					2.73								
Notes: Declared weed species under the Biosecurity Act 2015. On stockpile batter.													
08	Eucalyptus amplifolia Cabbage gum	27 x 16	1160	1360	13.92	M	Good	Fair	-	2(a)	Viable for retention		
					3.77								
Notes: On stockpile batter, 4.5m from edge of concrete drain.													
09	Cinnamomum camphora Camphor laurel	11 x 8	400	660	4.80	SM	Good	Fair	Footprint	2(a)	Consider removal		
					2.78								
Notes: Declared weed species under the Biosecurity Act 2015. Toe of stockpile batter.													

Table 01: Continued.

Table 17. Continued.

H	D	Hazard tree / unacceptable risk (H) or dead tree (D).						Trees with low retention values: senescence, developing defects or being non-prescribed exempt trees from LGA LEP, Tree Preservation Order (TPO) or SEPP.				
Tree No.	Botanical Name COMMON NAME	Height x spread (m)	DSH (mm)	ØRF (mm)	NRZ (m)	Age	Health	Form	Distance from construction (if known)	SULE	Priority to retain or remove	
					SRZ (m)						Consider removal	Viable for retention
10	Eucalyptus amplifolia Cabbage gum	27 x 20	1390	1860	15.00	M	Good	Good	-	1(a)	Viable for retention	
					4.29							
Notes: Toe of stockpile batter. Sub-dominant leader formed near ground level.												
11	Eucalyptus amplifolia Cabbage gum	27 x 15	800	930	9.60	M	Good – Fair	Good	-	1(a)	Viable for retention	
					3.21							
Notes: On stockpile batter.												
12	Exocarpus cupressiformis Cabbage gum	7 x 5	220	350	2.64	M	Good	Fair – Poor	-	3(a)	Viable for retention	
					2.13							
Notes: On stockpile batter. Failed leader on northern side.												
13	Eucalyptus amplifolia Cabbage gum	25 x 13	760	830	9.12	M	Good	Good	-	1(a)	Viable for retention	
					3.06							
Notes: On top of stockpile.												
14	Eucalyptus amplifolia Cabbage gum	24 x 14	470	560	5.64	M	Fair	Good	-	2(a)	Viable for retention	
					2.59							
Notes: On top of stockpile.												
15	Cinnamomum camphora Camphor laurel	10 x 8	500	770	6.00	SM	Good – Fair	Good – Fair	Footprint	2(a)	Consider removal	
					2.97							
Notes: Declared weed species under the Biosecurity Act 2015. 1.5m from toe of stockpile batter.												
16	Eucalyptus tereticornis Forest red gum	25 x 18	870	1020	10.44	M	Good	Fair	-	1(a)	Viable for retention	
					3.34							
Notes: On stockpile batter. First-order lateral has failed on the northern side.												
17	Eucalyptus tereticornis Forest red gum	30 x 20	1590	1840	15.00	LM	Good – Fair	Good – Fair	-	1(a)	Viable for retention	
					4.28							
Notes: On stockpile batter. Habitat tree.												
18	Eucalyptus amplifolia Cabbage gum	22 x 10	560	660	6.72	M	Fair	Good – Fair	-	2(a)	Viable for retention	
					2.78							
Notes: On stockpile batter.												

Table 01: Continued.

Tree No.	Botanical Name COMMON NAME	Height x spread (m)	DSH (mm)	ØRF (mm)	NRZ (m) SRZ (m)	Age	Health	Form	Distance from construction (if known)	SULE	Priority to retain or remove	
											Consider removal	Viability for retention
19	<i>Eucalyptus amplifolia</i> Cabbage gum	23 x 10	520	550	6.24 2.57	M	Fair	Good – Fair	-	2(a)		Viability for retention
Notes: On stockpile batter.												
20	<i>Eucalyptus amplifolia</i> Cabbage gum	23 x 10	700	820	8.40 3.04	M	Fair	Good – Fair	-	2(a)		Viability for retention
Notes: On stockpile batter.												
21	<i>Eucalyptus amplifolia</i> Cabbage gum	25 x 10	420	570	5.04 2.61	M	Fair	Good – Fair	-	2(a)		Viability for retention
Notes: On stockpile batter.												
22	<i>Eucalyptus amplifolia</i> Cabbage gum	25 x 8	400	490	4.80 2.45	M	Fair	Good – Fair	-	2(a)		Viability for retention
Notes: On stockpile batter.												
23	<i>Eucalyptus amplifolia</i> Cabbage gum	20 x 7	370	400	4.44 2.25	M	Fair – Poor	Good – Fair	-	3(a)		Viability for retention
Notes: On stockpile batter. Sparse canopy, predominantly epicormic growth.												
24	<i>Eucalyptus amplifolia</i> Cabbage gum	10 x 5	220	280	2.64 1.94	SM	Fair	Fair	-	2(a)		Viability for retention
Notes: On stockpile batter.												
25	<i>Eucalyptus amplifolia</i> Cabbage gum	10 x 5	280	310	3.36 2.02	SM	Fair – Poor	Fair	-	3(a)		Viability for retention
Notes: On stockpile batter. Sparse canopy, predominantly epicormic growth.												
26	<i>Eucalyptus amplifolia</i> Cabbage gum	23 x 14	830	920	9.96 3.32	M	Fair	Good – Fair	-	2(a)		Viability for retention
Notes: On stockpile batter.												
27	<i>Eucalyptus amplifolia</i> Cabbage gum	30 x 18	930	1030	11.16 3.35	M	Fair	Good – Fair	-	2(a)		Viability for retention
Notes: On stockpile batter.												

Table 01: Continued.

