

600 – 660 Elizabeth Street, Redfern – Arboricultural
Impact Assessment

NSW Land and Housing Corporation

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Template 2.8.1

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Abbreviations

Abbreviation	Description
AQF	Australian Qualifications Framework
AS	Australian Standards
DBH	Diameter at Breast Height
ELA	Eco Logical Australia
m	Metre
mm	Millimetre
NDE	Non-Destructive Excavation
NO	Number
NSW	New South Wales
SP	Species
SRZ	Structural Root Zone
TPZ	Tree Protection Zone
VTA	Visual Tree Assessment

1. Introduction

Eco Logical Australia Pty Ltd (ELA) has prepared an arboricultural impact assessment (AIA) on behalf of NSW Land and Housing Corporation (LaHC) to accompany a Planning Proposal to be lodged with the City of Sydney (CoS).

This Planning Proposal relates to land at 600-660 Elizabeth Street, Redfern (the study area). The Planning Proposal seeks to rezone the study area to allow redevelopment for a mix of social, affordable and private housing in an integrated residential community. The aims of the Planning Proposal are to rezone the study area to B4 Mixed Use. In November 2019 the Minister of Planning and Public Spaces announced that the Redfern project would change from a State Significant Precinct planning pathway to a Planning Proposal pathway led by Council.

An indicative reference scheme and urban design report has been prepared by Architectus, Silvester Fuller and Tyrell (the project team) to support the Planning Proposal and demonstrates how the Site may be redeveloped. The indicative reference scheme comprises:

- approximately 327 dwellings, with building heights ranging between 6 and 14 storeys;
- a mixed-use development, with over 1,500m² of non-residential floor space for local shops, cafes, community space and other services; and
- three ground floor communal courtyard spaces.

This report addresses the potential impacts of the development footprint on the tree protection zones of trees in the study area.

1.1 Project description

The study area will be transformed into a market leading build-to-rent redevelopment featuring contemporary urban and architectural design and creating a high-quality integrated community of social, affordable and private housing.

1.1.1 Communities Plus Build to Rent

Communities Plus is a key program under NSW Government's *Future Directions for Social Housing in NSW*, delivering integrated social, affordable and private housing by partnering with the private and not for profit sectors including registered Tier 1 or Tier 2 Community Housing Providers (CHPs).

The Redfern project aligns with Future Directions, by providing innovative options for private sector investment in social housing under a long-term lease. The project presents an opportunity to renew and increase social housing in a well-located integrated community with good access to education, training, local employment, and close to community facilities such as shopping, health services and transport.

On 6 July 2018, the NSW Government announced the Site as the pilot for Communities Plus build-to-rent. The project provides an opportunity for the private sector, in partnership with the not-for-profit sector, to fund, design, develop and manage the buildings as rental accommodation under a long-term lease.

Build-to-rent is a new residential housing delivery framework that can provide access to broader housing choices. Established in overseas markets such as the UK and the USA, locally build-to-rent has significant scope to provide increased rental housing supply and the opportunity for investment in residential housing in NSW.

1.1.2 Vision, Reference Scheme and Planning Framework

The study has been prepared to formulate and assess a suitable suite of planning controls to guide the redevelopment of the study area. A design, technical analysis and consultation process was undertaken to prepare a reference scheme which indicates how the future public domain, building form and connections could be delivered. The reference scheme (**Figure 1; Figure 2**) balances the challenges and opportunities of the study area, particularly the desire to deliver high quality urban design while providing new and modern social housing in an integrated mixed tenure environment.

The indicative reference scheme was prepared to indicate how the Site could, rather than will, be redeveloped and has been used as a basis to prepare draft amendments to the Sydney Local Environmental Plan 2012 (including zoning, height, floor space ratio and car parking controls) and the development of a new site specific Development Control Plan which will guide the detailed design of the Site.

The proposed planning framework has regard to:

- accessibility and connectivity of the Site to public transport, employment, shops, education and other services,
- the site and local area's rich history and cultural significance,
- the surrounding urban form and context, and
- the environmental and servicing considerations, including flooding, stormwater, traffic, utilities, noise, air quality and wind.

The proposed planning framework will guide future development applications for the Site which are anticipated to achieve the following:

- approximately 500 dwellings, with a maximum FSR of 3.7:1
- buildings with a predominant height of 6-9 storeys with a single tower up to 19 storeys (66m)
- some supporting retail and communal floor space to support incoming population. New public spaces on Kettle and Phillip Streets activated by shops, cafes, community space and other services

It is expected the study area will be developed over a period of three years, once the site has been rezoned.

