Regulated and Significant Trees

A proposal for change in the Planning, Development and Infrastructure Regulations

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We seek to amend the definition of a Regulated and Significant Tree and propose some associated changes to the *Planning, Development and Infrastructure (General) Regulations (2017)* and *Planning, Development and Infrastructure Act (2016)* in line with these proposed changes.

Currently, the definition of a Regulated Tree is a tree within a designated, regulated tree overlay with a trunk circumference of 2m or more or, in the case of a multi-stemmed tree, if the circumference of all stems sum to 2m or more with an average of 625mm or more, measured 1m above ground level.

The existing definition of a Significant Tree is a tree within a designated, regulated tree overlay with a trunk circumference of 3m or more or, in the case of a multi-stemmed tree, if the circumference of all stems sum to 3m or more with an average of 625mm or more, measured 1m above ground level.

A tree that can be both Regulated and Significant, is classed as a Significant Tree.

We are submitting this proposal because:

- The definition of a Regulated Tree does not account for trees outside of the area mapped in Fig 1.
- The term “average” can be interpreted in three ways (mean, mode or median) and thus can be uninformative
- Tree trunk circumference does not correlate with all of a tree's many diverse and valuable attributes so is not a reasonable trigger for legislative protection

Figure 1. Map showing the Regulated and Significant Tree Overlay (green areas) in South Australia. These areas are the only places in South Australia where a tree can be classed as Regulated or Significant and all other parts of South Australia are covered by the *Native Vegetation Act 1991*.

We propose a comprehensive methodology to value trees for classification as regulated or significant. These methods are based on existing, successful techniques used in other Australian states to determine a monetary valuation for a tree; we suggest creating a minimum monetary tree value upon which to base Regulation or Significance.

Variables and formulae to be used to value any tree that is proposed to be removed for development

There are many tree valuation methods available and we propose to value trees based on existing, successful methods used across Australia. The main valuation method is based on the Minimum Industry Standard for Tree Valuation (Strauss 2022). The authors of this method include lookup tables created in Excel to make valuations as straightforward as possible. Building upon this method is the City of Melbourne method, also endorsed and used by the City of Hobart, City of Adelaide, City of Burnside and City of Mitcham. City of Hobart have implemented a Tree Compensation Policy whereby developers are required to contribute the monetary value of any tree removed as an incentive to preferentially submit designs that favour tree preservation (Wilson and Strauss 2022). During the 33 months after this policy implementation, City of Hobart reviewed the success of the policy in favouring designs that retain existing trees. Findings include the retention of $306,344 in tree amenity following design changes to retain Significant Trees (Wilson and Strauss 2022). However, Wilson and Strauss (2022) also found that trees with a lower amenity value were removed with little consideration of tree retention.

The purpose of the method presented here is to deter developers from removing trees. Thus we propose a rigorous tree valuation method that developers are required to pay an arborist to perform. Any tree that is found to be significant and is removed by the developer will be paid for by the developer and we recommend that any tree to be removed for building works be paid into the local Council's urban trees fund as per the *Planning, Development and Infrastructure Act (2016)* Section 200(1).

Table 1. Brief overview of variables to be input into tree valuation equation for classification as Regulated or Significant tree

Tree valuation variable	Reference/source
Species name	City of Melbourne, Native Vegetation Council
Diameter at breast height (DBH, cm)	MIS506
Land use factor	MIS506
Social factor	MIS506
Quality factor	MIS506, International Society of Arboriculture (ISA), City of Melbourne
Loss factor	Native Vegetation Council
Reinstatement cost (2 years maintenance)	City of Melbourne
Carbon sequestration	GI-Val: the green infrastructure valuation toolkit, City of Melbourne

Tree valuations

According to the Minimum Industry Standard for Tree Valuation (Strauss 2022), we propose a tree valuation method based on Formula 1.

Formula 1. $\text{Valuation} = B \cdot Z \cdot S \cdot Q$

Where:

- B = Market baseline value (see Table 2 and Table 3)
- Z = Land use factor (Table 4)
- S = Social factor (Formula 2)
- Q = Quality factor (Formula 3)

B – Market Baseline Value

The Market baseline value is based on the measurement: Diameter at Breast Height. A Trunk diameter measurement taken at 1.4m above ground level unless the tree is juvenile, this is dealt with in Table 3. Diameter will be a calculated variable based on tree circumference that will be measured in the field.

Table 2. Market reference values used in the proposed tree valuation method (Strauss 2022).

