

Newcastle Urban Forest Technical Manual

Part B Public Trees

February 2018

The urban forest is the collection of trees, shrubs, and other vegetation types on both public and privately owned land within the Newcastle Local Government Area. The urban forest and associated tree canopy across Newcastle provides a range of benefits for the community. Some of these benefits include shade, microclimate regulation, air quality, sense of wellbeing, diverse flora and fauna, storm water management and interception. The liveability of the city is greatly improved by having a sustainable tree canopy and green spaces.

In May 2008, Council adopted the Newcastle Urban Forest Policy and Urban Forest Background Paper in recognising the importance of the Urban Forest. The goals of the Urban Forest Policy include sustaining and maximising the Newcastle urban forest on an intergenerational basis. In June 2013, Council adopted the Newcastle 2030 Community Strategic Plan which is the community's long term vision for the city. The Community Strategic Plan identifies that over the next 20 years the Newcastle community wants a greater connection with nature, with a greener more enriching environment where the urban forest is maintained and connected.

This Technical Manual contributes to Newcastle's urban forest by providing guidance on the management of trees (including shrubs) on both public and private land within the Newcastle Local Government Area. The Manual is an accompaniment to the Newcastle Development Control Plan Section 5.03 Vegetation Management. It is separated into three parts based on the land on which the tree is located and the type of vegetation present:

- Part A provides guidance on the management of trees and shrubs located on private land.
- Part B provides guidance on the management of trees and shrubs located on public land.
- Part C provides guidance on the management of native vegetation communities on private land.

Use the Part that relates to the land on which the tree, shrub or other vegetation is located, regardless of the proposed activity.

Urban Forest Technical Manual

Part B Public Trees

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1.0 Introduction

Part B of the Urban Forest Technical Manual is to be used for all activities relating to trees on public land (public trees). Public trees are those trees located on land managed by Newcastle City Council, including street trees, park trees, and trees within other natural areas such as bushland reserves, coastal areas, heathland and wetlands. Part B of the Urban Forest Technical Manual is to be used for:

- private development where public trees or allocated planting vacancies are located within 5m of the property boundary, or
- all public tree management activities including inspections, maintenance and planting, and
- all infrastructure design and works undertaken by Council.

1.1 How to use this manual

Part B of this Manual is presented in twelve sections:

Section 1.0 Introduction - this outlines when this part of the Manual is to be used.

Section 2.0 Public trees and Development Applications - provides the process to be followed when a Development Application impacts public trees.

Section 3.0 Roads Act 1993 - Section 138 application - provides the process to be followed for Section 138 applications in relation to public trees.

Section 4.0 Public tree removal tree assessment tests - defines when the tree assessment tests are required for public tree removal and details what is required to undertake each of the six tree assessment tests.

Section 5.0 Public trees and infrastructure - details the process for the design of Council's infrastructure around existing public trees, and incorporating new trees into the design.

Section 6.0 Tree species selection and supply - details the ordering and supply of tree stock in accordance with NATSPEC.

Section 7.0 Tree planting - provides extensive detail on best practice planting techniques.

Section 8.0 Protection measures - provides specific detail on tree protection for public trees in relation to any works undertaken by Council, utility agencies or private development.

Section 9.0 Public tree maintenance - provides best practice methodologies for public tree maintenance activity undertaken by Council.

Section 10.0 Biosecurity - identifies the biosecurity requirements to be implemented for tree maintenance activities.

Section 11.0 Utility providers - provides guidance on offsets from trees and options to minimise damage to public trees.

Section 12.0 Arborist reports and qualifications - sets out the level of qualification required for reporting on public trees.

2.0 Public trees and Development Applications

It is Council's preference that public trees are retained and protected through appropriate design of development, and during the construction process.

Council **does not** require arborist reports for public trees, rather they are assessed by Council officers through the Development Application (DA) referral process.

When public trees or allocated planting vacancies are located within 5m of the property boundary, the applicant must undertake the following:

1. Identify the location of all public trees and planting vacancies within 5m of the property boundary on the site plans. Council must be contacted to obtain location/s of planting vacancies (Contact 4974 2000), and
2. Where the proposed design is within the tree protection zone (12 x trunk diameter measured at 1.4m above ground level in accordance with AS 4970-2009), the designer is to consider the feasibility of alternative options in accordance with the driveway crossing or works on public land test (refer to Section 4.1.6).
3. The Development Application is to include documentation to show all reasonable design options considered as part of step 2 above, and detail the feasibility review of these options.

The information provided will be considered within the development assessment process. Tree protection measures may be required as part of the consent conditions (refer to Section 8.0). Tree removal may be approved where it is clearly demonstrated that alternative design options to retain public trees is not possible. The removal and replacement of public trees is to be undertaken by Council.

Fees are charged by Council for the removal and replacement of street trees as a result of an approved development (or other causes such as vandalism, vehicle impact, etc). All fees which are charged by Council for the replacement of street tree(s) will be utilised for the planting of new tree(s). Fees may be found in Council's Fees and Charges register and are updated each year www.newcastle.nsw.gov.au/Council/Our-Responsibilities/Integrated-Planning-and-Reporting/Fees-and-Charges. Contact Council on (02) 4974 2000 to arrange quotation and payment for tree removal and planting once the development consent is received.

Consent is also required under section 138 of the *Roads Act 1993* for works of any kind within the road reserve, once a DA has been approved. The requirement for consent under the *Roads Act 1993* will be included as part of the consent conditions in the development approval.

3.0 Roads Act 1993 - Section 138 application

Particular works or activities within the road reserve, including removal or interference with a public tree, require consent under Section 138 of the *Roads Act 1993*. Consent under Section 138 of the *Roads Act 1993* may be required as a condition of a Development Application approval or is required to be finalised prior to obtaining a Complying Development Certificate under *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*.

An application form for consent is available on Council's website: www.newcastle.nsw.gov.au/Living/Transport/Roads/Road-permits or from Council's customer enquiry centre.

A range of infrastructure and assets, including trees, are located within the footway and road reserve and cannot be easily relocated, or in some cases relocated at all. Relocation of infrastructure can result in significant cost and should be considered when preparing development plans.

Where a section 138 application is approved the applicant may be required to undertake the following as part of the conditions:

- obtain details of utilities prior to commencement of work
- employ a suitably qualified arborist to supervise works in the vicinity of public trees
- install protective fencing in accordance with a tree protection plan (refer to Section 8.0)
- ensure access is maintained at all times along the footway in the vicinity of the works (refer to Section 8.0), and
- any damage to public land is to be restored to the satisfaction of Council. The restoration work is to be undertaken at no cost to Council.

3.1 Driveways

The removal and installation of driveways can have negative impacts on public street trees and vacant planting sites. This can result in lost planting opportunities, tree removal and associated costs. The following should be considered when undertaking design of a building and/or driveways to reduce these impacts, retain trees and tree vacancies:

- Replace a driveway in the same location as the previous one, with no additional excavation in depth or width.
- Locate the new driveway to achieve a 3m offset from a vacant planting site or an existing tree where:
 - the tree **is not** greater than 270mm diameter (measured at 1.4m above ground level), or
 - the tree **is not** greater than 4m in height above ground level at the highest point of the canopy.
- Locate the new driveway outside the required tree protection zone (12 x trunk diameter measured at 1.4m above ground level, in accordance with AS 4970-2009) where:
 - the tree **is** greater than 270mm diameter (measured at 1.4m above ground level), or
 - the tree **is** greater than 4m in height above ground level at the highest point of the canopy.

The assessing Council Officer will seek advice from a Council arborist regarding the proposed offset from the tree to the driveway, and any other factors such as heritage or habitat. Council may choose to retain the tree and advise of the required offset, or may approve the removal of the tree.

Removal of the tree is only undertaken where:

- the condition of the tree is poor and an alternative planting site is available elsewhere across the development frontage, or
- where there is no possible alternative to achieve a driveway as per section 4.1.6 The driveway crossing or works on public land test.

Fees are charged by Council for the removal and replacement of street trees as a result of an issued consent. All fees which are charged by Council for the replacement of street tree(s) will be utilised for the planting of new tree(s). Fees may be found in Council's Fees and Charges register and are updated each year www.newcastle.nsw.gov.au/Council/Our-Responsibilities/Integrated-Planning-and-Reporting/Fees-and-Charges. Contact Council on (02) 4974 2000 to arrange quotation and payment for tree removal and planting once the *Roads Act 1993* consent is received.

4.0 Public tree removal tree assessment tests

The tests in this section are to be used when removing street trees, parks trees, or any other public tree (unless the removal can be undertaken in accordance with one of the other criteria outlined in the City Wide Maintenance Procedure 2017). The removal of a notifiable tree/s, as defined under the City Wide Maintenance Procedure 2017, requires documentation to meet the relevant tree assessment test (see example below) and Councillor notification.

The purpose of the tests is to ensure Council's tree management meets the goals and objectives of the Urban Forest Policy. This is achieved by ensuring existing public trees are appropriately investigated with the outcome of the investigation documented. Public trees will only be removed where it is demonstrated that no practical alternative is available for retention of the tree.

The tests ensure that a foreseeable risk is not created by damaging trees, and retained trees are protected during construction works and maintenance activities. This process is in accordance with the Statewide Best Practice Manual, *Trees and Tree Roots*, and Council's' City Wide Maintenance Procedure 2017.

The tree assessment tests are undertaken in two parts, with the first part being the tree inspection and advice, and the second part being the review of options to retain trees. The level of detail provided in the first part of the tests will be determined by the circumstance and intended use.

For example:

- a resident request will result in an inspection, with relevant notes recorded in Council's tree system (TAMS). The notes and outcome of the inspection recorded in TAMS are to have regard for the tree assessment test criteria and the City Wide Maintenance Procedure 2017, whereas
- the assessment of notifiable trees, or trees for a project would undertake the inspection as above. However, the information obtained during the inspection would be expanded into a document that addresses the inspection component of the relevant tree assessment test in more detail. The level of final documentation is to be tailored to the circumstance and may be in the form of a memo with summary of site inspection or a full report.

Removal of trees on public land can be undertaken by Council as exempt development, or development without consent (through the preparation of an REF) under *State Environmental Planning Policy (Infrastructure) 2007*, or as part of works under Section 88 of the *Roads Act 1993*. However, in all of the above cases a Council arborist provides tree assessment documentation as the first part of the tree assessment test. This tree documentation is to inform the project, address impacts to trees and risk, meet insurance obligations, and provide adequate information for project approval and meeting the requirements of Council's process.

Note 1: For removal of a heritage listed item, Aboriginal object or disturbance of an Aboriginal place of heritage significance consult with Council's Development and Building Section.

Note 2: The tree assessment tests are to be undertaken in addition to the approvals above.

Note 3: Project referral forms and Tree inspection forms are contained within **Appendix 9**.

Note 4: Council projects within the road reserve (that are to be undertaken under the *Roads Act 1993*) will seek required approvals from the Office of Environment and Heritage.

Note 5: Removal of mangroves requires an approval from NSW Fisheries.

Note 6: Private requests for the removal of Public Trees to mitigate bushfire risk are to be submitted to the Rural Fire Service who will assess the risk.

The six tree assessment tests are listed in section 4.1. The full infrastructure works test (see section 4.1.5) is not required in the two circumstances detailed below.

1. A Council arborist is to inspect the trees and provide written advice (**Appendix 9**). However, the review of feasible design options under the infrastructure works test is not required where:
 - the trees within the works area are confirmed to be in poor condition by a Council arborist, and this is recorded in Council's tree asset management system, or where
 - full road reserve construction works are to occur (works that incorporate both road and footways), and a Council arborist has inspected all trees where the tree protection zone radius is encroached by the works, and confirmed in writing they will be compromised.
2. A Council arborist will not conduct a tree inspection or provide written advice, and a review of feasible design options under the infrastructure works test is not required where:
 - the works are outside the required tree protection zone radius and is noted in the design report with appropriate tree protection.