1.2 Purpose of report

The key features of the proposal that are likely to negatively affect the subject trees (trees within the study area) can be summarised as follows:

- excavation works
- plant movement
- changes in soil grades

- installation of underground services.

1.3 Study requirements (DP&E 2018)

In November 2019 the Minister of Planning and Public Spaces announced that the Redfern project would change from a State Significant Precinct planning pathway to a Planning Proposal pathway led by the CoS. Subsequently, a Planning Proposal Lodgement Checklist was issued by Council. The planning proposal checklist items issued by Council are limited to addressing tree retention consistent with the DCP 2012. This is addressed in this report. This report also addresses the previous study requirements issued by DP&E 2018:

- undertake an arboricultural impact assessment for the proposal outlining trees to be removed or retained and the possible impacts on trees to be retained including allowing for future construction methodology (study requirements; DP&E 2018)
- identify the trees within the study area that are likely to be affected by the proposed works
- assess the current overall health and condition of the subject trees
- evaluate the retention value of the subject trees
- determine the likely impact to the subject trees.

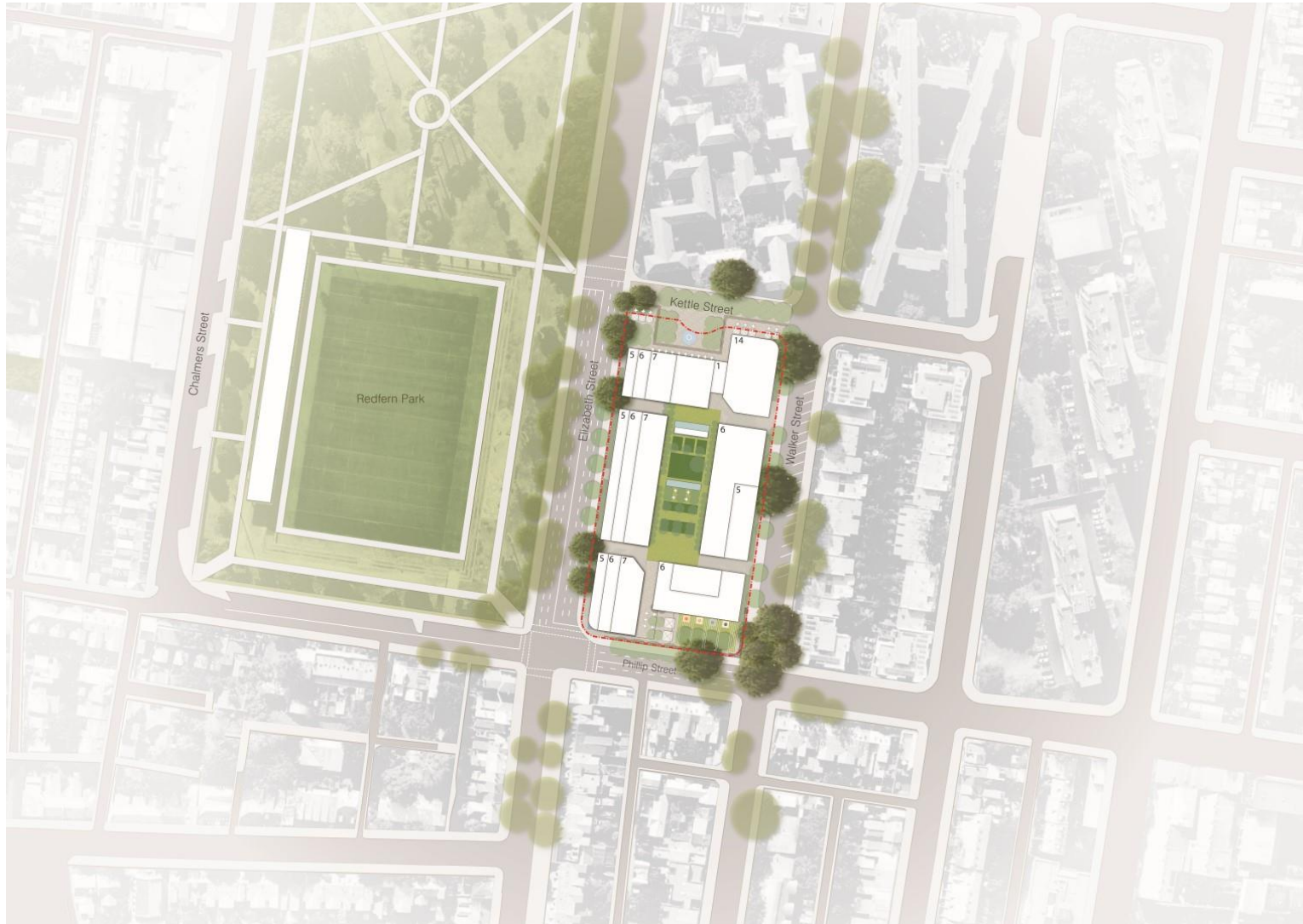


Figure 1: Indicative Reference Scheme. Source: LAHC 2020

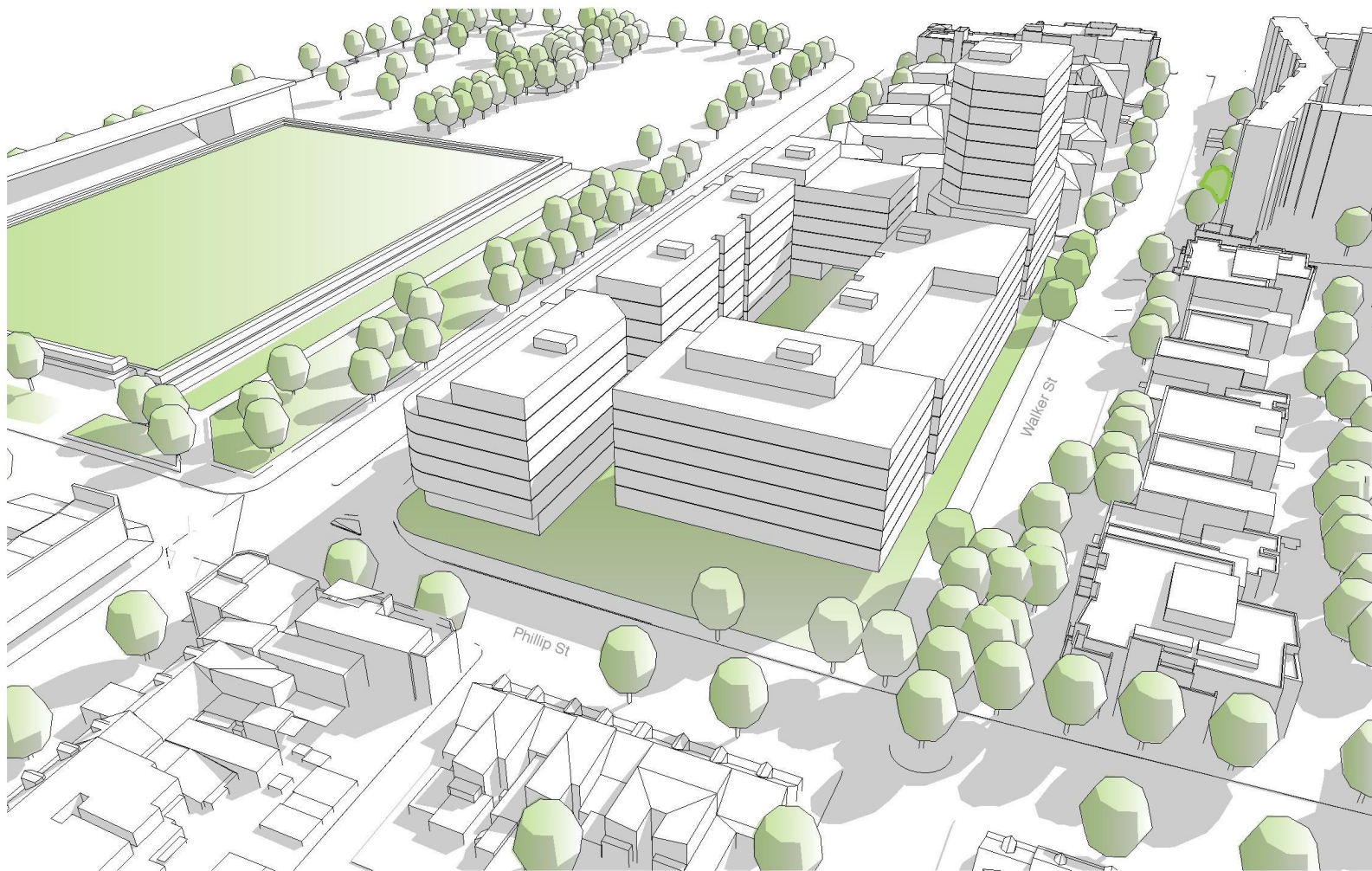


Figure 2: Indicative Reference scheme. Source: LAHC 2020

2. Method

2.1 Definitions used in this assessment

2.1.1 Definition of a tree

The City of Sydney Council defines a tree as having:

“(a) a height of 5m or more; or (b) a canopy spread of over 5m; or (c) a trunk diameter of more than 300mm, measured at ground level (City of Sydney Council 2012)”.