H D		Hazard tree / unacceptable risk (H) or dead tree (D).						Trees with low retention values: senescence, developing defects or being non-prescribed exempt trees from LGA LEP, Tree Preservation Order (TPO) or SEPP.					
Tree No.	Botanical Name COMMON NAME	Height x spread (m)	DSH (mm)	ØRF (mm)	NRZ (m)	Age	Health	Form	Distance from construction (if known)	SULE	Priority to retain or remove		
					SRZ (m)						Consider removal	Viable for retention	
28	Eucalyptus amplifolia Cabbage gum	30 x 12	620	710	7.44	M	Fair	Good – Fair	-	2(a)	Viable for retention		
					2.87								
Notes: On stockpile batter.													
29	Eucalyptus amplifolia Cabbage gum	30 x 15	660	740	7.92	M	Fair	Good – Fair	-	2(a)	Viable for retention		
					2.92								
Notes: On stockpile batter.													
30	Eucalyptus amplifolia Cabbage gum	30 x 10	610	640	7.32	M	Fair – Poor	Good – Fair	-	3(a)	Viable for retention		
					2.74								
Notes: On stockpile batter. Sparse canopy.													
31	Eucalyptus amplifolia Cabbage gum	30 x 12	610	700	7.32	M	Fair	Good – Fair	-	2(a)	Viable for retention		
					2.85								
Notes: On stockpile batter.													
32	Eucalyptus amplifolia Cabbage gum	30 x 12	540	570	6.48	M	Fair	Good – Fair	-	2(a)	Viable for retention		
					2.61								
Notes: On stockpile batter.													
33	Eucalyptus amplifolia Cabbage gum	30 x 20	1140	1170	13.68	M	Fair	Good	-	2(a)	Viable for retention		
					3.53								
Notes: On stockpile batter.													
34	Cinnamomum camphora Camphor laurel	12 x 10	620	730	7.44	SM	Good	Good – Fair	Footprint	2(a)	Consider removal		
					2.90								
Notes: Declared weed species under the Biosecurity Act 2015. On stockpile batter.													
35	Eucalyptus amplifolia Cabbage gum	30 x 20	900	1080	10.80	M	Fair – Poor	Good – Fair	-	2(a)	Viable for retention		
					3.42								
Notes: On stockpile batter.													
36	Eucalyptus amplifolia Cabbage gum	23 x 10	420	500	5.04	M	Fair	Good – Fair	-	2(a)	Viable for retention		
					2.47								
Notes: On stockpile batter.													

Table 01: Continued.

Hazard tree / unacceptable risk (H) or dead tree (D).						Trees with low retention values: senescence, developing defects or being non-prescribed exempt trees from LGA LEP, Tree Preservation Order (TPO) or SEPP.							
Tree No.	Botanical Name COMMON NAME	Height x spread (m)	DSH (mm)	ØRF (mm)	NRZ (m) SRZ (m)	Age	Health	Form	Distance from construction (if known)	SULE	Priority to retain or remove		
											Consider removal	Viable for retention	
37	Cinnamomum camphora Camphor laurel	8 x 6	230	340	2.76	SM	Good	Good	-	2(a)	Consider removal		
					2.10								
Notes: Declared weed species under the Biosecurity Act 2015. On stockpile batter.													
38	Eucalyptus tereticornis Forest red gum	15 x 12	700	750	8.40	SM	Good	Good	-	1(a)	Viable for retention		
					2.93								
Notes: On stockpile batter.													
39	Eucalyptus tereticornis Forest red gum	15 x 8	400	460	4.80	SM	Good	Good	-	1(a)	Viable for retention		
					2.39								
Notes: On stockpile batter.													
40	Melia azedarach White cedar	14 x 12	610	800	7.32	M	Good	Good	-	2(a)	Viable for retention		
					3.01								
Notes: 4m from toe of stockpile batter.													
41	Cinnamomum camphora Camphor laurel	15 x 12	940	1080	11.28	M	Good	Good	Footprint	2(a)	Consider removal		
					3.42								
Notes: Declared weed species under the Biosecurity Act 2015. On top of stockpile.													
42	Fraxinus sp. Ash	13 x 12	780	900	9.36	M	Good – Fair	Good	3m	2(a)	Consider removal		
					3.17								
Notes: Exotic species, 3m from toe of stockpile batter.													
43	Eucalyptus amplifolia Cabbage gum	12 x 8	320	400	3.84	SM	Good	Good	-	1(a)	Viable for retention		
					2.25								
Notes: On top of stockpile.													
44	Eucalyptus amplifolia Cabbage gum	10 x 5	250	320	3.00	SM	Good	Good	-	1(a)	Viable for retention		
					2.05								
Notes: On stockpile batter.													
45	Eucalyptus amplifolia Cabbage gum	15 x 18	800	800	9.60	M	Good	Good – Fair	-	1(a)	Viable for retention		
					3.01								
Notes: On stockpile batter.													

Notes:

See Table 02 for SULE categories.

Age Class: Refers to the estimated life cycle stage of a tree.

- **J** – Juvenile: Sapling or recently planted and not yet established.
- **Y** – Young: Established tree but small in terms of size potential; not yet reproductive.
- **SM** – Semi-mature: Active growth phase, not yet reached its expected maximum physical size for the species or location.
- **M** – Mature: Tree has reached an expected maximum size for the species or location. Seasonal extension growth rate is reduced.
- **LM** – Late-mature: Tree is approaching the later part of its life cycle; natural deterioration in health & form. Reduced vigour.

Health - Is an indication of the tree's overall vitality at the time of inspection. Consideration is given to the canopy density, foliage colour and size, twig die-back, seasonal variation, etc.; and is expressed as good, fair, poor, or dead.

- Good – appears healthy, typical foliage colour and size for the species (if known), good canopy density, requiring little or no maintenance.
- Fair – appears relatively healthy, may have minor health problems that are generally able to be managed; not likely to cause short-term problems.
- Poor – significant health problems, sparse canopy density, poor foliage color, extensive die-back or epicormic growth; generally requires extensive maintenance or removal.
- Dead – no obvious signs of life; generally require removal, consideration is given to habitat value.

Form - Is an indication of the trees structural condition at the time of inspection. Consideration is given to significant defects or faults, structural integrity, soil, and root disturbance, and is expressed as good, fair, or poor.

- Good – free from any major structural defects; form typical of the species (if known).
- Fair – minor or moderate structural defects can usually be managed or tolerated.
- Poor – significant structural defects, extensive decay. Consideration is given to the target value, retention value and cost of remediation or removal.



Figure 03: Environmental & Heritage map⁵, subject site outlined in yellow dashed lines. Purple shading indicates BV mapping.

⁵ NSW Planning Portal Spatial Viewer - <https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address>

4.0 Useful life expectancy

4.0.1 A commonly used method of determining an estimated life expectancy of a tree is the 'SULE' method. This system was developed by in 1993, by British arborist Jeremy Barrell, who loosely adopted the principles of the existing British standard (BS 5837 - *Trees in Relation to Construction*) but is more systematic and rigorous in his approach.

4.0.2 SULE or Safe Useful Life Expectancy makes an attempt to assimilate the vigour, condition, and value of a tree, balancing remaining life expectancy with risk, to determine its sustainability within the landscape. The basic concept of SULE is that the longer the tree can contribute to the amenity, in a sustainable way, and at an "acceptable" level of risk, the higher the retention value.

4.0.3 This system provides a reasonable retention value of 'sustainable amenity'; however, the categories are subjective and there is little information in its methodology to assist in determining the value, amenity or otherwise. The term 'safe' is also potentially misleading, in terms of risk.

4.0.4 The following table (Table 02) outlines the adopted SULE categories.

Table 02: SULE Categories.