Note 1: Tree Protection Zones (12 x trunk diameter measured at 1.4m above ground level, in accordance with AS4970-2009). The DBH of multi-stem trees is to be determined using Council's online calculator. www.newcastle.nsw.gov.au/Living/Environment/Trees/Public-Trees/Online-Calculator

Note 2: TPZ radius is measured from centre of the tree. SRZ is measured from the outer edge of the base.

Note 3: Council may decide to undertake the full infrastructure works test in some of the above circumstances.

The application of the tree assessment tests requires a review of options to retain trees. The review of each option is to be documented, including implications and feasibility to support the final determination. See **Table 1** as an example only for the Infrastructure Works Test.

Table 1 - Example of review of feasible options under the Infrastructure Works Test

Hazard	Risk Level	Option	Abatement Option	Residual risk	Feasible
Trips/Falls/ Impact by vehicle	High (22)	1	Construct a footpath on the existing footway past tree.	High (24)	No The works would significantly impact on tree health and overall structure. This work would not be in accordance with AS4970 and would compromise the trees structural root zone, significantly increase the likelihood of large branch shed or whole tree failure, sever a large area of water absorbing roots resulting in tree decline and likely death. This would constitute a foreseeable risk.
	High (22)	2	Extend the footway into the parking lane by way of kerb extension commencing at 12m from the tree to facilitate pedestrian access around the tree.	Low (5)	Yes This retains the tree and provides a safe area within the footway to walk. May shorten the crossing distance for pedestrians. There would be a loss of two parking spaces in what is primarily a suburban area. Does not affect the bus stop to the north. Does not affect turning movements of larger vehicles. This would also create an improved space for future planting. The cost associated with this work estimated at \$xx.
	High (22)	3	Remove tree and turf within existing footway creating suitable pedestrian access along the footway.	Low (5)	Yes Loss of tree and 565m ² of canopy. Tree value estimate \$xx with removal and replanting cost \$xx. Provides trafficable footway and addresses trip hazards.
	High (22)	4	Do nothing.	High (22)	No The site has a fully constrained footway which forces pedestrians to walk on kerb or on the road to pass. The potential risk is high and requires abatement. This would constitute a foreseeable and preventable risk.

4.1 Tree assessment tests

Public tree removal is subject to assessment under one or more of the following tests.

4.1.1 The unacceptable risk test

The objective of this test is to determine if the public tree poses an unacceptable risk that cannot be appropriately managed by arboricultural treatment, fencing, signage or other risk management measures.

The following is to be provided by a suitably qualified Council arborist:

- a tree inspection through visual tree assessment (VTA stage 1), (VTA stage 2 if more information is required), and
- a detailed tree risk assessment in accordance with industry best practice tree condition assessment methodology, and
- supporting evidence, including clear and relevant photographs of the tree(s), any hazards, targets, and demonstration of risk, and
- a review of options for managing risk other than by tree removal, and
- a summary of the risk abatement options and implications.

4.1.2 The diseased condition test

The objective of this test is to determine if the public tree is in a diseased condition that cannot be corrected by appropriate arboricultural treatment.

The following is to be provided by a suitably qualified Council arborist:

- an inspection of the tree and formal identification of the disease, and
- an assessment of the impact of the disease on the trees health and/or structural condition, and
- supporting evidence, including clear and relevant photographs of the tree(s), any visible signs of disease, and
- a review of options for managing the disease other than by tree removal, and
- a summary of the options and implications.

Where the trees structural integrity is at risk, a formal risk assessment is to be conducted using industry best practice tree condition assessment methodology.

4.1.3 The property damage test *within 12 months of assessment*

The test is to determine if public or private property is being significantly affected by the presence/location or growth of a public tree. The purpose of this test is to assess the degree of impact a tree is having on built assets (including utility services, footpaths, driveways, retaining walls and buildings) and to demonstrate whether removal is the only reasonable option to avoid further conflict within the short term, ie. 12 months.

The following is to be undertaken:

- A suitably qualified arborist is to:
 - review the condition and proximity of all relevant trees to the part of the built asset that is, or is likely to be damaged within 12 months, and

- assess the likely future growth and development characteristics of the tree(s), and
- undertake investigations to demonstrate the public tree(s) are implicated where existing damage is evident, and
- provide supporting evidence, including clear and relevant photographs of the tree(s), damage, root interaction and relationship of this to nearby trees, and
- provide the above to the person assessing damage of the built asset.
- A suitably qualified person (eg. structural, road or civil engineer) is to:
 - conduct an assessment of damage, and
 - review the arborist information in conjunction with the arborist, and
 - provide a review of options, other than tree removal, for managing the interaction between tree(s) and built assets.

4.1.4 The suppressed growth test

The objective of this test is to determine if the tree is part of a group of trees in which the spacing prevents each of the trees from attaining its desired full potential.

The following is to be provided by a suitably qualified Council arborist:

- an assessment of all trees in a group, and
- a report that:
 - demonstrates why the tree(s) in question would be the most beneficial tree(s) to remove, and
 - a site plan and clear photographic details to indicate exactly which tree(s) are to be removed, and
 - the method to be used and precautions to be adopted to protect remaining trees.

Note 1: This test does not apply to a traditional avenue planting of evenly spaced trees, or trees that are typically understorey plants.

Note 2: Caution should be exercised in removing trees from a mature /established group as changes in wind exposure could increase the likelihood of failure.

4.1.5 The public infrastructure works test

The objective of the test is to determine if a tree is likely to be significantly injured or damaged as a result of public infrastructure work. The test is applied for all public infrastructure works to avoid significant injury or damage to the tree(s) (refer to Section 4.0 for exemptions).

Significant injury or damage is defined as resulting in:

- tree death, or
- the tree posing an unacceptable risk, or
- a reduction in the remaining service life of the tree to an unacceptable timeframe.

The likelihood of significant injury must be confirmed in a report prepared by a suitably qualified Council arborist who must:

- conduct a tree inspection recorded in Council's' tree asset management system, and

- undertake a detailed assessment of the tree(s) existing health and structure, and the impact of the proposed works on the health and structure of the tree(s) to determine if significant injury or damage will occur, and
- provide a summary to the public infrastructure designer (**Appendix 9**).

The public infrastructure designer must:

- document all reasonable design alternatives to retain healthy trees, and
- ensure adequate space is provided in the design for future plantings, and
- provide the above information to the business unit manager for determination.

Note: Private trees within 5.0m of the boundary must be considered when designing and installing public infrastructure. Failure to consider this can result in the creation of a foreseeable risk. Refer to Infrastructure Works Test under Private Trees Part A section 3.4.4.5

4.1.6 The driveway crossing or works on public land test

The objective of this test is to ensure the design of driveway crossovers and other private structures and works gives appropriate consideration to alternatives to tree removal, or loss of vacant planting sites on public land.

The assessment of public trees under this test is conducted by a suitably qualified Council arborist through a referral by Council's Development and Building section. A Council arborist, upon receiving the referral, will:

- conduct a tree inspection recorded in Council's tree asset management system, and
- provide information regarding the vacant planting sites, the condition of the existing tree(s) and the minimum offsets required to maintain tree health and structure, to the assessing officer.

It must be demonstrated within the development process that the tree would prevent the installation or essential function of a proposed driveway crossing, street awning, street balcony, or other private structure or work, where such work/structure complies with Council's design standards and other requirements, and:

1. it is demonstrated that there is no reasonable alternative to removing the tree, and all reasonable alternative design considerations for the works have been considered in order to maximise the public benefits, and
2. the Council is satisfied that the proposal would not have adverse, heritage, streetscape, pedestrian or traffic impacts.

Note 1: Public benefits include minimising driveway crossovers to maximise tree space, to retain on-street parking, and to retain safe pedestrian access.

Note 2: Alternative design options considered in point 1 include: relocating and/or minimising driveway crossover widths to retain existing trees, altering development footprint, altering hard surface design, and utilising permeable pavement

5.0 Public trees and infrastructure

This section is to be used for all infrastructure works and maintenance activities undertaken by Council. This section has been separated into two parts, including:

- infrastructure design and maintenance within the root zone of existing trees (section 5.1), and
- infrastructure design incorporating new trees (section 5.2).

5.1 Design for existing trees

This section is to be used for all public infrastructure works and maintenance activities where there are existing trees. Public infrastructure works and maintenance activities undertaken as either exempt development or development without consent under the *State Environmental Planning Policy (Infrastructure) 2007* must follow this process. Where a Review of Environmental Factors (REF) is being prepared for the project, the advice received from a Council arborist and review of alternative design options must be incorporated into the REF.

When designing infrastructure around existing trees the following steps are to be undertaken:

1. Determine if the works are inside the required tree protection zone (TPZ) radius (refer to Section 5.1.1)
2. i) Where the works are within the TPZ refer the project to a Council arborist (refer to Section 5.1.2), OR
ii) Where the works are outside the TPZ, then a referral to a Council arborist is not required. The infrastructure works test, including a review of feasible design options, is not required. However, tree protection notes are to be included on plans and in the design reports for adjacent trees to prevent damage from equipment or storage eg. no materials, equipment, site sheds or washout from machinery is to be within the TPZ of any tree.
3. Where the works are within the TPZ, a Council arborist will inspect the trees and provide advice to the designer (refer to Section 5.1.3).
4. The designer is to consider suitable options to retain trees as identified by the arborist and incorporate these into the project charter or concept report (refer to Section 5.1.4).
5. The Business Unit Manager determines the final option and signs off the concept report.

5.1.1 Determining tree protection zone

The tree protection zone (TPZ) is defined as the area required to maintain the biological function, stability and health of a tree (AS 4970 - 2009). The structural root zone (SRZ) of a tree is the inner area of the TPZ, and is the radial area critical to tree stability (AS 4970 - 2009). However, the SRZ formula does not apply to trees with asymmetrical root plates. Street trees generally have an asymmetric root system and the TPZ is considered the SRZ in these circumstances. The TPZ offset is an appropriate starting point for investigation and design. However, these offsets may be reduced based on a range of variable factors, including tree height and surrounding materials.

It should be noted that offsets within the road pavement can often be significantly reduced due to density of pavement construction. However, advice should always be sought from a Council arborist before encroaching into these zones, particularly where kerb and gutter is proposed to be removed.

A Tree Protection Zone is calculated as 12 x trunk diameter at breast height (DBH), which is measured at 1.4m above ground level. The DBH of multi stemmed trees is calculated using Council's online calculator to achieve a single stem figure. The calculator can be accessed via Council's website www.newcastle.nsw.gov.au/Living/Environment/Trees/Public-Trees/Online-Calculator.

Note 1: The minimum TPZ radius available under AS4970-2009 is 2m. For a calculated TPZ less than 2m eg. 12 x 10cm (DBH) = 1.2m, the 2m minimum would be applied.

Note 2: The TPZ radius for palms is 1m outside the canopy edge (dripline).

Note 3: When designing works adjacent to **new or young plantings**, including storm water pits, bus stops or similar, consider the future mature size of the tree or palm. Generally footpath design can be undertaken in this circumstance using the minimum TPZ radius of 2m from the new tree.

5.1.2 Referral to a Council arborist

Where works are within the TPZ of an existing tree a referral is to be sent to a Council arborist. Referral can occur during preparation of the project charter or concept design stage. The referral is to include the following detail:

- the address / location of the site, including an aerial photograph with works location marked (see **Figure 1**), and
- the footprint of the proposed works, including distance of tree(s) from the edge of the excavation or batter works, and
- tree identification numbers from Council's mapping system, and
- a detailed description of the activity and where excavation will occur, eg. replacement of kerb on same alignment, excavation to occur at 300mm into footway.