2.1.2 Tree protection zone (TPZ)

The TPZ is the combination of crown and root area (as defined by AS 4970-2009) that requires restriction of access during the construction process. Tree sensitive construction measures must be implemented if works are to proceed within the Tree Protection Zone.

2.1.3 Structural root zone (SRZ)

The SRZ is the area of the root system (as defined by AS 4970-2009) used for stability, mechanical support and anchorage of the tree. It is critical for the support and stability of trees. Severance of roots within the SRZ is not recommended as it may lead to the destabilisation and/or decline of the tree.

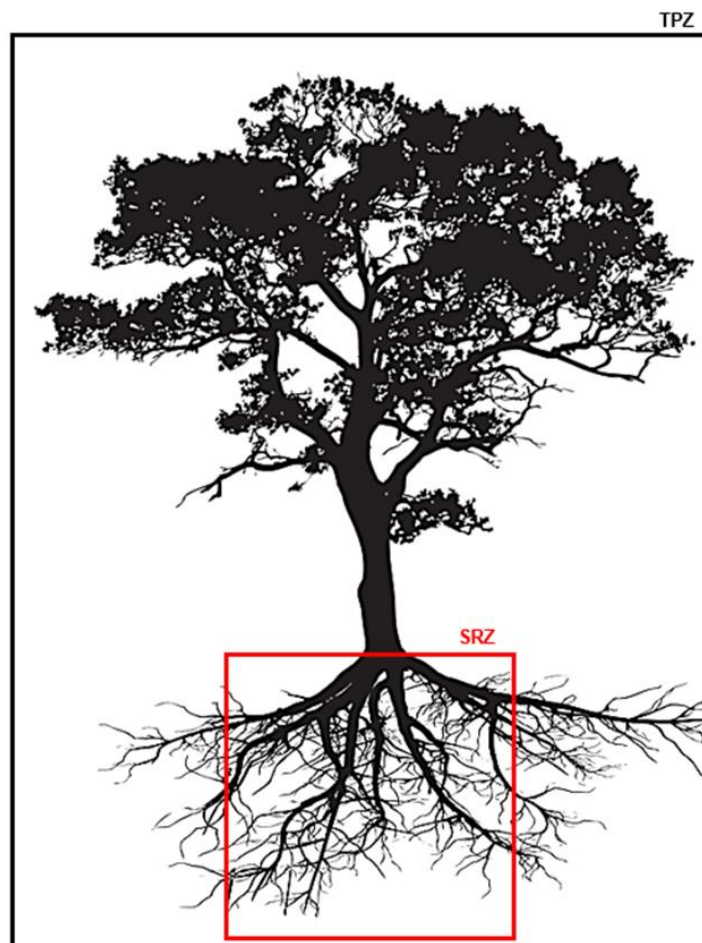


Figure 3: Indicative TPZ and SRZ

2.2 Tree assessment

The health and structure of the subject trees was assessed in accordance with a stage one visual tree assessment (VTA) as formulated by Mattheck & Breloer (1994), and practices consistent with modern arboriculture. Measurements to determine the tree protection zone were carried out in accordance with Clause 3.2 and 3.3.5 of AS4970-2000 Protection of Trees on Development Sites (Standards Australia 2009).

A total of 67 subject trees were inspected on 2 July 2018 by AQF Level 5 Consulting Arborist, Elizabeth Hannon. Some trees were assessed in a group.

The following applies to this methodology:

- Trees were inspected from ground level, without the use of any invasive or diagnostic tools and testing. Trees that met the definition of a tree in Clause 2.1 were assessed (City of Sydney 2012)
- No aerial inspections or root mapping was undertaken.
- Tree heights were determined using a clinometer 15 metres from the base of the tree
- Canopy spread was determined using a measured stride out on site.
- The diameter at breast height (DBH) was measured by placing a diameter tape around the trunk of the tree at 1.4 metres above ground and recording the measurement. The DBH measurements were used to determine the area for the tree protection zone (which also incorporates the structural root zone).
- The structural root zone (SRZ) was calculated by an estimated measurement of the trunk diameter taken above the root buttress.
- Tree identification to species level was based on broad taxonomical features present and visible from ground level at the time of inspection.