Rating	Category	Definition
01.	Long SULE: Trees that appear to be retainable with an acceptable level of risk for more than 40 years.	(a) Structurally sound trees located in positions that can accommodate future growth. (b) Storm damaged or defective trees that could be made suitable for retention in the long term by remedial tree surgery. (c) Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long-term retention.
02.	Medium SULE: Trees that appear to be retainable with an acceptable level of risk for 15 to 40 years.	(a) Trees that may only live between 15 and 40 more years. (b) Trees that may live for more than 40 years but would be removed to allow the safe development of more suitable individuals. (c) Trees that may live for more than 40 years but would be removed during the course of normal management for safety or nuisance reasons. (d) Storm damaged or defective trees that can be made suitable for retention in the medium term by remedial work.
03.	Short SULE: Trees that appear to be retainable with an acceptable level of risk for 5–15 years.	(a) Trees that may only live between 5 and 15 more years. (b) Trees that may live for more than 15 years but would be removed to allow the safe development of more suitable individuals. (c) Trees that may live for more than 15 years but would be removed during the course of normal management for safety or nuisance reasons. (d) Storm damaged or defective trees that require substantial remedial work to make safe, and are only suitable for retention in the short term.

Table 02: Continued.

04.	Remove: Trees with a high level of risk that would need removing within the next 5 years.	(a) Dead trees. (b) Dying or suppressed and declining trees through disease or inhospitable conditions. (c) Dangerous trees through instability or recent loss of adjacent trees. (d) Dangerous trees through structural defects including cavities, decay, included bark, wounds or poor form. (e) Damaged trees that are considered unsafe to retain. (f) Trees that will become dangerous after removal of other trees for the reasons given in (a) to (e).
05.	Young or Small Trees:	(a) Trees which are less than 5 metres (m) in height. (b) Trees which are over 5m in height but less than 15 years old.

Source: TreeAZ/01/1993, Barrell, J 2007.

4.1 Biodiversity Offset Threshold

4.1.1 The Biodiversity Offsets Scheme (BOS) Threshold is used to determine when an accredited assessor will be required to determine the impacts of a development proposal. The *Biodiversity Conservation Regulation* 2017 establishes threshold levels for when this scheme applies. The threshold has two key components:

- 1) whether the amount of native vegetation being cleared exceeds a threshold area, or
- 2) whether the impacts occur on an area mapped on the NSW Biodiversity Values Map.

4.1.2 The Biodiversity Values (BV) Map and Threshold Tool identifies land with high biodiversity value, which may be particularly sensitive to development & clearing impacts. If clearing or other impacts exceed either trigger, a Biodiversity Development Assessment Report (BDAR) will be required.

4.1.3 The proposed works are in an area mapped on the Biodiversity Values (BV) map. The applicant has engaged an environmental consultant to prepare a BDAR.

4.2 Notional Root Zone (NRZ)

4.2.1 The Australian Standard AS 4970 – 2025 Protection of trees on development sites describes a notional root zone (NRZ) as a “zone enclosed by a radius 12 times DSH that is the primary trigger for arboricultural input on a development site”.

4.2.2 To determine the NRZ for each tree, its’ diameter at standard height (DSH) is multiplied by 12 (NRZ = DSH x 12), the result is expressed as a radius and is measured from the centre of the stem at ground level. A NRZ should not be less than 2m and not greater than 15m, except where canopy protection is required. The NRZ for palms, cycads, tree ferns and the like, is not calculated but shall not be less than 2m.

4.3 Structural Root Zones (SRZ)

4.3.1 The structural root zone (SRZ) is a theoretical area around the base of a tree and is defined in AS 4970 – 2025 Protection of trees on development sites as *“the area around the base of a tree required for the tree’s stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres. This zone considers a tree’s structural stability only, not the root zone required for a tree’s health and long-term viability, which is typically a much larger area”* [the NRZ].

4.3.2 The SRZ shall be calculated when a major (>20%) incursion into a NRZ (Notional Root Zone) is proposed. Many factors can affect the size of the SRZ (e.g., tree height, crown area, soil type & volume, available soil moisture). Natural and/or built structures, such as rocks & footings, can also influence the SRZ. An indicative SRZ can be calculated as follows, $(D \times 50)^{0.42} \times 0.64$. Again the result is the radius of the structural root zone. D = trunk diameter in (m), measured above the root buttress or root flare. The SRZ for trees with a diameter less than 150mm is set at 1.5m. Root investigation can provide more information on these roots.

4.4 Tree Protection Zones (TPZ)

4.4.1 AS 4970 – 2025 defines a tree protection zone as a *“specified zone above & below ground and at given offsets from the trunk set aside to protect a tree’s roots and crown where these might be damaged by the development”*. It is an area isolated from construction disturbance, so that the tree remains viable. The NRZ is the starting point for determining the TPZ. The encroachments and factors⁶ listed below are considerations when determining tree protection zones:

- (a) *Location and distribution of roots.*
- (b) *Potential loss of root mass resulting from the encroachment (number & diameter of roots).*
- (c) *Tree species and tolerance to root disturbance.*
- (d) *If the works will result in a temporary (e.g., service trench) or permanent (e.g., basement carpark) loss of available soil volume.*
- (e) *Age, health, current size & projected size of the tree.*
- (f) *Presence of other trees with overlapping NRZ or grafted roots.*
- (g) *Proposed staging & timing of excavation or root-cutting.*
- (h) *Proposed tree maintenance & tree care activities.*
- (i) *Lean and stability of the tree.*
- (j) *Soil characteristics and volume, topography and drainage.*
- (k) *Prescence of existing or past structures, obstacles affecting root growth or recent encroachments.*
- (l) *Proposed construction measures that reduce the impact on trees.*
- (m) *Whether a root investigation is required. The location and distribution of the roots should be determined through minimally destructive investigation methods (pneumatic, hydraulic, hand digging or ground penetrating radar). Photographs should be taken and, where needed to address geospatial issues, a root map should be prepared.*

4.4.2 Alternatively, the tree protection zone/s may be specified by the consent authority.

⁶ AS 4970 – 2025 Protection of trees on development sites, section 3.3.