Market reference values (2022)	Australian dollars (AUD)
$ cm^{-2} trunk area (MTA)	16.78
$ cm^{-1} trunk diameter at 300 mm for a juvenile tree (MTD)	117.67

Table 3. Market baseline values (B) are calculated using the equations shown

Diameter at Breast Height (DBH) used to calculate base market value:	Formula
D300* = 1 - 10cm	Baseline market value (B_{D300}) = MTD · D300
DBH = 11 - 50cm	$B_{DBH} = B_{DBH-1} + (B_{DBH-1} / DBH_{DBH-1}) + 2 \cdot MTA^2$
DBH = 51 - 500cm	$B_{DBH} = B_{DBH-1} + (B_{DBH-1} / DBH_{DBH-1})$

* D300 is the diameter of a juvenile tree measured at 300mm above root crown

Z – Land Use Factor

The Land Use Factor variable is based on the Land Use Terms for each state. South Australia has 66 Land Use Terms detailed in the Planning and Design Code (Version 2022.21) and the weighting of all of these factors will need to be determined by a panel of specialists. The maximum range of scores for the Land Use Factor is 0.25

to 2.0. An example of some Factor weightings are outlined in Table 4, these are based on New South Wales examples (Strauss 2022).

Table 4. Land Use Factor (Z in Formula 1) examples

Land Use Terms	Factor
Organic waste processing facility	0.75
Recreation area	1.25
Residential flat building	1.1
Row dwelling	1.1
Semi-detached dwelling	1.05
Student accommodation	1.1
Supported accommodation	0.75

S – Social Factor

The Social Factor considers the impact of trees on humans.

Formula 2. Social Factor (S) = (Tp + Te + Hp + Hc + CS) / (6 + 6 + 6 + 6 + 0)

Where:

- Tp = Tree proximity to other trees
- Te = Ecosystem considerations
- Hp = Human population impacted
- Hc = Canopy cover of area referencing strategy
- CS = Tree of cultural significance

Table 5. Method for determining tree proximity to other trees variable (Strauss 2022).

Location and proximity considerations (Tp)	Score
Canopy intersecting another tree	3
One of a close group of plantings	4
Wide plantings	5
Irregular spacing between trees; regular spacing one side (not hard surface)	5
Hard surface plantings (street or pathway), or plantings with regular spacing both sides	6
Solitary feature specimen tree, part of a hedge, avenue, park, reserve or other green space design feature	7

Ecosystem considerations have been investigated by many groups, including the University of Adelaide where the Environment Institute has created a database of common Adelaide Street Trees and many of their characteristics called Right Tree in Right Place. These include climate suitability or unsuitability, soil type, life expectancy and pest resilience among many others. We propose to use this document where possible to inform tree valuations in South Australia. Where the tree is not listed in Right Tree Right Place, then another database may be used such as the Plant Selector +(Botanic Gardens of South Australia 2022).

Table 6. Ecosystem considerations (Te, Formula 2, (Strauss 2022)). Tree may fall into multiple categories for this variable, if this is the case, then the score used must be the highest of these. Note that for this proposal, we have amended the "Climate suited" standard method as the standard method includes a statement about including Indigenous or exotic species that are climate suited; as South Australia has the *Native Vegetation Act (1991)* and we propose to make these regulations state-wide, we have removed this stipulation.

Ecosystem considerations (Te)	Detailed description	Score
Declared noxious weeds	As listed by PIRSA (Department of Primary Industries and Regions 2021)	0
Climate unsuited	Species not well suited to current or future climates	4
Climate suited	Species climate suitable	6
Positive attributes	A desirable, rare, precious or cultivated variety	7
Habitat characteristics	Visible hollow/s wider than 5cm and/or part of a habitat corridor	7

Table 7. Population density variable (Hp, Formula 2) based on data provided by Australian Bureau of Statistics (2019-2020). This variable provides consideration of the relationship of humans to trees.

Population density - ABS generated categories: population per km² (Hp)	Score
0	1
<500	3
500 - 1999	5
2000 - 4999	6
5000 - 7999	7
≥8000	8

Table 8. Canopy coverage (Hc in Formula 2, %) of either the canopy cover percentage in the geographic area that a "strategy" is targeting or canopy coverage of the individual tree, whichever is appropriate. If a large scale valuation is being made, the geographic area that a strategy is targeting is to be determined by the local Council where the tree is growing.