2.3 Retention value

The retention value/importance of a tree or group of trees is determined using a combination of environmental, cultural, physical and social values. This tree retention assessment has been undertaken in accordance with the Institute of Australian Consulting Arboriculturists (IACA) *Significance of a Tree, Assessment Rating System (STARS[®])*. The following categories were used:

- **Low:** These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
- **Medium:** These trees are moderately important for retention. Their removal should only be considered if adversely affected by the proposed works and all other alternatives have been considered and exhausted.
- **High:** These trees are considered important and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by Australian Standard AS4970 - Protection of trees on development sites.

Further details and assessment criteria are in Appendix B.

2.4 Potential impacts

Trees may be affected by cutting or damaging roots or branches. Impacts on the tree protection zones are determined by the percentage of the area that the development incurs into the tree protection zone. The following are the definition of these impacts:

- **High impact:** The SRZ may be affected if the proposed encroachment is greater than 20 % of the TPZ. Trees may not remain viable if they are subject to high impact.
- **Medium impact:** If the proposed encroachment is greater than 10% of the TPZ and outside of the SRZ, the project arborist may require detailed root investigation to demonstrate that the tree(s) would remain viable.
- **Low impact:** If the proposed encroachment is less than 10% (total area) of the TPZ, and outside of the SRZ, detailed root investigations should not be required.
- **No impact:** No likely or foreseeable encroachment within the TPZ.