4.4 Encroachments within the NRZ

4.4.1 It is possible for construction activities to encroach into the NRZ. *“The proposed encroachment is considered minor if it is less than or equal to 10% of the area of the NRZ, has not had recent NRZ encroachments and is outside of the SRZ. Generally, it is unlikely that there will be significant impact to tree health, longevity or structure. Tree protection should be implemented during site works. To avoid a net loss of soil area and volume, an area equivalent to the encroachment shall be incorporated into the TPZ, unless the project arborist otherwise demonstrates the tree will remain viable”.*

4.4.2 *“The proposed encroachment is considered moderate if it is greater than 10% and less than or equal to 20% of the area of the NRZ and is outside of the SRZ. A project arborist shall be engaged to review the proposed impact and undertake any other necessary investigation to address the factors listed in clause 3.3.2 [of AS 4970 – 2025, outlined above in section 4.4.1 of this document] to demonstrate how the tree will remain viable. This may be through the implementation of suitable design measures and construction controls to mitigate impacts during the development process as part of a TPS and TPP. To avoid a net loss of soil area and volume, an area equivalent to the encroachment shall be incorporated into the TPZ, unless the project arborist otherwise demonstrates that the tree will remain viable”.*

4.4.3 *“The proposed encroachment is considered major if it is greater than 20% of the area of the NRZ or inside the SRZ. A project arborist shall be engaged to explore alternative designs with the design team and/or demonstrate the tree will remain viable. Relevant factors listed in clause 3.3.2 [of AS 4970 – 2025, outlined above in section 4.4.1 of this document] should also be considered”.*

4.4.4 *“For assessment of major encroachment a more detailed investigation is necessary. This can include research such as root investigation, soil analysis, historical records of the tree or site, relevant literature and examples of similar encroachments. A TPS and TPP should be prepared to support the retention of the tree. To avoid a net loss of soil area and volume, an area equivalent to the encroachment shall be incorporated into the TPZ, unless the project arborist otherwise demonstrates that the tree will remain viable”.*

4.4.5 It is important to note that the standard does not prohibit major incursions or works inside structural root zones; the functionality of the indicative structural root zone specified by AS 4970 – 2025 is to act as a trigger, alerting the assessor to fact the works may be detrimental to the trees structural integrity. The following table (table 03) outlines the indicative NRZ's, SRZ's & incursions of the subject trees, calculated under the provisions of the Australian Standard (AS 4970 – 2025). Works shall not encroach into the NRZ of any native tree to be retained. Weed species proposed for removal shall be taken as impacted and assume a 100% incursion.

Table 03: TPZ calculations⁸.

Tree No.	DSH (mm)	NRZ (m)	Area (m ²)	ØRF (mm)	SRZ (m)	Incursion (m ²)	Incursion as a %
01	700	8.40	221.67	700	2.85	0	0
02	570	6.84	149.98	660	2.78	0	0
03	1320	15.00	706.86	1430	3.85	0	0
04	300	3.60	40.72	350	2.13	0	0
05	300	3.60	40.72	320	2.05	0	0
06	520	6.24	122.33	650	2.76	122.33	100

⁷ 4.5.1 – 4.5.4: AS 4970 – 2025 Protection of trees on development sites.

⁸ Treetec - https://www.treetec.net.au/tree-arborist-victoria/tpz_srz_dbh_calculator/

Table 03: Continued.

Tree No.	DSH (mm)	NRZ (m)	Area (m ²)	ØRF (mm)	SRZ (m)	Incursion (m ²)	Incursion as a %
07	500	6.00	113.10	630	2.73	113.10	100
08	1160	13.92	608.74	1360	3.77	0	0
09	400	4.80	72.44	660	2.78	72.44	100
10	1390	15.00	706.86	1860	4.29	0	0
11	800	9.60	289.65	930	3.21	0	0
12	220	2.64	21.90	350	2.13	0	0
13	760	9.12	261.30	830	3.06	0	0
14	470	5.64	99.93	560	2.59	0	0
15	500	6.00	113.10	770	2.97	113.10	100
16	870	10.44	342.41	1020	3.34	0	0
17	1590	15.00	706.86	1840	4.28	0	0
18	560	6.72	141.87	660	2.78	0	0
19	520	6.24	122.33	550	2.57	0	0
20	700	8.40	221.67	820	3.04	0	0
21	420	5.04	79.80	570	2.61	0	0
22	400	4.80	72.44	490	2.45	0	0
23	370	4.44	61.93	400	2.25	0	0
24	220	2.64	21.90	280	1.94	0	0
25	280	3.36	35.47	310	2.02	0	0
26	830	9.96	311.65	920	3.20	0	0
27	930	11.16	391.27	1030	3.35	0	0
28	620	7.44	173.90	710	2.87	0	0
29	660	7.92	197.06	740	2.92	0	0
30	610	7.32	168.33	640	2.74	0	0
31	610	7.32	168.33	700	2.85	0	0
32	540	6.48	131.92	570	2.61	0	0
33	1140	13.68	587.93	1170	3.53	0	0
34	620	7.44	173.90	730	2.90	173.90	100
35	900	10.80	366.44	1080	3.42	0	0
36	420	5.04	79.80	500	2.47	0	0
37	230	2.76	23.93	340	2.1	23.93	100
38	700	8.40	221.67	750	2.93	0	0
39	400	4.80	72.44	460	2.39	0	0

Table 03: Continued.

Tree No.	DBH (mm)	TPZ (m)	Area (m ²)	ØRF (mm)	SRZ (m)	Incursion (m ²)	Incursion as a %
40	610	7.32	168.33	800	3.01	0	0
41	940	11.28	399.73	1080	3.42	399.73	100
42	780	9.36	275.23	900	3.17	82.43	29.95
43	320	3.84	46.32	400	2.25	0	0
44	250	3.00	28.27	320	2.05	0	0
45	800	9.60	294.98	800	3.01	0	0

4.5 Tree roots & the impact of construction activities

4.5.1 Outside of the arboriculture & horticulture profession, it is fair to say that tree roots are poorly understood. The primary functions of roots are absorption of water & solutes, transport (in both directions – from the root system to the canopy & vice versa), storage (starch – energy reserves), production of hormones and structural support.

4.5.2 The typical root system is comprised of structural roots, woody roots & absorbing roots; their structure and function are defined by four stages of development.

1. **Pioneer roots** – all roots start as pioneer roots. As the name suggests, they grow into new soil via rapid elongation. They are very fine roots (around 1 - 3mm in diameter) and are protected by a root cap. The zone of elongation (ZoE) is the area between the root cap & root hairs; a pioneer root will become an absorbing root in a matter of days.
2. **Absorbing roots** – again are very fine, delicate roots and the absorbing components are microscopic. They are ephemeral, although they can last much longer with beneficial fungi associations, and are almost solely responsible for the uptake of water & solutes via root hairs & mycorrhizal fungi. Root hairs are single cell extensions that extend into the soil from the outside surface of the absorbing root and form symbiotic relationships with fungi, greatly increasing their absorption network. Both pioneer and absorbing roots are readily stimulated by water availability & soil temperatures >16°C.
3. **Woody roots** – absorbing roots will start to become woody roots after a few weeks. Woody roots can be thought of as underground branches; they will become darker in appearance as lignin is added to their cells. They become inefficient at absorption and despite undergoing lignification (cell death), they will remain flexible as they bear no load from the tree.
4. **Structural roots** – provide direct structural support to the tree. They endure load & have a higher proportion of lignified cells compared to other roots. Originating from the trunk, they usually rapidly taper off, this is referred to as the zone of rapid taper (ZRT); within this zone are first order lateral roots (grow directly from the trunk), they branch laterally or circuitously near the trunk or go directly down near the trunk to form what's termed 'sinker roots'. Sinker roots are arguably the most critical support structure. Structural roots are long-lived, specialised wood roots that act as a connection between the trunk & non-loaded woody roots. Damage to structural roots is seldom desirable.