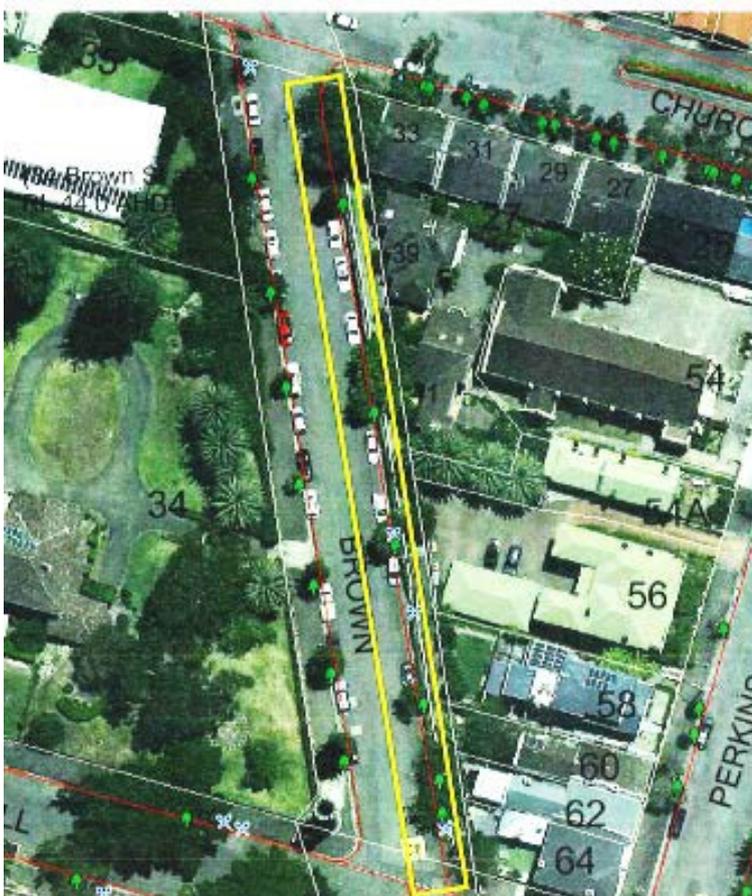


Figure 1 - Example of aerial photograph showing area of works

5.1.3 Arborist inspection and review of options

A Council arborist will inspect the tree(s) identified by the project designer in accordance with the public infrastructure works test and provide advice regarding the impact to tree(s) (**Appendix 9**). The designer will assess the feasibility of design options to retain tree(s) based on the arborist advice.

However, the review of feasible design options under the infrastructure works test is not required where:

- the trees within the works are confirmed in writing to be in poor condition by a Council arborist, and this is recorded in Council's tree asset management system, or where
- full road reserve reconstruction works are to occur (works that incorporate both road and footways), and a Council arborist has inspected all trees where the TPZ radius is encroached by the works and confirmed in writing they will be compromised.

Note 1: Whilst the infrastructure works test is not required for full road reserve construction works, Council may elect to undertake the full test in some circumstances.

5.1.4 Explore alternative design options

The following is a list of possible alternative design options that may be considered by the designer during the application of the public infrastructure works test:

- moving kerb and gutter alignment into the parking lane
- move footpath alignment, or location
- ramp or bridge over tree roots, or use elevated walkways
- install footpath without excavation and reduced batter
- move above or below ground infrastructure (eg. powerlines, watermains) away from trees
- avoid level changes, eg. maintain road height
- install small sections of kerb and gutter by hand past trees.

This list is not exhaustive and there may be other suitable design options. Additional information is available in **Appendix 3**.

5.2 Design for new trees

Assessment of the site early in the design phase provides an opportunity to ensure trees are appropriately incorporated into the proposed works. Tree roots can interact with surrounding infrastructure and avoidance of conflict is the most practical solution to limit tree root damage to other assets or structures. This results in an appropriate tree asset and adds a range of urban forest benefits

When designing for new trees the following should be considered:

1. Determine required soil volume and clearances from infrastructure (see section 5.2.1).
2. Consider alternative designs for creating additional space (see section 5.2.2).
3. Incorporate aeration and drainage into planting design (see section 5.2.3).

5.2.1 Space required below ground and clearances from infrastructure

5.2.1.1 Calculating mature tree soil volume

Trees require an adequate root system for tree stability, to maintain biological function and healthy growth. The amount of suitable soil that a tree has available will determine the amount of root system that the tree can develop and the amount of soil water and nutrients available to the tree. Tree roots are generally limited to the top 60cm of soil, with the majority located in the top 30cm, and form a broad root plate which can extend well beyond the canopy. In some cases tree roots may grow deeper in the soil, subject to oxygen levels, and are known as sinker roots. The overall stability of a tree is achieved through a combination of the shallow root plate and the sinker roots. See Council case book study on tree failure at the link below for further information and **Figure 2**.

[Tree Failure Casebook History - Informing Tree Management in Newcastle - 2000-2011](#)



Figure 2 - Tree root development

The generalized & unimpeded root system is broad and shallow (often only 200-300mm deep) with load bearing (structural) roots extending radially 2-4m with descending (sinker) roots below the trunk. Non-structural fine 'feeder' roots are wide-spreading often beyond the edge of canopy (drip line)

Graphic source - The Morton Arboretum

Soil volume required for root growth in soils is calculated as per the Cornell University formula which is widely accepted. The Cornell University formula requires the crown projection to be calculated first. Crown projection is the mature canopy spread for that particular species. Crown projection is to be calculated by a suitably qualified arborist.

- Crown projection (CP)(m²) = $\pi \times r^2$ $\pi = 3.142$ $r =$ average radius(m)
- Soil volume is then calculated by
- Soil volume (SV)(m³) = CP x 0.6

Example: A mature Tuckeroo with an average radius of 4m.

$$CP = \pi \times 4^2$$

$$CP = 50\text{m}^2$$

$$SV = 50\text{m}^2 \times 0.6$$

$$SV = 30\text{m}^3$$

Note: The soil volume calculation does not include the percentage consumed by the inorganic fraction where gap graded soils (eg. structural soils) are used. Therefore, the total volume of a gap graded soil with high proportion of rock particles will be greater than for other options.

Once the soil volume has been calculated the area required to achieve this volume is to be determined based on a maximum soil depth of 60cm. Depth of soil below this may allow for some sinker roots but lower oxygen levels generally restrict fine root growth.

Using the example above the mature Tuckeroo requires a soil volume of 30m³. At 60cm deep the surface area required can be calculated as follows:

- Surface area (SA) (m²) = Soil Volume/depth (m)
- SA = 30/0.6
- SA = 50m²

This cannot effectively be achieved in most street tree planting locations. Therefore, it is important to provide as much soil as possible in a given situation. Break out zones are generally ineffective as these often lead to interaction between tree roots and infrastructure. When designing new areas or full road rehabilitation, wider footways with an area clear of footpaths and utilities provide the best opportunity for increased soil volume. This results in faster establishment of canopy, healthy trees and reduced interaction with infrastructure.

The allocation of the required square metre area into width and length is to account for the development of the trees future radial structural root zone. Therefore, narrow planting beds are not suitable. See Council's online calculator or AS4970-2009 to determine the radius of the structural root zone. www.newcastle.nsw.gov.au/Living/Environment/Trees/Public-Trees/Online-Calculator

5.2.1.2 Clearance guidelines from infrastructure to new planting(s)

Site planning and design should ensure appropriate offsets between trees, utilities and structures to avoid compromising the longevity and health of the tree. Consideration should be given to the location of trees in relation to underground or overhead services.

In accordance with the Street Tree Selection Manual, species should be selected and located to provide the clearances indicated in **Table 2**.

Table 2 – Clearance guidelines from infrastructure to new tree planting

Site Constraint	Clearance guidelines
Minimum distance between tree plantings	6m from tree centre (species dependent)
Street intersection	10m from intersection of kerb line on approach 7m from kerb line on departure
Driveway	3m from edge of driveway
Power and light pole	3m from centre of pole

Site Constraint	Clearance guidelines
Storm water inlet	2m from edge of a pit lintel
Major underground service junction	3m from edge of junction box
Bus stops	15m on the approach and 3m on the departure
Traffic lights	10m from pole of traffic lights

5.2.2 Consider alternative designs for creating additional space

There are a range of possible options for designing space for trees. The above ground design needs to consider the mature size of the tree in relation to the surrounding surface and proximity of buildings. The required soil volume below ground can be difficult to achieve given the competition for space with various structures, utilities and hardstand areas required as part of the urban environment.

The following list provides a number of options that can be used to incorporate new trees in the design of the works, and is to be used once the required space has been calculated (refer to Section 5.2.1.1). The following list of options is to be considered:

- excavate large planting pits or continuous trenches where space permits (Section 5.2.2.1)
- use improved planting soil below porous pavement (Section 5.2.2.2)
- provide blisters for planting bed in parking lane
- design wider verges or medians in new development sites (Section 5.2.2.3)
- create wider verges during full road rehabilitation, or bring kerb lines out during partial rehabilitation works (Section 5.2.2.3)
- installation of structural cells or load bearing soils (Section 5.2.2.4)
- use of suspended slab pavements (Section 5.2.2.4)
- installation of root barriers (Section 5.2.2.5)

5.2.2.1 Large planting pits or continuous trenches

Large pits or continuous trenches provide the greatest opportunity for trees to quickly establish. This is due to the volume of feeder roots and associated mycorrhizal fungi that can be established, which significantly increase soil and nutrient uptake.

Trenches or pits should be a minimum 3m wide and to a depth of 600mm, with the existing soil either improved or replaced with suitable planting soil. The trench or pit is to be free draining or drainage must be installed (see Standard Drawings series 3000

www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Standard-Drawings). While the tree may look small for the size of the planting pit or trench when installed, it will quickly develop into a larger canopy within a few years.

5.2.2.2 Improved planting soil below porous pavement

A suitable soil specification and installation method for use under porous paving can be found at **Appendix 2a and 2b**. This soil consists of a rapidly draining bedding layer for the paving, which sits over a horticultural soil.

The soil specification can also be used for general planting and can be installed under footpath or cycleway pavement to increase the area for root growth. This approach can extend the life of both the tree and built assets. The added use of flexible joint products (such as Trip stop) further decreases the likelihood of interaction between trees and infrastructure.

This specification and installation method is a cost effective way of providing underground space, improved water infiltration and gaseous exchange.

5.2.2.3 Design wider verges or medians

When practicable verges should be widened or medians installed to increase space for trees. This may be achieved by moving kerb lines into the parking lane, either for a length of road or in isolated sections. The best opportunity to incorporate wider footways or install medians is where full road rehabilitation is being undertaken, or in new subdivision design.

Utilities and footpaths should be located as far from trees as possible to minimise future interaction.

5.2.2.4 Installation of structural cells or load bearing soils

Load bearing soil systems allow for horticultural grade root space beneath a load bearing surface. The technologies include suspended slab pavement, structural cells and gap graded soils.

Suspended pavement designs involve the use of piers, eg. concrete pillars or other precast concrete supports, which bridge horticultural grade soil.

Structural cells or gap graded soils are placed beneath hard surfaces to improve the volume of soil available for root development. Each planting location is different and the soil volume required varies depending on site conditions and the mature size of the tree species planted.

It is recommended that structural cells are installed as per the manufacturer's specifications.

The soil to be used is to meet Council's specification as per Standard Drawings series 3000 www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Standard-Drawings. The soil is to be tested by a NATA accredited soil laboratory and changes made to suit the specification and chosen species.

Gap graded soil (Structural Soil ®) should not be used within the structural root zone of the chosen species, often called the zone of rapid taper. This is to ensure the tree has the opportunity to develop larger structural roots. Where gap-graded soil is to be used the soil shall be equivalent to the specification for Benedict Sand and Gravel, SmartMix™3 40mm Structural Soil Mix Product Data Sheet. If sourced from an alternative supplier a sample of the filler soil and additives shall be tested for compliance by a NATA accredited laboratory and results submitted to Council for approval prior to installation. Install 20mm GMB20 base to a minimum depth of 150mm over the finished surface of the gap-graded soil in accordance with the specification provided.

Note: Refer to **Appendix 4** for Material Specification for Gap-graded Soil and GMB20 Base

5.2.2.5 Root barriers and deflectors

The installation of root barriers at the time of planting may assist tree roots to grow away from services, pavements and other structures. Root barriers should not be installed in such a manner as to restrict essential development of stabilising roots and fine roots required to sustain tree growth.