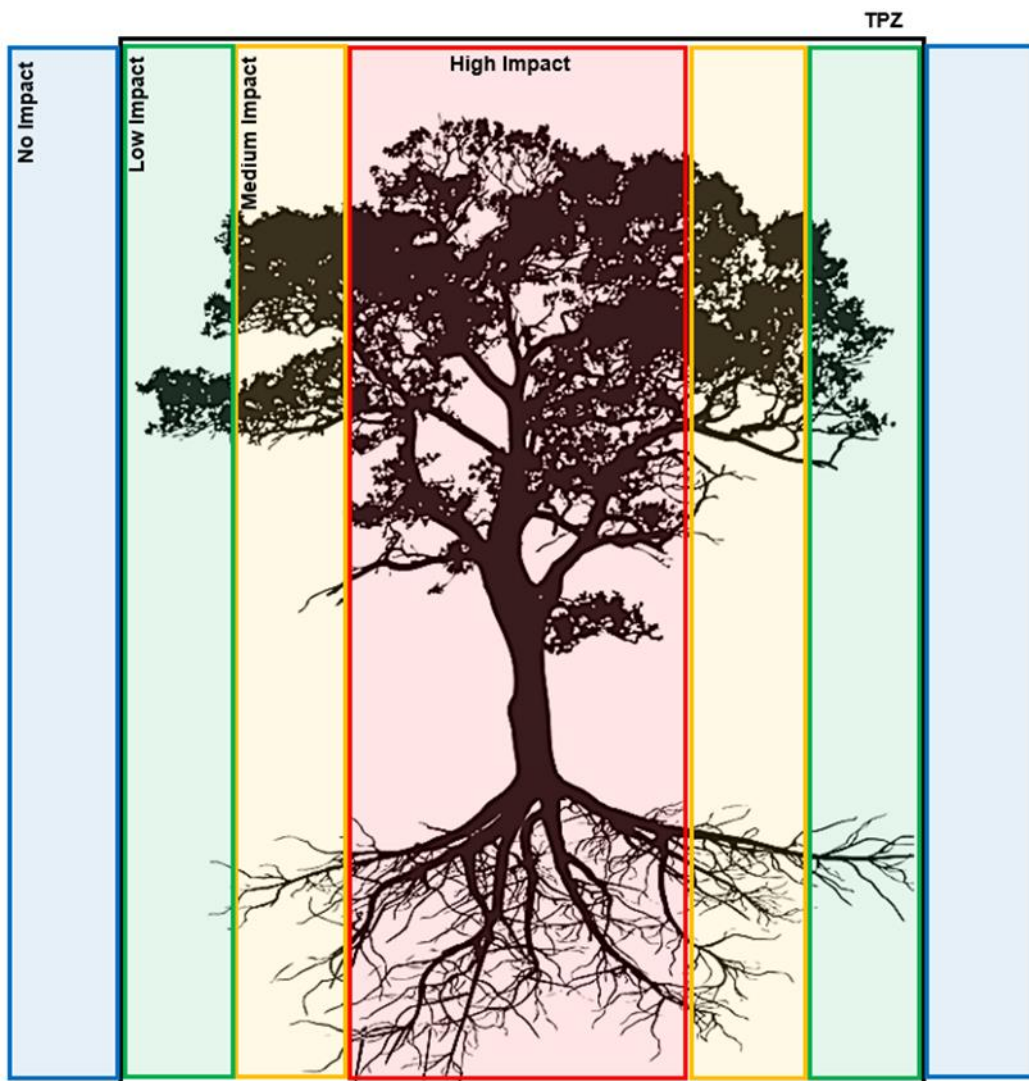


Figure 4: Indicative zones of impact

3. Results and discussion

Results of the arboricultural assessment are tabulated and mapped in Appendix A and **Table 1**. Below is a summary of key results:

- **High impact (>20%): 48** trees would be subject to a major encroachment (>20%) within the TPZ. These trees are unable to be sustainably retained without substantial modification of the proposed footprint. Trees in this category have the following retention values:
 - **32** trees with a low retention value
 - **12** trees with a medium retention value
 - **four** trees with a high retention value.

- **Medium impact (<20%): Six** trees would be subject to a medium impact (<20%) of the TPZ. More detailed assessments will be required to determine the suitability of retention. Trees in this category have the following retention values:
 - **two** trees with a low retention value
 - **one** tree with a medium retention value
 - **three** trees with a high retention value

- **Low impact (<10%): Three** trees would be subject to a low impact within the TPZ. The anticipated low impact of the proposed development will have negligible impacts to the tree's health, vigour or stability. Under the current proposal, these trees can be successfully retained. Trees within this category have the following retention values:
 - **three** trees with a medium retention value

- **No impact: Ten** trees would not be affected by the proposed development. Under the current proposal, these trees can be successfully retained. Of these:
 - **one** tree with a low retention value
 - **five** trees with a medium retention value
 - **four** trees with a high retention value.

Table 1: Results of arboricultural assessment

Tree	Scientific Name	Height (m)	Spread (m)	Health	Structure	Retention Value	Group	DBH (mm)	TPZ (mm)	SRZ (mm)	Impacts	Notes
1	<i>Cupressus sp.</i>	4	2	Fair	Poor	Low	1	200	2400	1683	No Impact: 0%	
2	<i>Cupressus sempervirens</i>	7	3	Fair	Poor	Low	1	500	6000	2474	High Impact: >20%	
3	<i>Ficus benjamina</i>	7	6	Good	Fair	Medium	1	800	9600	3013	High Impact: >20%	
4	<i>Casuarina cunninghamiana</i>	8	2	Fair	Poor	Low	3	200	2400	1683	High Impact: >20%	Group of 3
5	<i>Casuarina cunninghamiana</i>	7	3	Fair	Fair	Low	1	500	6000	2474	High Impact: >20%	
6	<i>Eucalyptus robusta</i>	12	6	Fair	Fair	Medium	1	700	8400	2849	High Impact: >20%	
7	<i>Celtis australis</i>	8	6	Fair	Poor	Low	1	400	4800	2252	High Impact: >20%	
8	<i>Celtis australis</i>	8	6	Fair	Poor	Low	1	650	7800	2762	High Impact: >20%	
9	<i>Celtis australis</i>	7	6	Fair	Poor	Low	1	500	6000	2474	High Impact: >20%	
10	<i>Podocarpus elatus</i>	10	8	Good	Good	High	1	1000	12000	3309	High Impact: >20%	
11	<i>Melaleuca quinquenervia</i>	14	3	Good	Fair	Medium	1	400	4800	2252	High Impact: >20%	
12	<i>Melaleuca quinquenervia</i>	13	6	Good	Fair	High	1	800	9600	3013	High Impact: >20%	
13	<i>Melaleuca quinquenervia</i>	12	7	Good	Fair	High	1	900	10800	3166	High Impact: >20%	
14	<i>Melaleuca quinquenervia</i>	13	6	Fair	Good	Medium	1	300	3600	1996	High Impact: >20%	
15	<i>Casuarina glauca</i>	15	6	Good	Fair	Medium	1	600	7200	2670	High Impact: >20%	
16	<i>Podocarpus elatus</i>	12	7	Good	Fair	Medium	1	700	8400	2849	High Impact: >20%	
17	<i>Liquidambar styraciflua</i>	12	7	Good	Fair	Low	1	650	7800	2762	High Impact: >20%	
18	<i>Agonis flexuosa</i>	7	4	Poor	Poor	Low	1	500	6000	2474	High Impact: >20%	Bracket fungi
19	<i>Eucalyptus sieberi</i>	11	6	Poor	Fair	Medium	1	550	6600	2575	High Impact: >20%	
20	<i>Casuarina glauca</i>	13	7	Fair	Good	Medium	1	560	6720	2594	High Impact: >20%	
21	<i>Syagrus romanzoffiana</i>	8	4	Fair	Fair	Low	2	250	3000	1849	High Impact: >20%	Group of 2
22	<i>Cedrus deodara</i>	7	6	Fair	Fair	Low	1	500	6000	2474	High Impact: >20%	
23	<i>Populus nigra</i>	12	6	Poor	Fair	Low	1	800	9600	3013	High Impact: >20%	
24	<i>Phoenix canariensis</i>	3	4	Poor	Fair	Low	1	900	10800	3166	High Impact: >20%	
25	<i>Tristaniopsis laurina</i>	5	3	Fair	Poor	Low	2	300	3600	1996	Medium Impact: <20%	Group of 2
26	<i>Celtis australis</i>	8	4	Fair	Poor	Low	1	500	6000	2474	High Impact: >20%	
27	<i>Celtis australis</i>	5	2	Poor	Poor	Low	2	300	3600	1996	High Impact: >20%	Group of 2