Canopy coverage of area referencing strategy (Hc, %)	Score
80 - 100	1
60 - <80	3
40 - <60	5
20 - <40	6
5 - <20	7
<5	8

Table 9. Cultural Significance (CS in Formula 2); named Significance in (Strauss 2022); renamed here as Cultural Significance (CS) to avoid confusion with a Significant Tree.

Cultural Significance (CS)	Score
None	0
Suitable, important tree on land or listed site with Indigenous, cultural, heritage or scientific significance	3
Suitable tree listed as a heritage item or with Indigenous, cultural, heritage or scientific significance, eg in parks or reserves	6
A suitable important tree growing on land listed on a Heritage Register, a tree that is being evaluated as a trial species, of Indigenous, cultural or scientific importance or if the subject of specific research or scientific rarity	12
Suitable, important tree listed as a significant item with Indigenous, cultural, heritage or scientific significance at the regional or state level	24
Suitable, important tree listed as a significant item with Indigenous, cultural, heritage or scientific significance at the national level	48
Special characteristics to be estimated based on expert assessment	TBA

Q – Quality Factor

The Quality Factor in the MIS506 Tree Valuation (Strauss 2022) considers the quality of the tree itself and thus what amenity it provides to the community.

Formula 3. Quality Factor (Q) = (V + F + L) / (3 · 28)

Where:

- V = Vitality (Table 10)
- F = Structure (Table 11)

- L = Life expectancy (Table 12)

Table 10. Vitality (V), a descriptor of overall tree health as described by the International Society of Arboriculture (cited by Strauss 2022)

Vitality (V)	Score
Tree is demonstrating excellent or exceptional growth. The tree should exhibit a full canopy foliage and be free of pest and disease problems	28
Foliage of trees is entire, with good colour, very little sign of pathogens and of good density. Growth indicators are good, i.e. Extension growth of twigs and wound wood development. Minimal or no canopy dieback (deadwood)	24
One or more of the following symptoms: <25% dead wood, minor canopy dieback, foliage generally with good colour though some imperfections may be present. Minor pathogen damage present, with growth indicators such as leaf size, canopy density and twig extension growth typical for the species in this location.	20
One or more of the following symptoms of decline: >25% deadwood, canopy dieback is observable, discoloured or distorted leaves. Pathogens present, stress symptoms are observable as reduced leaf size, extension growth and canopy density	15
In a state of decline. Not growing to full capacity. The canopy may be very thin and sparse. A significant volume of dead wood may be present in the canopy and/or pest disease problems may be causing a severe decline in tree vitality.	10
In severe decline: >55% deadwood, very little foliage, possibly epicormic shoots and minimal extension growth	5
The tree is completely dead and exhibits no new growth or live tissue	0

Table 11. Tree Structure (F, Formula 3) as described by the International Society of Arboriculture (cited by Strauss 2022).

Structure (F)	Score
Trunk and scaffold branches show good taper and attachment with minor or no structural defects. Tree is a good example of species with well-developed form showing no obvious root problems or pests and diseases	28
Minor structural defects or minor damage to trunk, e.g. bark missing, there could be cavities present. Minimal damage to structural roots. Tree could be seen as typical for this species	21
Major structural defects, damage to trunk or bark missing. Co-dominant stems could be present with likely points of failure. Girdling or damage roots obvious. Tree is structurally problematic.	14
Tree is an immediate hazard with potential to fail, this should be rectified as soon as possible.	0

Table 12. Life expectancy score (L, Formula 3) based on Useful Life Expectancy score provided by City of Melbourne (cited by Strauss 2022)

Life expectancy (L, years)	Score
>60	28
31-60	27
21-30	20
11-20	16
6-10	12
1-5	9
<1	2

In addition to the Minimum Industry Standards Tree Valuation (Strauss 2022) methods, we propose the addition of other methods to gain a further understanding of our trees and their significance in the landscape. These methods are introduced in Table 1 and detailed below according to current practitioners.

Carbon sequestration

City of Melbourne includes information on carbon sequestration. We propose to include this in the tree valuation using

Formula 4. Carbon sequestration ($) = Tree mass (g) · 3.66 · MAC (Marginal Abatement Cost, $ t CO_2e^{-1})

Where:

- Tree mass is calculated based on wood density, leaf density and tree volume. For an accurate value of tree mass, we recommend the creation of a species specific database of both wood density and leaf density.

- 3.66 is a constant value; the ratio of carbon dioxide to carbon (CO_2 : C)
- MAC is the Marginal Abatement Cost, $AUD per tonne of CO_2 equivalent gas. This dollar value is based on the current price of carbon, the source of the current price of carbon will need to be agreed upon by an expert panel.