Tree root barriers are only suitable for use in certain situations and may fail because:

- they were not installed correctly including: poor jointing, inadequate depth or length for the circumstance, or
- the tree roots have bypassed the barrier either by going over, under, around or through the joints. This can be limited by ensuring only qualified persons using proven methods for installation of root barriers, and by embedding the top of the root barrier in concrete where ever possible.

Note 1: Tree root barriers/deflectors require periodic monitoring as roots deflected downwards may return to the surface if soil oxygen levels are not sufficient to support growth at depth.

Note 2: Root barriers should not be used to restrict roots so that the tree is prevented from developing a mechanically and biologically efficient root system to achieve maturity.

5.2.3 Additional requirements for design of new trees

The addition of aeration tubes and drainage can significantly improve the success of tree planting. The following information is to be considered within any design that is to incorporate new plantings. See also Council's Standard Drawings 3000 series www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Standard-Drawings.

5.2.3.1 Drainage

Check drainage through infiltration rate testing prior to selection of tree species. This can be provided for by either:

- geotechnical advice obtained by sampling at the planting holes, or
- conduct falling head infiltration testing.

5.2.3.2 Subsoil/subsurface drainage

One or more of these options may be considered to ensure planting holes are free draining:

- Ag-pipe: install slotted, flexible 100mm PVC pipe and fittings minimum to AS 2439.1. (Perforated plastics drainage and effluent pipe and fittings). Install 5-7mm drainage gravel filter material around Ag-pipe.
- Line flushing points: provide flushing inlets and approved surface covers to permit flushing of subsoil drainage lines.
- Auger drain holes: install a minimum of six drain holes to the bottom perimeter of the planting pit. Drain holes are to be 10cm in diameter, 60cm deep and filled with sand or fine gravel.
- Additional options as per Council's standard drawings 3000 series are: connect to stormwater system, or extend trench to allow additional infiltration.

5.2.3.3 Aeration tubes

Aeration tubes may be installed when trees are being planted to maximise gaseous exchange at depth for root growth.

Install slotted agricultural pipe within the planting hole ensuring that it has access to the atmosphere at both ends.

Note that:

- The pipe is to be set at the base of the root ball.
- The pipe inlets are to be flush or slightly proud (25mm maximum) of the final surface levels.
- The pipe ends should be wrapped with filter fabric to stop rubbish entering the pipe.
- Use a heavy duty slotted cap in busy public or vandalism prone areas. The pipe cap is to be visible from ground level and the slots are to occupy 50% of the caps surface area.
- This pipe is for aeration only.

6.0 Tree species selection and supply

6.1 Tree species selection

All tree species selections for planting on Council managed land are to be undertaken using the process defined in Council's Street Tree Selection Manual 2016.

The use of a species at any given location is subject to the plants individual requirements and site conditions. Procuring the specific species can be difficult either due to poor tree stock quality, or the plant no longer being available commercially. The critical factor is that the chosen tree species is suitable for the space and capable of growing into a mature healthy tree in the site conditions.

It is important that species considered an undesirable species or an environmental pest must not be used. The undesirable tree species list is not a list of trees that have to be removed from current locations. However, they are a list of species that will not be planted in the foreseeable future.

Note: Refer to section 7, Table 3 Undesirable replacement tree species in the Newcastle LGA
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6.2 Supply of trees

6.2.1 National specification for supply of trees (NATSPEC)

Obtaining quality trees is important to achieving consistent city wide tree plantings, superior tree growth and managing future risk.

NATSPEC Construction Information Guide: *Specifying Trees – A guide to assessment of tree quality* (2nd Edition by Ross Clark, 2003) provides industry recognised standards and specifications for tree supply.

Council will only accept NATSPEC certified trees for planting:

- as a street tree within the road reserve or other public land
- for Category 2 and 3 developments, (refer to Development Control Plan 2012, Section 7.02.01).

6.2.2 Ordering and delivery of stock

The following steps should ensure that quality trees are available at the time of planting:

1. Prior to ordering and on delivery to site a suitably qualified person is to inspect a representative sample of each batch of trees to comply with NATSPEC (**Appendix 8** provides further detail on how to assess tree stock in accordance with NATSPEC).

This must include:

- above-ground assessment
 - below-ground assessment
 - complete a tree balance assessment
 - root growth characteristics assessment
 - written evidence provided to Council demonstrating the tree stock meets the NATSPEC requirements.
2. Prior to delivery of tree stock the nursery is to mark orientation of north on the side of the pot as grown. Trees to be orientated in the same direction at planting.
 3. At the time of delivery ensure safe loading and handling procedures and transport in a covered vehicle to avoid damage and stress to stock. Trees are to be slung by the root ball and not by the trunks.

7.0 Tree planting

Successful tree planting depends on the ability of the tree to rapidly initiate root growth and to uptake water. Planting can be undertaken at various times, but is best undertaken in autumn (March to April) when lower air temperatures greatly reduce the stress on the newly planted trees, and soil temperatures are highest to encourage root activity. Summer planting is not recommended due to high temperatures with potential extremes and increased resource requirements, eg. additional watering.

It is important to note that, the root ball of a new tree can only hold enough water for one day until the root system establishes in the surrounding soil.

The success and long-term objectives of any planting is achieved by:

- completing a full assessment of the site (refer to Council's Street Tree Selection Manual 2016), and
- selecting species appropriate to the site and suitable to the space (refer to Council's Street Tree Selection Manual 2016), and
- application of best practice site preparation, stock handling, and
- planting in accordance with best practice, and
- ensuring adequate establishment maintenance for the circumstance.

All planting on public land undertaken as part of subdivision or commercial development, is to be undertaken by a Landscape Contractors Association (LCA), or an Australian Institute of Landscape Designers and Managers (ALIDM) affiliated contractor or Arborist (minimum level AQF3), with demonstrated experience in the installation of soils, tree handling, planting and establishment of advanced trees.

7.1 Full assessment of the site

A full assessment of the site is to be undertaken in accordance with Council's Street Tree Selection Manual 2016 process. In addition, the following information is provided to assist with site assessment.

7.1.1 Soils

The properties of the growing media directly influence the growth of trees. Physical attributes of the soil affect the availability of water and the levels of oxygen in the soil while chemical attributes influence nutrient availability. Typically urban soils have been highly disturbed and/or compacted and require remediation. Soil testing will determine the type and extent of remediation required.

Trees should be planted into existing soils wherever possible. Improved soil meeting Council's specification should be used in situations where the existing site soil is deemed unsuitable for the intended use and cannot be appropriately remediated.

7.1.1.1 Soil testing - annual planting program

Soil testing for the annual planting program is to incorporate samples taken from one or more of the tree planting vacancies. The onsite testing is to include a soil texture test and pH of both the top soil and subgrade soil to a depth of 600mm. The depth of the top soil (A Horizon) and subgrade soil (B Horizon) is to be recorded.

The drainage capacity of the soil is to be determined by assessing the texture of the A Horizon and B Horizon and comparing the results to the texture triangle. The outcome is to be used to complete the drainage component of the Street Tree Selection Manual Planting Site Inspection Form.

The *Planting Site Inspection Form* categorises soil drainage into good, fair and poor. The soil types within the texture triangle (**Figure 3**) are grouped into the following as generally meeting the drainage type:

- Good Drainage - Sand, sandy loam, loamy sand
- Fair Drainage - Loam, sandy clay loam, sandy clay
- Poor Drainage - Clay, silty clay, silty clay loam, silt, silt loam, clay loam

Note: See **Appendix 10**: Measuring Soil Texture in the Field

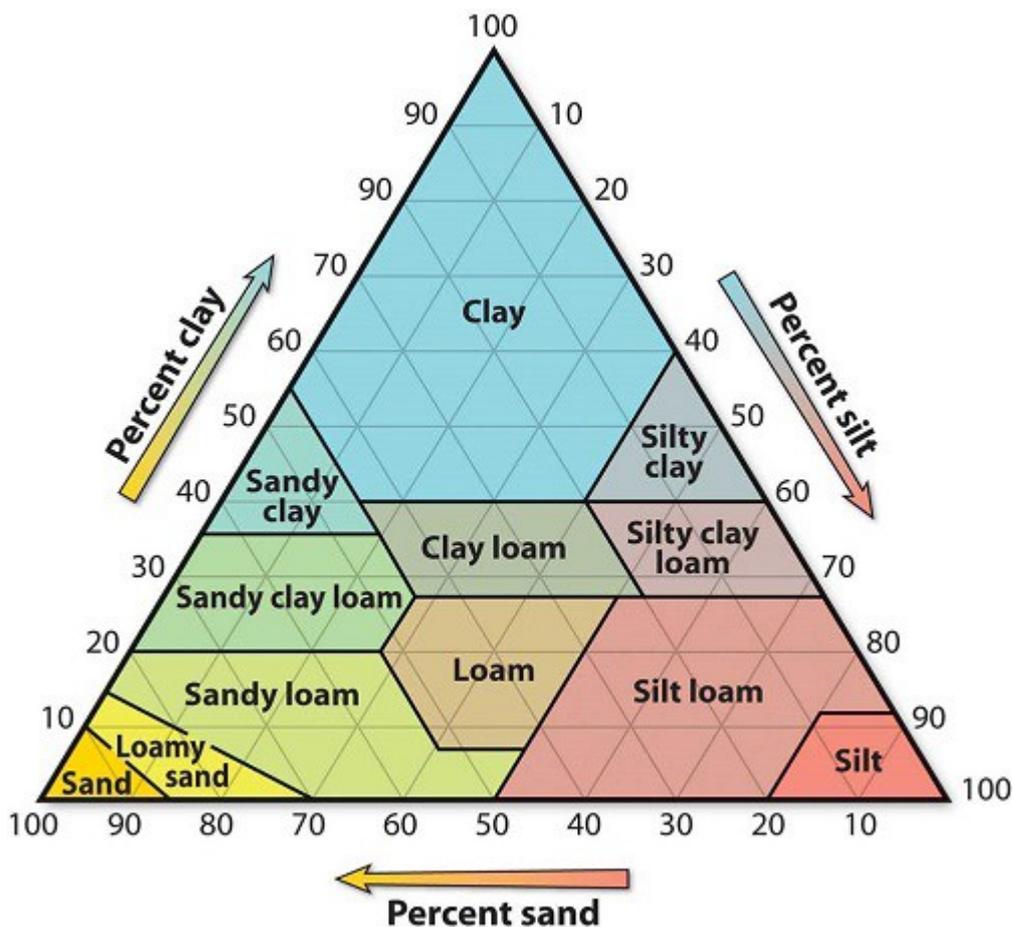


Figure 3 - Texture triangle (Source Picphotos.net)

7.1.1.2 Soil testing - Council works, subdivisions and commercial developments

During design and planning for Council works, private subdivision or commercial developments where tree planting is to be undertaken, the following soil testing is required:

1. Geotechnical assessment (including infiltration rates) of the proposed planting holes is to be conducted at the same time as other geotechnical works.
2. Full physical and chemical tests are to be undertaken by a National Association of Testing Authorities (NATA) laboratory.
3. The above information is to be provided on a plan and in documentation that incorporates soil remediation measures, or replacement, where required.

7.2 Selection of species appropriate to the site and suitable to the space

The selection of species for planting on public land is to be undertaken in accordance with the Newcastle Street Tree Selection Manual 2016.

From an urban forestry perspective, all woody species have inherent value, even those species that have some negative characteristics. For example, although Camphor Laurel is listed as 'undesirable' as a replacement species, the mature trees still provide essential shade, stormwater capture, and filter air pollution.