4.5.3 The greatest threat to a trees' vitality from construction activities comes from root damage. Absorbing roots and root hairs are intricate structures and are easily damaged, either directly via activities such as excavation, or indirectly via increased compaction. Severing a woody root with a diameter around 25mm could plausibly result in the loss of millions of root hairs.

4.5.4 Losing a portion of a root system means the tree has an increased reliance on the remaining functioning roots. When soil moisture levels are low, or roots have been cut, the tree expends more energy to obtain the same amount of water; this often leads to stress. The loss of roots regularly results in foliage wilt, thinning or total loss, which can lead to death of smaller branchlets and larger limbs. Under optimal conditions, the cut end of a woody root will generate new roots; adequate soil moisture, temperature & solute availability will stimulate new root development. In ideal circumstances, root disturbance should be avoided by creating sufficient tree protection zones.

5.0 Discussion

5.0.1 The proposed work involves removing eight (8) large mounds of soil, stockpiled either side of the concrete drainage channel (Lapstone Creek); there is five (5) stockpiles on the southern side & three (3) on the northern side. Given the extent of vegetation on, and near the stockpiles, complete removal cannot be achieved whilst retaining the trees in situ. Figure 04, below, depicts the indicative notional root zones overlayed onto the site survey.

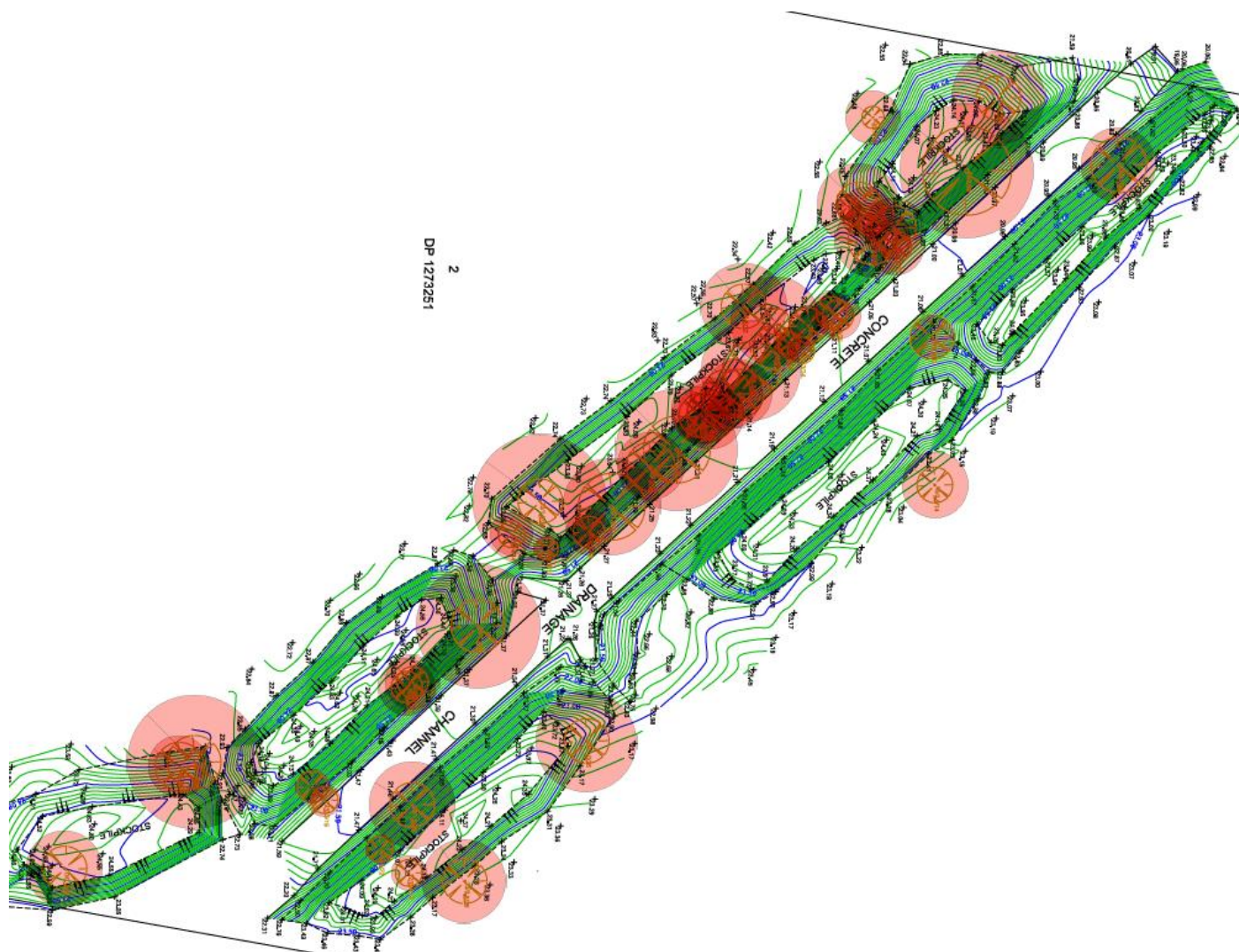


Figure 04: Indicative notional root zones overlayed onto the site survey⁹, at a scale of 1:600.

⁹ RHC Plan of Details & Levels, CAC data overlay.

5.0.2 The majority of the stockpiled material has been placed around the subject trees, several are growing on top of stockpiles, but most are on the batter. The proposed civil drawings have been designed as such that all earthworks are outside of the indicative notional root zones (NRZ) of all native trees to be retained, refer to Figure 06 below.

5.0.3 *Cinnamomum camphora* (Camphor laurel) are a declared environmental weed species in NSW and their removal is supported. Species under 8m in height are listed as exempt in the Penrith LGA; however, those >8m and those in environmentally sensitive areas are subject to council consent.

5.0.4 Tree 42 (*Fraxinus sp.*) sustains an encroachment of 82m², or approx. 30% of NRZ, under the current design. It is an exotic species that could be considered for removal.

6.0 Conclusion

6.0.1 The author is of the opinion that the proposal to remove the some of the stockpiled soil as part of the rezoning process can proceed without negatively affecting the native vegetation, subject to co-operation with the project arborist. Rigid exclusion zones around significant trees (trees 03, 08, 10, 17 & 33), and those on top of stockpiles can be established; however, the practicalities of establishing rigid tree protection around all TPZ's is acknowledged, and as such the onus will be on the applicant to engage a suitably qualified project arborist to oversee all earthworks in proximity of notional root zones of any tree to be retained.