Tree Re-instatement

City of Melbourne include the addition of a reinstatement cost. These costs will vary depending on the local Council operating costs and include:

- Reinstatement greening fee if the tree plot is lost to development and Council needs to find a new plot for a replacement tree
- Reinstatement greening fee if Council is able to replant the tree in the same plot but the developer has not rehabilitated the plot
- Cost of the tree itself
- Planting costs
- Maintenance for two years
- Tree protection if required
- Removal of original tree
- Water Sensitive Urban Design (WSUD) if required

Loss Factor

The final element that we propose to add to the tree valuation method is based upon that of the Native Vegetation Council. Most elements that the Native Vegetation Council require for tree valuation are included in Formula 1. One that is missing is the Loss Factor (Table 13). We propose including this factor as a valuation multiplier to include trees that will be heavily pruned or severely damaged.

Table 13. Loss factor as described by the Native Vegetation Council (NVC) Scattered Tree Assessment Manual (Native Vegetation Branch 2020). This factor is used as a formula multiplier for Indigenous tree valuation.

Scale of impact	Loss factor
Complete removal of a tree	1
Tree removed back to a stump, but able to reshoot	0.8
Major pruning of the tree with more than 50% of the tree to be removed	0.6
Major pruning of the tree with more than 25% of the tree to be removed	0.4
Minor pruning of the tree with less than 25% of the tree to be removed	0

South Australian Regulations for valuing a Regulated or Significant Tree

Based on the information gathered from all the previous tree valuation methods, we propose the following.

Formula 5. Tree value = (Market Baseline Value · Land Use Factor · Social Factor · Quality Factor · Loss Factor) + Tree Reinstatement cost + Carbon Sequestration

Based on this tree valuation method, any tree that has a value of $500 or more will be considered Regulated and Significant. Though a $500 tree may not be enough of a deterrent to developers to consider retaining it, we do suggest that the removal of any tree should have its value paid into the Urban Tree Fund. Thus, any tree removed will fund a new planting or other associated benefit.

Implementation

Valuations will be carried out by qualified arborists with a minimum Certificate III in Arboriculture or equivalent. There may be opportunity to train and manage a group of accredited tree value assessors in the same vein as Native Vegetation Accredited Consultants within the Native Vegetation Management branch. All valuations are to be carried out in accordance with those set out here as per Tree Valuation MIS-506 (Strauss 2022).

Examples

Two examples of the application of this method are detailed below. The first example is provided in an Excel spreadsheet as a tree calculator with a copy of the book Tree Valuation MIS-506 (Strauss 2022). Tree value assessors will be able to use this tree calculator when they do their valuations. The second example is a generalised small street tree in suburban Adelaide. The monetary value of both trees is calculated based on a 2022 market reference value of \$16.78 cm^{-2}.

Table 14. Example 1; complete removal of a large, stand-alone, healthy tree, native to Australia but not Indigenous to South Australia, situated on a street in suburban Adelaide with a DBH of 60cm, height of 17m, 60 years old with > 60 years life expectancy.

	Market Baseline Value (B)	Land Use factor (Z)	Social factor (S)					Quality factor (Q)			Loss Factor
Variable name	B	Z	Tp - Proximity	Te- Ecosystem	Hp - Population	Hc - Canopy	CS - Cultural Significance	V - Vitality	F - Structure	L - Life Expectancy	LF
Category description	DBH = 60cm	Row dwelling	Feature tree	Climate suited	ABS4: >2000-5000 / CTI4: 60-<80	60% - < 80%	Local property or precinct	Good	Good	> 60 yrs	Complete removal
Variable value	$60 116	1.1	7	6	6	3	3	24	28	28	1
Total for factor	$60 116	1.1			1.04				0.95		1

The value of the tree in example 1 is **$65 602.45**. This is assuming a similar Land Use Factor value as for the NSW example (Table 4). This example does not take into account the costings for Tree Reinstatement and Carbon Sequestration as these variables need to be addressed by experts prior to the implementation of this proposal.

Table 15. Example 2; severe pruning of a street tree for establishment of a new driveway as part of a development application. The tree is a small, exotic, healthy street tree, with a DBH of 30cm, height of 8m, 10 years old with > 40 years life expectancy.