The urban forestry approach seeks to strategically manage 'undesirable' trees by discouraging the further planting of these species rather than wholesale removal. Species deemed as undesirable for use as replacement plantings are listed in **Table 3**. These species are described as 'undesirable' due to one or more of the following:

- excessive or unmanageable seed dispersal
- poisonous leaves, fruit or flowers
- excessive or unmanageable root suckering
- garden escape
- readily self-propagating from pruning and other materials from gardens
- non-local native species that is becoming an environmental weed as determined by Council
- known irritant species in certain high use areas as determined by Council.

Table 3 - Undesirable replacement tree species in the Newcastle LGA

Scientific Name	Common Name	Notes/Exceptions	Principal Reason
<i>Acacia baileyana</i>	Cootamundra Wattle		Native species but may become an environmental weed outside its natural habitat range
<i>Acacia salignus</i>	Golden Wattle		Native species but may become an environmental weed outside its natural habitat range
<i>Ailanthus altissima</i>	Tree of Heaven		Invasive (seed)
<i>Albizia lophantha</i>	Cape Wattle		Invasive (seed)
<i>Chamaecytisus palmensis</i>	Tree Lucerne		Invasive (seed)
<i>Chrysanthemoides monilifera</i>	Bitou Bush		Invasive (seed)
<i>Cinnamomum camphora</i>	Camphor Laurel	Except where the tree height exceeds 10m or the trunk diameter at 1.4m above ground level exceeds 450mm	Invasive (seed)
<i>Cotoneaster spp.</i>	Cotoneaster	All species	Invasive (seed)
<i>Erythrina x-sykesii</i>	Coral Tree		Brittle structure and Invasive due to vegetative reproduction
<i>Ficus elastica</i>	Rubber Tree		Invasive roots
<i>Gleditsia triacanthos</i>	Honey Locust	Not grafted horticultural cultivars	Root suckering
<i>Ligustrum spp.</i>	Privet	All species	Invasive (seed)
<i>Nerium oleander</i>	Oleander		Toxicity
<i>Pyracantha spp.</i>	Firethorn	All species	Invasive (seed)
<i>Robinia pseudoacacia</i>	Black Locust	Not grafted horticultural cultivars	Root suckering

Scientific Name	Common Name	Notes/Exceptions	Principal Reason
<i>Salix spp.</i>	Willow	All species	Invasive due to vegetative reproduction and root suckering
<i>Schefflera actinophylla</i>	Umbrella Tree		Invasive (seed)
<i>Schinus terebinthifolius</i>	Brazilian Mastic		Invasive (seed)
<i>Syagrus romanzoffianum</i>	Cocos Palm		Invasive (seed)

7.3 Best practice site preparation and stock handling

7.3.1 Site preparation

Site preparation should be undertaken in accordance with the following sections and Council's standard drawings 3000 series.

7.3.1.1 Types of imported soil media

Imported soil media used for tree planting should be suitable for the species of tree to be planted. The soil should have sufficient water holding capacity and adequate coarse component to ensure root growth. The soil specification provided in **Appendix 2a** provides further information.

7.3.1.2 Soil samples

Samples of imported planting soil are to be tested prior to delivery for all sites in accordance with the specification in **Appendix 2a**. The supplier is to undertake all necessary remediation measures recommended from the soil laboratory results.

For subdivision works a sample of proposed soil mix, including full soil analysis details, is to be retained and provided immediately on request to Council or an Accredited Certifier, for approval prior to installation.

Soil delivered to site is to be covered where there is a risk of weed contamination.

7.3.1.3 Street and park tree planting preparation

The key steps in site preparation are:

- Site investigations in accordance with Council's Street Tree Selection Manual 2016.
- Creation of the largest planting pit possible for the site. This may include under pavement zones for root growth.
- Removal of surface material, which may be hard stand, grass, other vegetation such as weeds or compacted/contaminated soil. Only spraying grass can lead to increased maintenance and risk of tree health/death when trying to manage grass.
- Replacement or remediation of poorer soils (refer to **Appendix 2a**).
- Installation of sub soil drainage to improve growing conditions
- Watering of the soil as it is installed to remove voids and improve establishment rates.

- Application of mulch at the time of planting by hand or mulch blower.
- Installation of tree protection measures.

7.3.1.4 Broad acre planting preparation

Planting should occur within an entire bed rather than augured holes.

The key steps to achieving success of broad acre plantings are:

- site investigations
- weed grass treatment and removal
- soil ripping both A and B horizon
- rotary hoeing (or similar) of the A horizon
- improve drainage where required
- application of mulch at the time of planting by hand or mulch blower.

Note: The use of any machinery on the prepared planting area to spread mulch generally results in compaction of the soil.

7.3.2 Stock handling

Trees can easily be damaged during transportation and installation which can affect tree health, structure and long term viability. Damage to tree trunks can effectively ring bark the trees and crushing of root balls can reduce stability and limit root growth. The following is to be applied when transporting or installing trees:

- Thoroughly water the root ball of the container stock at least twelve (12) hours prior to planting.
- Ensure the root ball is moist when it arrives at site and maintain root ball moisture by using a moisture probe if planting is delayed. Do not over water.
- Trees must be slung and lifted by the root ball only. In some cases a support sling is required to assist with guiding the tree but should take no weight.
- Plan and prepare where the tree will be planted to avoid further lifting. Holes should be correct depth and base material levelled. Never use weight of any kind to push trees down into the holes, including buckets of machines or stamping with boots.
- The root balls of trees must never be dragged or pulled by any means, including machinery or ropes to vehicles.

Note: The bark layer is live tissue that is critical to the trees survival as this layer transports soil water and photosynthates. This tissue is extremely vulnerable in young trees and must be protected.

7.4 Planting

7.4.1 Moving stock

Move trees to the dedicated planting hole by lifting or slinging under the root ball. Do not lift by the trunk or place slings around the trunk . In some cases, a support sling is required to assist with guiding the tree, but should take no weight. Smaller stock should be carried by the pot and not the trunk.

7.4.2 Tree planting

To avoid multiple lifts of the tree and potential damage ensure tree planting holes are of suitable depth and width for the size of root ball that is to be planted. The top of the root ball must finish at the predetermined height, eg). root ball to finish level with surrounding soil or just below to allow for mulch.

When the trees arrive on site:

- measure the root ball depth and width and adjust hole accordingly, and
- ensure base of the planting hole is level and at the correct height before tree is lowered into the hole.

7.4.3 Soil additives at planting

A soil conditioner such as Terracottem® or approved equivalent is to be used in all tree planting. The additive is to be applied in accordance with manufacturer's recommendations.

7.4.4 Consolidating backfill

The consolidation of backfill is to occur to ensure soil doesn't sink post planting. This assists with stabilising the tree and helps prevent any paved surface from deforming. The following process is to be used:

1. water in the soil as the planting hole is being backfilled to remove air pockets
2. ensure backfill is not placed over the top of root ball.

7.4.5 Soil watering berm

A berm of soil is to be built around the edge of the root ball to hold water. The berm is to be covered with mulch, but must not be made of mulch. The following steps are to be used:

1. Form a soil berm 60-80mm high at the outermost edge of the root ball.
2. Ensure edge of berm overlaps the outer edge of the root ball.
3. Apply mulch to the specified depth across the planting area and over the berm.
4. Gently fill inside of soil berm area with water at completion of each tree planting.
5. The soil berm is to be maintained intact for the duration of the tree establishment period.

7.4.6 Watering

Newly installed trees, including drought tolerant species, are dependent upon watering or irrigation until established, typically for two years. The use of irrigation systems can be problematic due to unreliable performance and can result in shallow root systems. Trees require watering to below the root ball depth to establish and sustain the root system and manual watering is to be undertaken.

The root ball of a new tree can only hold enough water for one day in summer and regular watering is critical to the establishment and survival of the tree. Conversely, in winter the root ball may hold sufficient water for up to six days. Therefore, it is vital that the frequency and amount of water is determined by the time of year that planting occurs, and is subject to soil moisture tests using a soil moisture probe prior to and during watering of both the root ball and surrounding soil.

The best mechanism to achieve this is a water budget based on individual site conditions and species requirements. The water budget is to be provided as part of the planting documentation.

Watering of the new tree is to be focused on the root ball through the early establishment period. However, additional watering of the surrounding planting bed soil can slow the loss of water from the root ball. A proven method for rapid establishment and growth of new trees is contained within **Table 4** and **Figure 4**. While this may not be possible in large scale plantings it provides a guideline against which water budgets can be established.

Table 4 - Watering frequency by season

Season	Frequency from planting	Amount
Late Spring to early Autumn (includes Summer)	Daily first six weeks, Every second day for 3 weeks Every third day for 3 weeks Weekly or as required.	To field capacity
Mid to late Autumn	Every second day for 3 weeks Every third day for 3 weeks Weekly or as required	To field capacity
Winter	Every third day for 3 weeks Weekly or as required	To field capacity
Early Spring	Every second day for 3 weeks Every third day for 3 weeks Weekly or as required	To field capacity



Figure 4 - Example of two Magnolias planted at same time (2005) with different planting and maintenance approaches. Tree on left was watered using Table 4, the tree on the right was not (photo 2015).

7.4.7 Mulching

Trees are to be provided with a mulched bed at the base of the tree to prevent damage from mowing, pedestrian or vehicle movement.

The addition of **inorganic** mulch (eg. rock or gravel or recycled hardwood) benefits tree health by conserving soil moisture and reducing weed growth.

The use of **organic** coarse mulch derived from live composted material benefits tree health by conserving soil moisture, reducing weed growth, increasing soil organism activity, providing soil organic matter and plant growth nutrients.

The mulch should be retained at 75mm depth and should never exceed 100mm in depth. Mulch placed at greater than 100mm depth, or containing a high proportion of fine material will limit gaseous exchange between the soil and the atmosphere reducing soil organism activity and suppressing root development. In addition, it will reduce water infiltration which further inhibits plant growth.

The supply of organic mulch should be in accordance with Council's specification and *AS 4454 – 2003 Compost, soil conditioners and mulches*.

The area covered with mulch is to be:

- the area cultivated for planting, or
- the extent of the dripline as the tree grows. This may not be possible in all plantings eg. street plantings due to footpaths, etc.

Correct installation of mulch will:

- result in mulch tapering down to zero at the base of new trees next to the trunk, or
- result in a mulch free gap of not less than 100mm and preferably 200mm clear from the trunk of maturing or mature trees, and
- ensure that buttress or other large surface roots are not covered.

Refer to **Figure 5** for correct mulching method diagram.

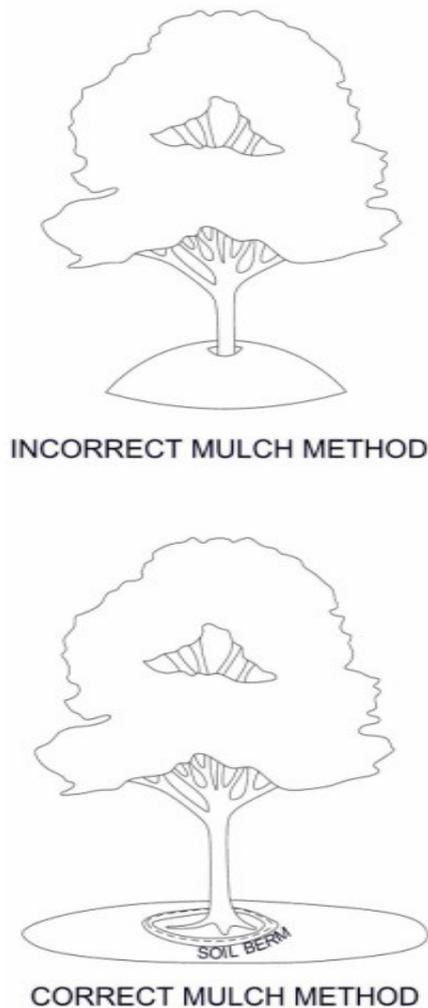


Figure 5: Mulch diagram

7.4.8 Tree staking

Trees that conform to NATSPEC quality should not normally require staking. Some circumstances, eg. areas of high wind exposure, may require staking for protection during tree establishment. The staking is to be loose so as to not restrict trees, but must not damage fragile tree trunks by rubbing.