7.0 Recommendations

7.0.1 An AQF level 05 arborist shall be appointed as the project arborist. Excavation shall be outside of indicative notional root zones of any tree to be retained and should be completed under supervision of the project arborist when in proximity of tree protection zones.

7.0.2 Approval should be sought to remove the exotic (*Fraxinus sp.*) & weed species (*Cinnamomum camphora*) – trees 06, 07, 09, 15, 34, 37, 41 & 42. Tree removal shall be completed in a way that ensures no damage occurs to the trees to be retained.

If you require any further assistance, please do not hesitate to contact me.

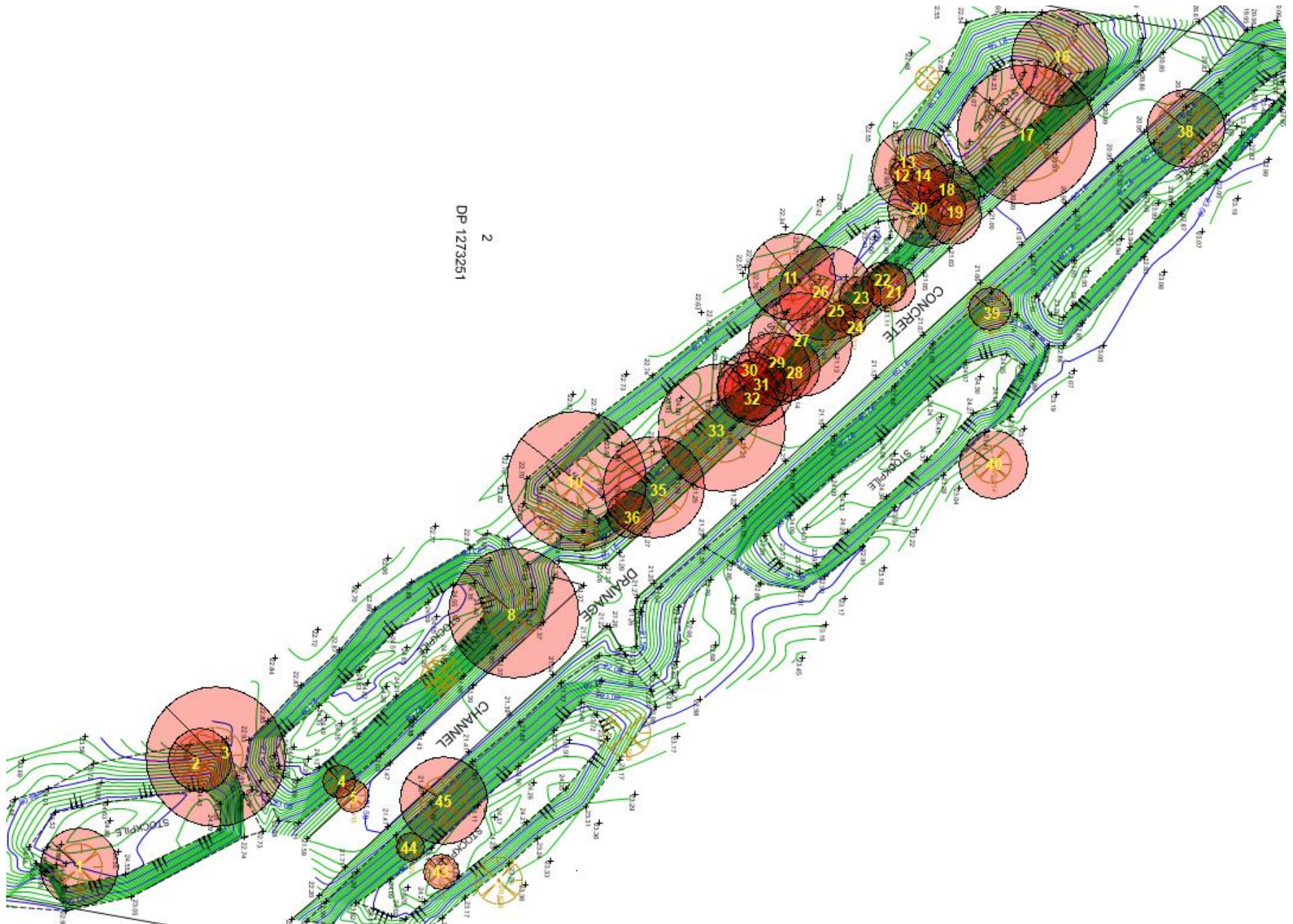
Kind regards



Isaac Dale

AQF V Diploma of Arboriculture (with distinction)
AQF III Horticulture (Arboriculture)
AQF IV Training & Assessing
Arboriculture Australia Member 2025
VALID Tree Risk / Benefit Assessor (Validator)
QTRA Registered User No.8110
ISA TRAQ (Tree Risk Assessment Qualification)





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Figure 05: Notional Root Zones (NRZ) of trees to be retained.