Tree	Scientific Name	Height (m)	Spread (m)	Health	Structure	Retention Value	Group	DBH (mm)	TPZ (mm)	SRZ (mm)	Impacts	Notes
28	<i>Celtis australis</i>	11	6	Fair	Poor	Low	1	800	9600	3013	High Impact: >20%	
29	<i>Eucalyptus microcorys</i>	16	5	Good	Fair	Medium	1	650	7800	2762	High Impact: >20%	
30	<i>Celtis australis</i>	14	6	Fair	Fair	Low	1	700	8400	2849	High Impact: >20%	
31	<i>Celtis australis</i>	14	7	Good	Poor	Low	1	800	9600	3013	High Impact: >20%	
32	<i>Populus nigra</i>	14	3	Fair	Fair	Low	1	800	9600	3013	High Impact: >20%	
33	<i>Jacaranda mimosifolia</i>	11	6	Poor	Poor	Low	1	500	6000	2474	High Impact: >20%	
34	<i>Phoenix canariensis</i>	5	3	Poor	Poor	Low	1	450	5400	2366	High Impact: >20%	
35	<i>Celtis australis</i>	10	5	Poor	Poor	Low	1	400	4800	2252	High Impact: >20%	
36	<i>Ficus benjamina</i>	10	5	Fair	Poor	Low	1	900	10800	3166	High Impact: >20%	
37	<i>Ficus rubiginosa</i>	11	6	Fair	Fair	Medium	1	700	8400	2849	High Impact: >20%	
38	<i>Phoenix canariensis</i>	6	4	Fair	Fair	Low	1	600	7200	2670	High Impact: >20%	
39	<i>Celtis australis</i>	14	6	Fair	Poor	Low	1	600	7200	2670	High Impact: >20%	
40	<i>Syagrus romanzoffiana</i>	12	4	Poor	Poor	Low	1	400	4800	2252	High Impact: >20%	
41	<i>Platanus x acerifolia</i>	9	5	Good	Good	High	1	530	6360	2535	No Impact: 0%	
42	<i>Melaleuca quinquenervia</i>	10	4	Good	Good	High	2	440	5280	2344	No Impact: 0%	Group of 2
43	<i>Melaleuca quinquenervia</i>	9	4	Good	Fair	High	1	700	8400	2849	Medium Impact: <20%	
44	<i>Platanus x acerifolia</i>	9	5	Good	Good	High	1	440	5280	2344	No Impact: 0%	
45	<i>Melaleuca quinquenervia</i>	12	5	Good	Fair	Medium	1	680	8160	2814	Medium Impact: <20%	
46	<i>Platanus x acerifolia</i>	6	5	Good	Fair	Medium	1	250	3000	1849	No Impact: 0%	
47	<i>Melaleuca quinquenervia</i>	9	4	Fair	Fair	Medium	1	640	7680	2744	Low Impact: <10%	
48	<i>Melaleuca quinquenervia</i>	8	5	Good	Fair	Medium	1	600	7200	2670	Low Impact: <10%	
49	<i>Melaleuca quinquenervia</i>	6	4	Good	Fair	Medium	1	800	9600	3013	No Impact: 0%	
50	<i>Cupaniopsis anacardioides</i>	8	5	Good	Fair	Medium	1	400	4800	2252	No Impact: 0%	
51	<i>Melaleuca quinquenervia</i>	14	8	Good	Good	High	1	900	10800	3166	Medium Impact: <20%	
52	<i>Melaleuca quinquenervia</i>	12	8	Good	Good	High	1	950	11400	3239	Medium Impact: <20%	
53	<i>Melaleuca quinquenervia</i>	5	5	Fair	Fair	Medium	1	600	7200	2670	Low Impact: <10%	
54	<i>Melaleuca quinquenervia</i>	15	9	Good	Good	High	1	1620	19440	4053	High Impact: >20%	
55	<i>Eucalyptus microcorys</i>	15	6	Good	Fair	Medium	1	650	7800	2762	High Impact: >20%	
56	<i>Eucalyptus microcorys</i>	10	4	Good	Fair	Medium	1	450	5400	2366	High Impact: >20%	