7.4.9 Edging

Use edging to separate mulch areas from turf areas. Edging will aid in reducing turf growth into mulch areas and minimise maintenance. Edging should be installed below ground and higher than surrounding grass. However, install flush with the surrounding surface in pedestrian areas, where applicable, to avoid a trip hazard.

7.4.10 Tree guards and grates

Tree guard selection and installation is to be in accordance with Council's Standard Drawings www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Standard-Drawings

The planting of trees along coastal areas can expose them to strong salt laden winds, which can damage foliage resulting in tree decline and death. The best mechanism to manage trees in these areas is a combination of species selection, frequent watering and tree guards that protect the entire tree and deflect wind. The V shaped guard is the most effective, with the leading post located in the direction of the prevailing wind direction. Along the Newcastle coast the leading post would generally be located in an easterly direction as the onshore wind tends to vary between northeast through to southeast. These guards need to be large enough to protect the entire tree. The use of antitranspirants at planting and in the first growing season can also assist. However, care should be taken as these reduce transpiration slowing the establishment of the tree.

7.5 Establishment maintenance

The establishment maintenance period is essential to ensure the tree develops a healthy and mature canopy. Where works are undertaken for commercial or subdivision development, a bond or bank guarantee may potentially be required by Council to ensure quality tree establishment is completed. The following sections detail the requirements during the establishment maintenance period for all plantings.

7.5.1 Inspections

Inspections of all new tree plantings are to be scheduled to ensure that weeding, watering and mulch requirements are met in a timely manner. The schedule is to be prepared in advance and is to cover the 104 weeks intensive establishment maintenance period. The schedule needs to be flexible enough to allow for increased inspections during periods of low rainfall, or times of greatest grass and weed growth (eg. spring).

7.5.2 Practical completion report

A Practical Completion Report is required to be submitted to Council for all tree planting undertaken in subdivisions, commercial developments or where contractors plant on Council's behalf. The following information is to be kept to support the practical completion report:

7.5.2.1 Log book record

The contractor or Council planting team is to keep a log book of all works. The log book must include the time and date of visit, name of the person in charge of the site, the duration of site visit and works carried out. The following is to be recorded:

- watering events including dates and amount
- non chemical weeding events and method used
- rubbish removal dates, amount and type
- fertiliser application dates, product specification and rate
- treatment of trees for insect pests and disease, include method, rate and date
- tree replacement date, species, root ball size, reason for replacement including failed, damaged or stolen trees
- reinstatement of mulch to required depths dates, mulch used, and volume
- formative pruning include dates and works undertaken. Pruning in accordance with AS 4373 - 2007 Pruning of amenity trees (conducted at 102 weeks).

7.5.3 Establishment and maintenance works

7.5.3.1 Watering

Regular watering should occur during the establishment period in accordance with the predefined water budget (Refer to Section 7.4.6)

7.5.3.2 Mulch replenishment

Ensure mulch is replenished as required to maintain cover and depth specified at time of planting (Refer to Section 7.4.7).

7.5.3.3 Fertilising

Fertilising trees should not be necessary if appropriate soil conditions are provided or if the trees are in a load bearing structure. Fertilising may be required for trees that have been affected by disturbance, where a soil nutrient deficiency is affecting the performance of a tree, or where pest or disease is present. The tree should not be fertilised while stressed with application occurring once the stressor has been managed.

Benefits gained from the increase in stored resources may aid the tree to overcome any stress caused by future disturbances. Nutrient requirements should be based on a soil test undertaken by a registered soil laboratory.

7.5.3.4 Weed management

The use of chemicals to control weeds can be detrimental to trees, with many large tree species highly susceptible to even small amounts of chemical. Laboratory testing has shown that weed chemicals stay active when absorbed by mulch. It is vital to tree health to minimise the use of weed chemicals within the root zone or on mulch beds wherever possible.

During establishment maintenance ensure the tree planting pit and adjacent mulch areas are free of weeds for the entire period. Weed management should be undertaken by hand with inspection frequency to be increased where required to minimise weed establishment.

Where chemicals are used to manage weeds in large continuous mulch beds, or where the weeds have established, then the application must occur using only hand wands with hoods over the nozzle. The spray must not fan beyond the footprint of the weed. Broad spraying is not permitted.

7.5.3.5 Pest and disease management

Generally, insect populations can threaten tree health to the point of mortality. Notify Council of any pests and diseases found. Treatment of pests is generally undertaken by a licensed pest control operator.

There are a range of maintenance activities that can increase the risk of pest and disease attack in trees including:

- compaction of the soil within the dripline or root zone of the tree
- imported fill that may contain disease or pests
- roto-tilling, trenching or removing soil from the tree root area
- excessive or regular watering on, or near the tree trunk
- planting water loving understory plants within the dripline
- use of contaminated mulch, soil or plant stock.

The likelihood of pest and disease problems can be reduced by:

- using mulch that is free of weed species, harmful or foreign matter in accordance with *AS 4454 - 2012 Compost, soil conditioners and mulches*
- placing mulch well clear of plant stems
- regular watering to maintain field capacity
- use of certified growing media
- using certified plant material. Request certificate from Nursery supplier to certify disease free stock
- avoiding compaction
- avoiding chemical use
- aerating compacted soil.

Note: Refer to Biosecurity for common pests and diseases in the Newcastle LGA and **Appendix 1**.

8.0 Protection measures

The purpose of this section is to ensure that appropriate tree protection measures are documented and implemented to prevent damage to all trees on Council managed land. The Australian Standard *AS4970-2009 Protection of trees on development sites* applies for trees on both private and public land, and contains information required to determine the tree protection zone and prepare a tree protection plan.

The tree protection zone (TPZ) is the distance specified within documentation and construction plans that is to be protected during all phases of any works. The TPZ is calculated as 12 x trunk diameter at breast height (DBH) which is measured at 1.4m above ground level. The trunk diameter (DBH) of multi stemmed trees is calculated using Council's online calculator to achieve a single stem figure: www.newcastle.nsw.gov.au/Living/Environment/Trees/Public-Trees/Online-Calculator

The following information is supplied as a summary of the key elements of AS 4970 - 2009 and is to be read in conjunction with that standard. The information provided below applies to the protection of tree on public land.

8.1 Trees and Development Applications

Australian Standard *AS4970-2009 Protection of trees on development sites* requires the preparation of a tree protection plan. Arborist reports submitted as part of a Development Application are required to include a tree protection plan and tree protection requirements for public trees will be included as part of conditions of consent. This is to ensure that any public tree retained within 5m of the property boundary is adequately protected during the demolition and construction phase of development. A final tree protection plan for public trees is to be submitted to and approved by Council prior to issue of a Construction Certificate.

Inspections are to be undertaken by the Certifying Authority to ensure the tree protection measures are installed and maintained in accordance with the approved tree protection plan. Tree protection measures are to be implemented prior to the commencement of construction and remain in place until construction is complete.

8.2 Preparing a tree protection plan

Tree protection plans are to be prepared by an arborist with minimum qualification level of AQF 4.

Tree protection plans are to be prepared in accordance with AS 4970-2009 and the information detailed in the following sections. In some circumstances the tree protection zone may require modification, for example trees on road verges. All modifications should be determined prior to construction or, where issues arise on-site, by a suitably qualified arborist who will document the modification and reasons why.

8.3 Tree protection zone fencing

All retained trees will require tree protection fencing to be established prior to any tree removal works, demolition, earthworks, or construction works. The tree protection fencing is to be installed in accordance with the approved tree protection plan.

The site supervisor is responsible for the implementation of tree protection zone fencing. The site supervisor must also ensure the fencing is maintained at the required distance from the tree, and kept secure to exclude access until completion of works and rehabilitation of the site has occurred.

8.3.1 Fencing types

The type of tree protection fencing to be used is to be specified within the tree protection plan, and is to meet the requirements and intent of the AS 4970-2009. The fence is to be stable and robust so as to withstand weather events and accidental impact, and is to have signage stating Tree Protection Zone No entry (see **Figures 6 & 7**).

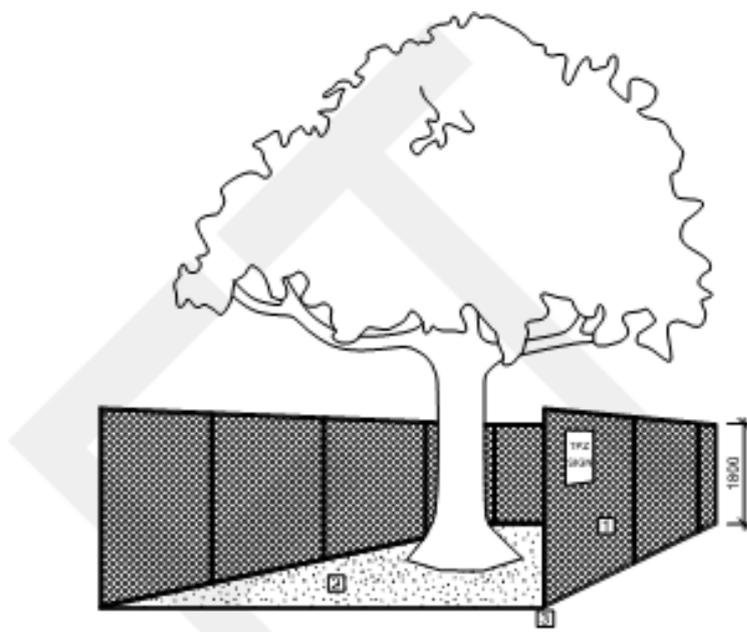


Figure 6 - Generic tree protection fencing



Figure 7 - Tree protection fence sign

8.3.2 Tree protection fencing for public footways

For trees situated within a road verge, only the area between footpath and road shall be enclosed with the required tree protection fencing for a 3m distance each side of the tree to allow access to property. Maintain pedestrian and roadway clearances for safe public use. **Figure 8a** and **8b** indicate typical treatment, however, modifications may be required.

All works adjacent to the roadway require a Traffic Control Plan as per AS 1742.3 - *Traffic control devices for works on roads*.