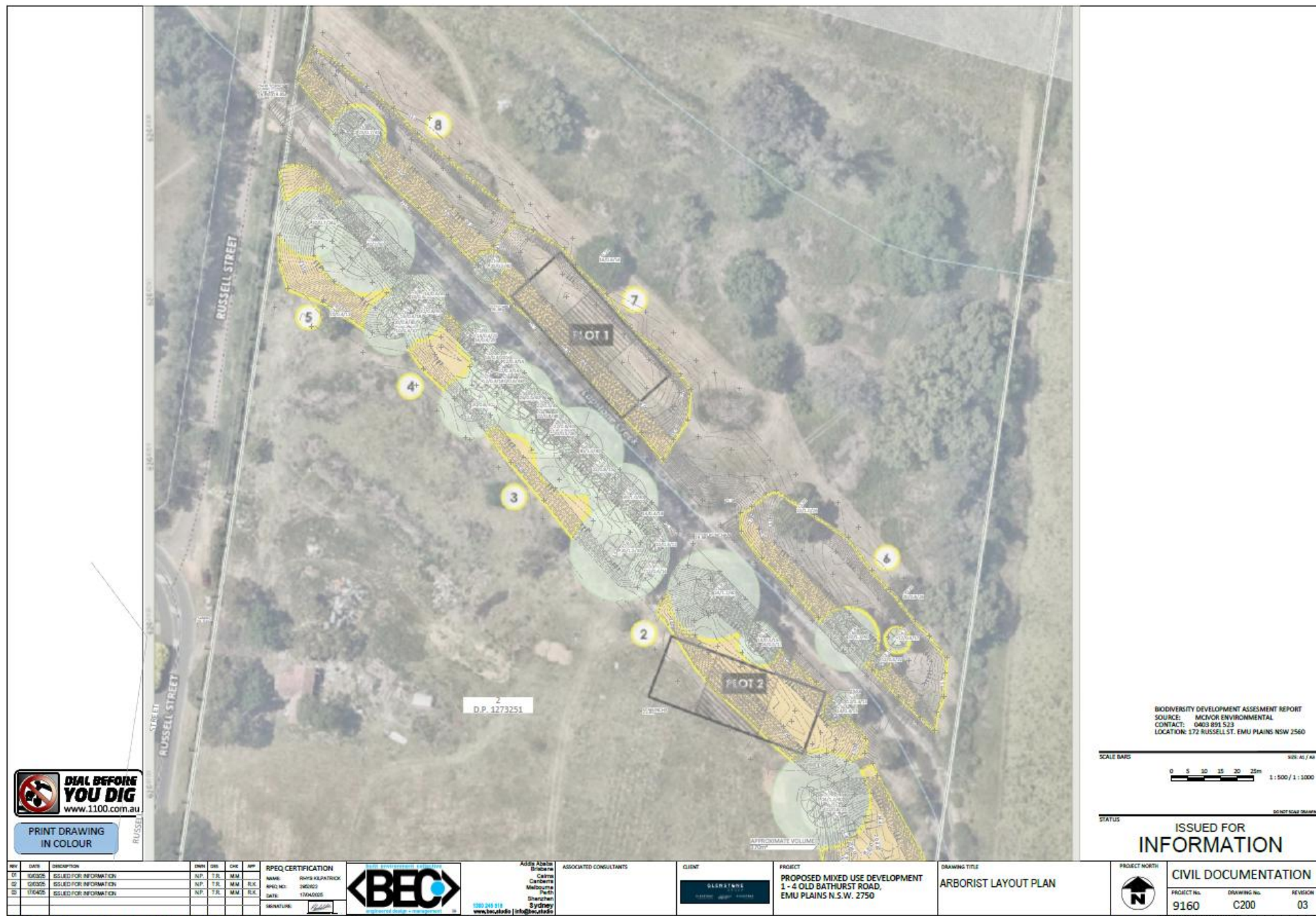


Figure 06: Proposed earthworks, positioned outside of indicative notional root zones.

Appendix 01: Site Photographs



Figure A1: Tree 01.



Figure A2: Trees 02 & 03.



Figure A3: Trees 04 & 05.



Figure A4: Trees 06 & 07.



Figure A5: Tree 08.



Figure A6: Tree 09.



Figure A7: Tree 10.



Figure A8: Tree 11.



Figure A9: Tree 12.



Figure A10: Trees 13 & 14.



Figure A11: Tree 15.



Figure A12: Tree 16.



Figure A13: Tree 17.



Figure A14: Trees 18 - 20.



Figure A15: Trees 21 & 22.



Figure A16: Tree 23.



Figure A17: Trees 24 - 27.



Figure A18: Trees 28 - 32.



Figure A19: Tree 34.



Figure A20: Tree 35.



Figure A21: Tree 37.



Figure A22: Tree 38.



Figure A23: Tree 39.



Figure A24: Tree 40.



Figure A25: Tree 41.



Figure A26: Tree 42.



Figure A27: Trees 43 & 44.



Figure A28: Tree 45.



Figure A29: View of the site, looking east near T41.



Figure A30: Stockpile & natural grade near T02 & 03.

Appendix 02: Tree Protection Plan

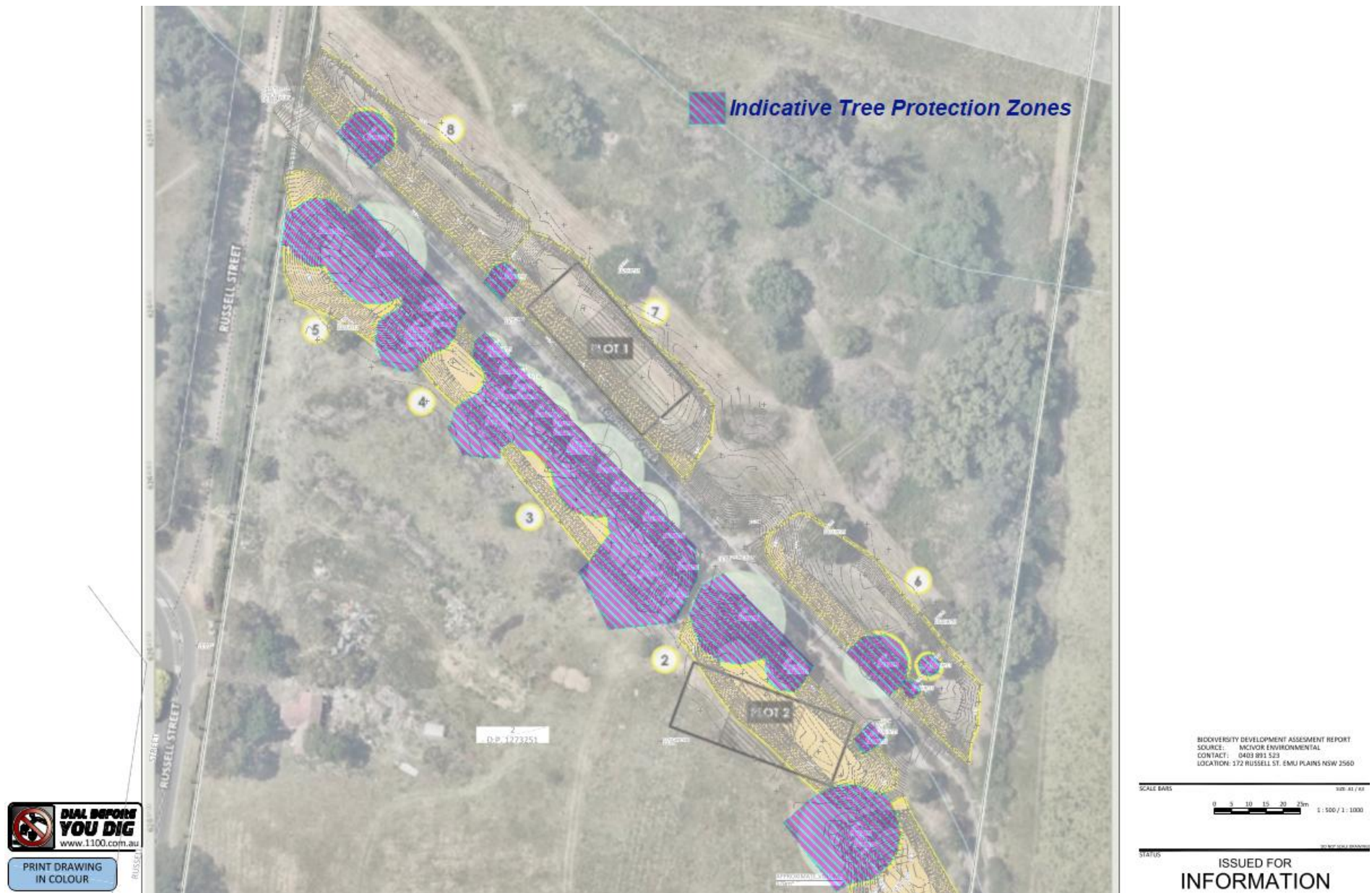


Figure B1: Indicative tree protection zone layout.