	Market Baseline Value (B)	Land Use factor (Z)	Social factor (S)					Quality factor (Q)			Loss Factor (LF)
Variable name	B	Z	Tp - Proximity	Te- Ecosystem	Hp - Population	Hc - Canopy	CS - Cultural Significance	V - Vitality	F - Structure	L - Life Expectancy	LF
Category description	DBH = 30cm	R2	Hard surface plantings	Climate unsuited	>2000-5000 /	60% - < 80%	Local property or precinct	Good	Good	31-60 yrs	Major pruning; >50% to be removed
Variable value	$21,539.53	1.1	6	4	6	3.0	3	24	28	27	0.6
Total for factor	$21,539.53	1.1			0.91				0.94		0.6

The value of the tree to undergo major pruning in example 2 is **$12 160.45**. Thus, payment into the urban tree fund would be $12 160.45 in this case. This valuation is assuming a similar Land Use Factor value as for the NSW example (Table 4). This example does not take into account the costings for Tree Reinstatement and Carbon Sequestration as these variables need to be addressed by experts prior to implementation of this proposal.

Miscellaneous changes required

Changes required to the *Planning, Development and Infrastructure Act (2016)* to support proposed changes to the Regulations.

Abandon Section 127(4):

Subject to subsections (6) and (8), if a development authorisation provides for the killing, destruction or removal of a regulated tree or a significant tree, the relevant authority must apply the principle that the development authorisation be subject to a condition that the prescribed number of trees (of a kind determined by the relevant authority) must be planted and maintained to replace the tree (with the cost of planting to be the responsibility of the applicant or any person who acquires the benefit of the consent and the cost of maintenance to be the responsibility of the owner of the land).

We propose that any tree that is to be removed for development is paid for into the relevant fund as per the urban trees fund described in Section 127(7). A comprehensive set of methods will need to be established to determine what species a Council will plant to replace that which is to be removed; that has not been presented here but is certainly an achievable goal.

We propose that Section 119(7 & 8) be amended from:

(7) A relevant authority should, in dealing with an application that relates to a regulated tree, unless the relevant authority considers that special circumstances apply, seek to make any assessment as to whether the tree is a significant tree without requesting the applicant to provide an expert or technical report relating to the tree.

(8) A relevant authority should, in dealing with an application that relates to a regulated tree that is not a significant tree, unless the relevant authority considers that special circumstances apply, seek to assess the application without requesting the applicant to provide an expert or technical report relating to the tree.

To:

A relevant authority should, in dealing with an application that relates to a proposed tree removal, unless the relevant authority considers that special circumstances apply, require the applicant to provide an arborist's report relating to the tree and whether it is regulated or significant.

We propose this addition to Section 200(6):

(c) to install Biodiversity Sensitive Urban Design (BSUD) elements

(d) to install Water Sensitive Urban Design (WSUD) elements

We propose the removal of Section 200(8)(a):

Despite the operation of any other provision, if—

(a) a person is required to make a payment in lieu of planting 1 or more trees;

and

(b) the person is a designated person,

then the amount of the payment that would otherwise apply must be discounted by 66.6%.

We propose the removal of Section 200(9)(b)(ii):

In this section—

designated person means a person—

(a) who is an owner and occupier of the land where the relevant tree is situated;

and

(b) who—

(i) is the holder of a current Pensioner Concession Card issued by the Commonwealth Government and is in receipt of a full Commonwealth pension in connection with that card; or

(ii) falls within a class of person prescribed by the regulations for the purposes of this definition.

Suggested changes to the *Planning, Development and Infrastructure (General) Regulations (2017)*

In addition to changes proposed to the *Planning, Development and Infrastructure Act (2016)* and *Planning, Development and Infrastructure (General) Regulations 2017*, we suggest a revision of Schedule B Homebuilder development, Section 1(f) in reference to Single storey additions and alterations:

the alteration or addition will not result in a contravention of the following minimum private open space requirements in respect of the site (with the site area including the area occupied by the relevant dwelling, any existing dwellings and any outbuildings or carports):

Site area	Minimum area of private open space in site area	Minimum area of private open space at rear or side of relevant dwelling
more than 501 m^2	80 m^2	24 m^2
between 301 m^2 and 501 m^2 (inclusive)	60 m^2	24 m^2
less than 301 m^2	24 m^2	24 m^2

Development sites that require removal of trees and other urban forest are contributing to canopy loss, particularly within the City of Port Adelaide Enfield due to

the third row stipulation in the table provided with Section 1(f). These open space requirements are very low and often involve replacing existing trees and other urban forest with grass or other, small trees that will not provide the same value as those removed for development.

References

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