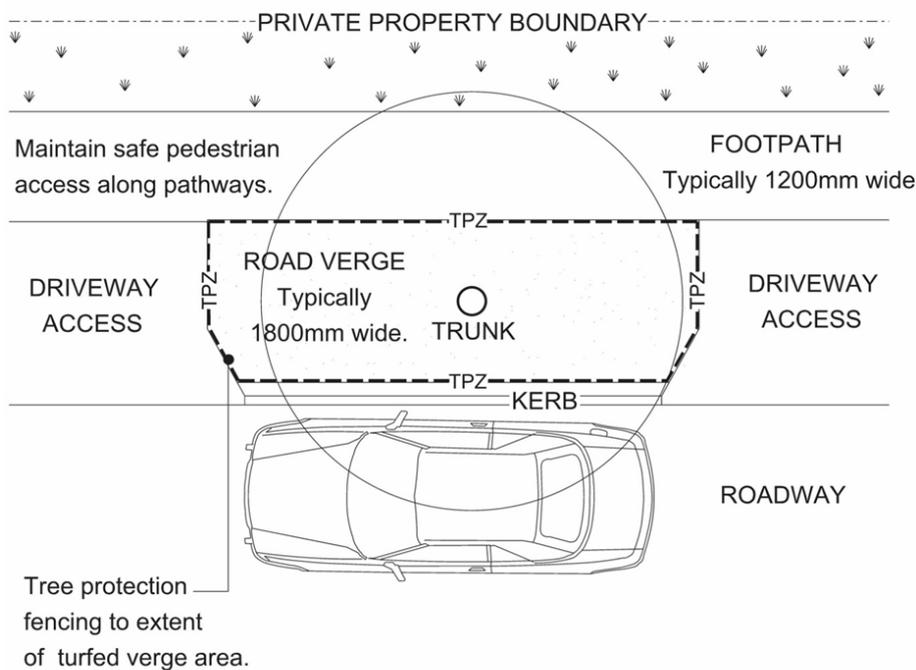


Figure 8a - Indicative tree protection on the road verge

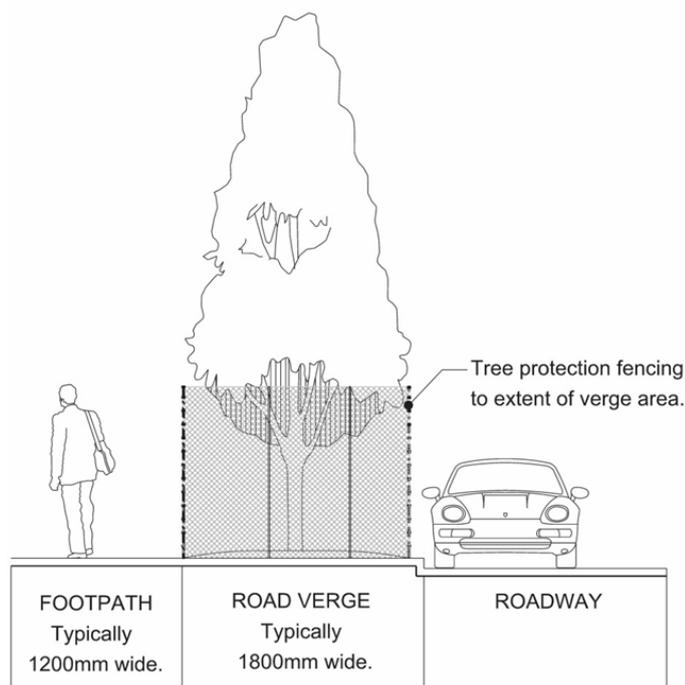


Figure 8b - Indicative tree protection on the road verge

8.3.3 Tree protection in limited space

Where public infrastructure works are required in limited space, then trunk, stem and ground protection are to be implemented in accordance with AS 4970-2009 (see **Figure 9** below). This may also be required where access is in proximity to tree(s).

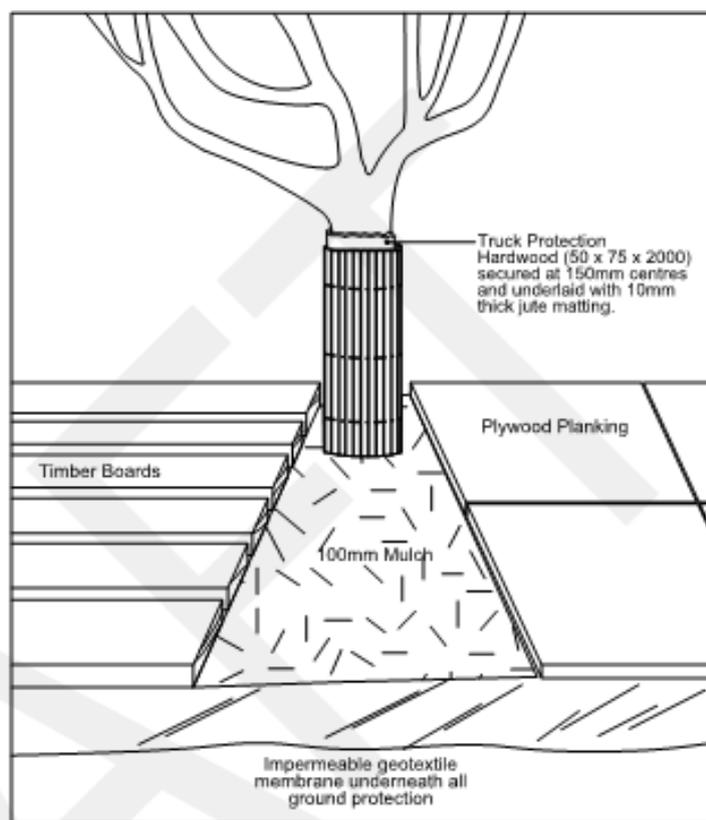


Figure 9 - Trunk and ground protection

8.3.4 Tree protection fencing in parks, reserves and bushland settings

Tree protection fencing is required for works within the specified tree protection zone on Council managed land.

The TPZ is calculated as 12 x trunk diameter at breast height (DBH) which is measured at 1.4m above ground level. The trunk diameter (DBH) of multi stemmed trees is calculated using Council's online calculator to achieve a single stem figure.

www.newcastle.nsw.gov.au/Living/Environment/Trees/Public-Trees/Online-Calculator

The protection fence is to be stable and robust so as to withstand weather events and accidental impact, and is to have a signage stating Tree Protection Zone No entry (see **Figure 6 & 7**).

In some circumstances the density of planting can require access through the tree protection zone of some trees (see **Figure 10**). Where this access is required ground protection is to be provided, which may include 200mm mulch, gravel and/or rumble boards (see **Figure 9**).

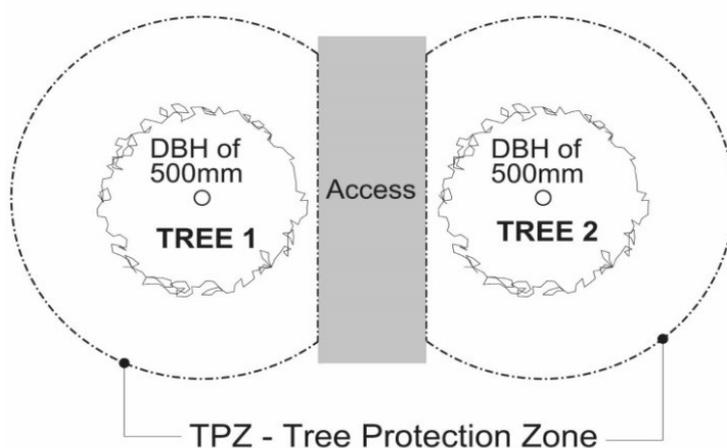


Figure 10 - Access between trees when space is limited

9.0 Public tree maintenance

The maintenance of established trees plays a vital role in ensuring the viability and sustainability of the urban forest. Works undertaken to an individual tree will determine if the tree remains healthy, or increases stress which may lead to decline. The maintenance and health of individual trees will cumulatively result in Council meeting the objectives of the Urban Forest Policy.

All public tree maintenance activities, including pruning and removal, can only be undertaken by Council. The following sections address:

- Tree Inspections
- Tree Maintenance Works (including pruning and removal)
- Infrastructure Maintenance and Public Trees.

Note: The pruning of small shrubs or hedges within Parks, or other facilities, are undertaken in accordance with appropriate horticultural practice.

9.1 Tree inspection

A request for inspection of a public tree(s) can be made via Council's website www.newcastle.nsw.gov.au/Council/Forms-Publications/Forms/Custom-Request-Form or phone (4974 2000). Inspections are undertaken by a Council arborist who will assess the tree(s) and specify appropriate works in accordance with the following:

- Council's City Wide Maintenance Procedure 2017, and
- Relevant Australian Standards (AS4373-2007, AS4970-2009), and
- Urban Forest Technical Manual Part B, Section 4.0, and
- Best Practice guidelines and arboriculture principles.

9.1.1 Outcome of inspections

The outcome of the inspection is recorded in Council's tree management system. Where works are identified these are allocated to an appropriate Council tree crew. A notice of inspection outcome is left in the resident's mail box, or posted to the relevant persons (eg. corporate body representative, property owner).

9.2 Tree maintenance works

All public tree maintenance works are to be undertaken by qualified Council staff and contractors in accordance with relevant Australian Standards and best practice requirements. The following information is provided to direct overall maintenance activities:

- Pruning is to be undertaken in accordance with the specification provided in the work order and the Australian Standard AS4373-2007. Pruning is to be undertaken in a manner that does not pose a risk to workers, the public, or property at any stage of the works. The works must not damage other parts of the tree or adjacent trees.
- Removal of trees is to be undertaken in a manner to ensure there is minimal risk to tree workers, the public, adjacent trees or property at any stage of the works.
- The management activities around trees and any root pruning is to be undertaken in accordance with the specification contained within the works order, and having regard for *AS4970-2009 Protection of Trees on Development Sites*.
- Hygiene protocols are to be implemented wherever there is a risk of the spread of disease or pest (refer to Section 10.0).

9.2.1 Compacted soils

Friable soils around trees are vital for the on-going health of the tree. Compaction of soils occurs by a range of means including foot traffic and vehicle movements. Impacts to tree health occur in the early stages of soil compaction, but generally a high level of compaction has occurred by the time symptoms such as dieback of the canopy are observed.

Soil that is compacted within the dripline of a tree can be ameliorated by:

- mulching (see section 7.4.7)
- restricting access to vehicles.

9.2.2 Mulch

The area of mulch required around a tree increases as the tree matures to ensure its biological and bio-mechanical functions are maintained. Refer to Section 7.4.7 for further detail on mulching requirements around public trees.

9.2.3 Watering

Watering regime should be undertaken in accordance with Section 7.4.6.

9.3 Infrastructure maintenance and public trees

This section applies to Council's infrastructure maintenance activities adjacent to public trees. The offset of many street trees to infrastructure is within the required tree protection zone. Therefore, removal of old infrastructure and installation of new infrastructure immediately adjacent to trees can result in an increased risk of tree failure, or reduced asset life. Outcomes can include tree dieback, death, increased risk of branch failure or structural failure. There is an increased likelihood of these outcomes with mature trees as the capacity of the tree to tolerate disturbance reduces with age.

Council has two adopted workflows to ensure trees and roots are considered when undertaking maintenance activities. These workflows provide options for the maintenance teams to carry out works without damage to the tree(s). However, where this is not possible and roots may be cut or damaged then:

- an inspection by a Council arborist and works coordinator/roads coordinator is required, and
- the works are modified to retain trees where possible (Section 9.3.1), or
- where it is determined that tree roots can be safely cut then root pruning works are assigned to Council's tree team, or
- where there are no suitable alternatives tree removal will be assigned to Council's tree team.

9.3.1 Alternatives to tree removal

The following options may be appropriate where there is an interaction between public infrastructure and tree roots:

- divert or remove the footpath
- pour kerb in asphalt or concrete directly over roots without excavation
- replace the footpath with reinforced concrete
- install tripstop or similar near trees
- grind the trips along footpath
- ramp the walking surface over the roots or lifted slab
- install of flexible paving
- use pier footings, wooden walkways.

Alternative options are to be investigated in consultation with a Council arborist to ensure the selected option will not damage the tree(s) or make them unsafe.

9.3.2 Removal of pavement adjacent to retained trees

Removal of existing pavement over tree roots is to include the following precautions to avoid tree damage:

- break the hardstand into manageable pieces to facilitate careful removal
- do not permit vehicles on the exposed roots or within the minimum distance specified in the tree protection plan
- do not remove pavement or other material that has been utilised by established roots without prior arborist advice
- apply water absorbing fabric to the exposed area immediately, wet the fabric and keep moist until the overlay surface is applied
- where tree roots are encountered within the tree protection zone, the need and implications for the cutting of any roots is to be determined in advance by a Council arborist.

10.0 Biosecurity

There is a risk to the tree population within any urban forest from a range of pests and diseases. It is critical that appropriate measures are put in place to ensure that any pest or disease is not introduced or spread.

Inspection prior to works is critical in protecting the City's canopy from the spread of disease. Any tree maintenance activities (including propagation, planting, mulching, pruning or removal works) are to ensure that the requirements of **Appendix 1 Disease and Insect Pest Management Protocol** are included in all documentation and implemented.

11.0 Utility providers

The installation or repair of various utilities is required throughout the city. These works can significantly damage trees, particularly where trenching is required. Excavation may cause damage to trees resulting in tree death, canopy dieback or an increased risk of limb or whole tree failure.

Utility operators undertake activities under a range of legislation. These activities should not permit injury or damage to public trees that would result in a hazard. Council requires utilities, when undertaking activities that may impact upon public trees, to:

- liaise with Council's Asset Management team during the planning phase. Council's Asset Management team can be contacted on (02) 4974 2000.
- liaise with Council's public utility officer prior to commencement of works on site, and
- employ a suitably qualified arborist to supervise works in the vicinity of public trees, and
- install protective fencing to avoid damage to trees and roots, and
- manage and control the use of machinery and private vehicles when operating in public open space.