Tree Protection Specification

1.0 Pre-construction

1.0.1 Prior to any civil works, an AQF level 5 arborist shall be appointed as the 'project arborist' and shall oversee all arboricultural matters pertaining to this development, including implementation of the tree protection specification.

1.0.2 Trees approved for removal are to be clearly identified and removal should be conducted by an arborist with a minimum qualification of AQF level 03 and shall be done in a manner that ensures no damage occurs to the trees to be retained.

1.0.3 Upon completion of tree/vegetation removal, where practical a rigid, temporary fence of chain wire or welded mesh construction, no less than 1800mm (1.8m) in height shall be erected as per the TPZ layout and secured, in a way which limits sideways movement. Fence posts and supports should be constructed of steel and be no less than 20mm in diameter. Existing perimeter fences or structures may be used as part of the protective fence if suitable. Bracing may be used inside the TPZ, installation of posts or supports should avoid damaging roots. The fencing shall remain in place until the completion of works. Further information on fencing requirements is available in AS 4687 - 2007, *Temporary fencing and hoarding*. Where rigid fencing cannot be installed due to the topography or site constraints, the NRZ's are to be delineated using hi-visibility woven mesh, flagging or similar, prior to works commencing.

1.0.4 Signs shall be placed on the outside of the TPZ's, so they are visible from the development site. The signs are intended to identify the TPZ and list all activities that are not permitted within the TPZ, as well as the name and contact number of the project arborist. The signs shall be at least 600mm x 600mm and with 72-point font size, in red lettering on a white background, the words '**Tree Protection Zone - Keep Out**' to comply with AS 1319 - 1994, *Signs for the Occupational Environment*.

1.0.5 Activities that are **NOT** permitted within the TPZ include, but are not limited to...

- Any excavation including trenching (other than that approved under the DA).
- Storage of any materials including site facilities.
- Changes to the existing grade.
- Parking of vehicles or plant.
- Refuelling.
- Cleaning or washing down of any equipment including paint brushes.
- Placement of fill or spoil.
- Preparation of cement or chemicals.
- Dumping of waste.
- Cultivation including landscaping, unless completed using hand-digging and approved by the project arborist.

1.0.6 The project arborist should certify, as appropriate, that tree protection has been implemented in accordance with the tree protection specification, tree protection plan & conditions of consent.

2.0 During construction

2.0.1 It is the principal contractors' (PC) responsibility to ensure all site staff, including contractors are notified of the requirements and conditions of the tree protection specification and tree protection zones, and should have documented evidence acknowledging their understanding and compliance of the conditions.

2.0.2 Excavation in proximity of tree protection zones should be conducted under supervision of the project arborist. No excavation is permitted inside of the indicative notional root zones.

2.0.3 No storage, including site shed/amenities, waste bins and plant/equipment, is permitted inside of the tree protection zones.

2.0.4 Any unforeseen changes to design, during construction, will require an amendment to this report or an additional arboricultural impact assessment report.

3.0 Post construction

3.0.1 All tree protection measures shall be removed at the practical completion of the development.

3.0.2 A final inspection of the condition of the trees and their growing environment shall be carried out by the project arborist, with works to include...

- A visual inspection of the overall health and vigour of the trees.
- Inspection of any trunk, branch, or root damage.
- Detail any remedial work necessary such as pruning to AS 4373 - 2007 or any soil remediation.
- Ensure works have been carried out in accordance with the approved plans and specifications for tree protection as detailed in this document.
- Document any deviations from the original plans and impact potential on the trees.
- Detail any requirements for ongoing maintenance such as irrigation.

3.0.3 Upon completion of the final inspection and any remedial works, the project arborist should certify as appropriate that the works completed were compliant with the specifications, conditions of consent and approved plans.



Figure B2: Example of a TPZ sign.

4.0 Schedule of hold points & responsibilities

Table B1 in appendix 02: Hold points & responsibilities.

Hold Point	Task	Responsibility	Project Arborist Certification Required	Staging
1	Clearly identify tree/vegetation approved for removal.	Principal Contactor	No, but PC should provide documented evidence.	Prior to site establishment & earthworks.
2	Establishing tree protection.	Principal Contractor	Yes, project arborist to install & certify, or certify installation by others if complaint.	Post removal of approved trees & prior to earthworks.
3	Supervision of excavation in proximity of tree protection zones.	Principal Contractor	Yes.	As required, prior to works commencing.
4	Final certification.	Principal Contractor	Yes, as appropriate.	At practical completion of works.



Figure B3: Example of rigid TPZ fencing.

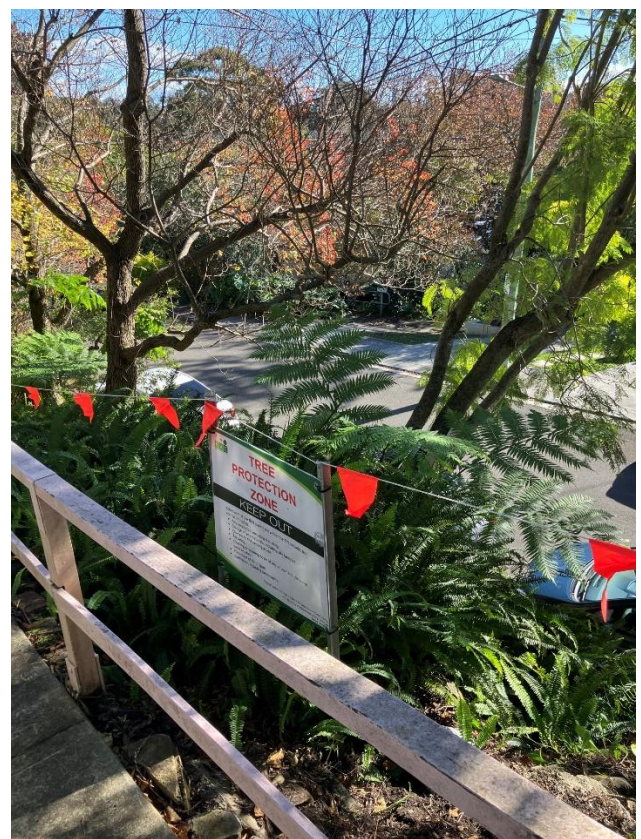


Figure B4: Example of soft TPZ deliniation.



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