Note: Council assets are not obtainable from dial before you dig searches.

The following section provides options for utility installation that minimises the impact to trees root systems.

11.1 Trenchless techniques

Trenchless techniques provide an alternative method to open trenching for underground service installation. For new installations, directional drilling, pipe jacking, and boring all reduce reinstatement work and maintain visual amenity.

Trenchless techniques require reliable location of other services and survey marks. Where high risk services are identified, consultation with the utility/service provider is essential.

Note: Refer to AUS-SPEC #2 Specification 305 - Trenchless Conduit Installation.

11.1.1 Underboring

Underboring is the preferred option for installing utilities in proximity to trees. Open excavation should cease at a distance from the tree, dependant on the tree size. This distance is to be determined by implementation of *AS4907-2009* having regard for notes 1, 2 and 3 below.

Where underboring will pass within the root structure of a public tree, the minimum bore depth is to be 700mm. Where underboring or open trenching is proposed adjacent to public trees, Council's conditions are required to be implemented. These conditions are available by contacting Council on (02) 4974 2000.

Directional boring is to be used when working within the tree protection zone. Where this is impractical consultation with the asset (or property) owner is required.

Note 1: Refer to Section 5 for tree protection zone information.

12.0 Arborist reports and qualifications

Council undertakes all inspections of trees on Council managed land. Council's arborists, or tender approved consultants, conduct inspections in accordance with industry best practice and Council processes. The minimum qualification required for a Council arborist (or consultants) undertaking tree inspections or writing reports is Diploma Arboriculture (Level AQF 5). The qualification should be accompanied by 5 years post qualification experience in assessing public trees and report writing.

The following are the minimum requirements for an arborist report on public trees. Report layout may vary subject to the brief and the scale of the project.

12.1 Council Arborist Report

Arborist reports prepared by Council, or on behalf of Council, must use clear and precise language and be based on the following:

1. be guided by theoretical and factual scientific concepts, and
2. be objective and disclose any pecuniary or non-pecuniary interests, and
3. state findings based on observations and discuss the connective significance of those observations, and
4. provide suitable evidence, including clear relevant photographs, and references to support claims/recommendations, and

5. provide the relevant detail of the tree assessment test where required, and
6. include the information contained in **Table 5** when prepared by consultants for Council.

Table 5 - Contents of a Consultant arborist report prepared for Council

Arborist	Full name
	Business name and ABN
	Business address
	Qualification and AQF Level, certificate number and date of award
	Business telephone and email address
The site and the brief	The full address of the site
	The full name and address of the client
	Dates of all site visits
	The project brief as provided by the client
	A table of contents including list of photographs
	A clear site plan showing relevant site details accurately plotting existing tree locations and actual crown spread
	A relevant site description including a summary of soil and drainage conditions
	A table listing each tree by number, common and scientific name, DBH, estimated height, age class, health, vigour and structure
	A summary of trees proposed to be removed and the reasons for removal

Glossary

Action Plan: for the purpose of the University of Newcastle Callaghan Campus the term refers to the Action Plans in Section 9.3 of the Landscape Management Implementation Plan Callaghan Campus dated 3 September 2012.

Amenity: is the term used to describe the features, facilities or services that make for a comfortable and pleasant life. Amenity is not only enjoyed by residents in their homes and gardens but also in the street and public places.

Arborist: a person who holds the Australian Qualifications Framework (AQF) 5 Diploma in Horticulture (Arboriculture) or AQF 4 Certificate IV in Horticulture (Arboriculture) and is enrolled in the NSW TAFE AQF 5 Diploma in Horticulture (Arboriculture) course.

Bushland Management zone: for the purpose of the University of Newcastle Callaghan Campus the term refers to the Bushland Management zone map in Section 9 of the Landscape Management Implementation Plan Callaghan Campus 3 September 2012.

Bush Regeneration: the rehabilitation of bush from a weed infested or otherwise degraded plant community to a healthy community composed of native and indigenous species.

Canopy cover: refers to the total area contained within the vertical projection of the periphery of tree crowns (or other overstorey). It provides an indicator of the quantity of urban forest, and its capacity to provide ecological, economic, social and aesthetic benefits.

Circumference breast height: the girth of the supporting stem of a tree at a height of 1.4m above ground level measured at the trunk centre, and so as to contain the outermost projection of any flanges or buttresses.

City Arborist: person designated as such by The City of Newcastle.

Compensatory planting: tree planting required offsetting the loss of retainable tree canopy.

Council: means Newcastle City Council.

Crown: portion of the tree consisting of branches and leaves and any part of the trunk from which branches arise.

Crown projection: is the size of the tree canopy. An equation is used to work out the crown size. Crown size (m) = πr^2 where r equals the average distance to canopy dripline.

Compaction: compression of the soil that creates an upper layer that is impermeable.

DBH (Diameter at Breast Height): the diameter of the tree trunk at 1.4m above natural grade.

Dead tree: is where the biological function of the tree has ceased, no leaves are present and visible evidence of trunk, root plate and canopy desiccation.

Development Control Plan (DCP): has the same meaning as in the *Environmental Planning and Assessment Act, 1979*.

Note: The term is defined as a development control plan made, or taken to have been made, under Division 6 of Part 3 and in force.

Development site: includes all areas within which the development will occur and can extend across several lots or development blocks.

Disturbed area: the area which will be impacted by a development, including construction, demolition and use.

Dying tree: demonstrates reduced growth rates, sparse foliage and reduced response to damage or stress over subsequent growing seasons.

Exotic: any flora or fauna species which is not native or indigenous.

Gap-graded soil: a mix of 40mm crushed basalt aggregate, filler soil and other additives to meet specification supplied. Components are thoroughly pre-mixed before placing in trench.

Hazard: anything with potential to harm health, life or property.

Indigenous: any tree, shrub, fern, creeper, vine, palm or plant that is native to the Lower Hunter Region, and includes the flower and any part thereof.

Infiltration: the practice of discharging drainage water into the ground soil matrix.

Injuring: in relation to a tree, means a wound resulting from an activity, including but not limited to excessive pruning, cutting, trenching, excavating, altering the grade, paving or compaction within the tree protection zone of a tree. Injury includes bruising, scarring, tearing or breaking of roots, bark, trunk, branches or foliage, herbicide or poisoning, or any other action foreseeably leading to the death or permanent damage to the tree health.

Lopping: an unacceptable practice as defined in the Australian Standard AS4373 – 2007.

Main body of vegetation: is the area shown on Map 1 - Callaghan campus

Manual: the technical manual/s that support Newcastle Development Control Plan 2012.

Native: any tree, shrub, fern, creeper, vine, palm or plant that is native to Australia but not indigenous, and includes the flower and any part thereof.

Native Vegetation: has the same meaning as in the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*. As such native vegetation is any of the following types of plants native to New South Wales:

- (a) trees (including any sapling or shrub or any scrub)
- (b) understorey plants,
- (c) groundcover (begin any type of herbaceous vegetation),
- (d) plants occurring in a wetland.

Native Vegetation Community: plant communities, comprising primarily native species, the composition and structure of which reflects the interactions between plant species, between plants and fauna and with the environment. Native vegetation communities include canopy trees (where present), understorey, and ground cover. Regrowth and newly colonising stands of native species are included as part of the native vegetation community.

LEP: the Newcastle Local Environmental Plan (LEP) is a city wide plan covering the entire local government area. The plan anticipates social and economic trends as well as the need to protect the environment. The LEP is prepared by Council and approved by the Minister for Planning and Infrastructure.

Park Tree: a public tree located in a park managed by Council. These are generally mown areas but may have some pockets of trees with understory.

Project Arborist: a suitably qualified arborist retained by a property owner or development applicant for the purpose of overseeing on-site activity involving the welfare of the trees to be retained. The Project Arborist shall be responsible for all reports, appraisals, tree preservation plans, or inspections as required.

Property: refers to any infrastructure (eg. underground water/sewer pipes, electrical cables etc.) and structural elements on private land. Structural elements include driveways, and walls which are retaining devices only.

Pruning: is the selective removal of branches in accordance with the requirements and classifications within AS4373-2007 Pruning of amenity trees.

Public Tree: tree/shrub species located on any land managed by Council.

Remnant: native vegetation community within the boundaries of the Newcastle University Callaghan Campus.

Removal: complete tree removal such as cutting to the ground or extraction of the tree or taking any action foreseeably leading to the death of a tree or permanent damage to its health or structural integrity, including but not limited to excessive pruning, cutting, girdling, poisoning, over watering, unauthorized relocation or transportation of a tree, or trenching, excavation, altering the grade within the tree protection zone, or paving within the drip-line of the tree.

Riparian zone: refers to a riparian corridor as defined by Department of Primary Industries - Office of Water - i.e. a riparian corridor that forms the transition between land and river or watercourse.

Risk: the chance of injury, loss or damage to property, a person, organisation or the community measured in terms of consequences and likelihood.

Risk management: is the process of identifying, analysing, evaluating, monitoring and communicating risks in a way that minimises losses and maximises opportunities. It is described generically in AS/NZS 4360:1999 Risk Management.

Shrub: a woody perennial plant that is generally smaller than a tree species at maturity and has many main stems or trunks.

Stormwater: the runoff from rainfall events.

Streetscape: the form, character and visual amenity of the street environment.

Street tree: public trees and shrubs within the road reserve. These have been surveyed and mapped by Council.

Street tree vacancy site: sites identified by Council for future tree planting. The sites have been identified from analysis of the Local Government Area based on criteria in the Tree Asset Management System (TAMS). The information on locations of street tree vacancy sites is available on request from Council.

Structural soil: see Gap-graded soil.

Suitably qualified person: a person with appropriate level of skills and formal training in a particular field relevant to a particular situation or works, such as a structural engineer who is required to assess structural works, a civil engineer required to assess road works.

Solar: suitable access to sunlight for human wellbeing.

Topping: an unacceptable practice as defined in the Australian Standard AS4373 – 2007.

Tree Private land: a long lived woody perennial plant greater than 3m height (or will be at maturity), with one or relatively few main stems or trunks.

Tree Protection Plan (TPP): a plan prepared by a suitably qualified arborist that details measures to protect and preserve trees.

Tree Protection Zone (TPZ): is a determined area of ground under a tree that is to be fenced off during the development of a site to ensure that activity does not cause damage to the tree or its root system.

Trenching: any excavation to provide irrigation, installation of foundations, utility lines, services, pipe, drainage or other property improvements below ground.

Urban forest: the totality of trees and shrubs on all public and private land across Newcastle LGA, and measured as a canopy cover percentage of the total area.

Urban Forest Technical Manual: produced by the City of Newcastle to supplement section 5.03 Tree Management of the Newcastle DCP 2012 by providing technical information for the design, implementation and management of tree planting in the local area.

Undesirable Species: tree species listed in Appendix 1 of this Technical Manual that are unsuitable for replanting due to negative characteristics.

Verge: the part of the street reserve between the carriageway and the boundary of adjacent lots (or other limit to street reserve). It may accommodate public utilities, footpaths, stormwater flows, street lighting poles and planting.

Vertical mulching: auguring, hydraulic or air excavation of vertical holes within a trees root zone to loosen and aerate the soil, typically to mitigate compacted soil. Holes are typically penetrated four to six feet on centre, two to three feet deep, two to six inches in diameter and backfilled with either perlite, vermiculite, peat moss or a mixture thereof.

Weed: a plant encroaching on an area mulched for trees.

Wetland area: for the purposed of the Urban Forest Technical Manual a wetland area includes the outer boundary of the wetland plus 100 m from that edge.

Appendices

Appendices are provided as separate documents on Council's website.

www.newcastle.nsw.gov.au/Development/Land-Use-Planning/Development-control-plans