Tree	Scientific Name	Height (m)	Spread (m)	Health	Structure	Retention Value	Group	DBH (mm)	TPZ (mm)	SRZ (mm)	Impacts	Notes
57	<i>Celtis australis</i>	12	11	Poor	Poor	Low	1	700	8400	2849	High Impact: >20%	
58	<i>Phoenix canariensis</i>	4	3	Poor	Poor	Low	1	600	7200	2670	High Impact: >20%	
59	<i>Robinia pseudoacacia</i>	8	4	Fair	Fair	Low	1	450	5400	2366	High Impact: >20%	
60	<i>Syzygium paniculatum</i>	7	3	Good	Fair	Medium	2	400	4800	2252	No Impact: 0%	Two trees

4. Tree protection plan

Following the approval of a proposed building envelope, the following measures are to be implemented to protect trees to be retained:

4.1 Tree pruning and removal

- All tree work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture.
- All tree work must be in accordance with *Australian Standard AS 4373-2007, Pruning of Amenity Trees* and the *NSW WorkCover Code of Practice for the Amenity Tree Industry (1998)*.
- Permission must be granted from the relevant consent authority prior to removing or pruning of any of the subject trees.

4.2 Tree protection measures

Encroachment within the TPZ must be offset with a range of mitigation measures to ensure that impacts to the subject tree(s) are reduced or restricted wherever possible. Mitigation must be increased relative to the level of encroachment within the TPZ to ensure the subject tree remains viable. Table 2 outlines mitigation requirements under AS 4970-2009 within each category of encroachment. Tree protection measures should be implemented by the contractor and would include:

- Tree protection fencing must be established around the perimeter of the TPZ (Table 2). If the protective fencing requires temporary removal, trunk, branch and ground protection must be installed and must comply with *AS 4970-2009 - Protection of trees on development sites*. Existing fencing and site hoarding may be used as tree protection fencing.
- If temporary access for machinery is required within the TPZ, ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Ground protection may include a permeable membrane such as geotextile fabric beneath a layer of mulch, crushed rock or rumble boards.
- Any additional construction activities within the TPZ of the subject trees must be assessed and approved by the project arborist and must comply with *AS 4970-2009 - Protection of trees on development sites*.

Further information and guidelines on tree protection are in Appendix C.

4.3 Hold points, inspection and certification

A copy of this report must be available on-site prior to the commencement of works, and throughout the entirety of the project. Hold points have been specified in the schedule of works below to ensure trees are adequately protected during construction. It is the responsibility of the principal contractor to complete each of the tasks.

- Pre-construction
 - Indicate clearly (with spray paint on trunks) trees marked for removal.
- During construction

- Monthly inspection of trees by the project arborist (or other timing as agreed with the project arborist)
- Notification to be given prior to the commencement of work within the tree protection zone, with supervision by the project arborist of any work undertaken in this zone.
- Post-construction
 - Final inspection of trees by project arborist after all major construction has ceased and following the removal of tree protection measures.

Once each stage is reached, the work will be inspected and certified by the project arborist and the next stage may commence. Alterations to this schedule may be required due to necessity, however, this shall be through consultation with the project arborist only.

4.4 Replacement planting

Any loss of trees should be offset with replacement planting in accordance with the relevant offset policy and in consultation with City of Sydney Council.

4.5 Conclusion

This Arboricultural Impact Assessment has been prepared for *NSW Land and Housing Corporation* (LAHC) to prepare an arboricultural impact assessment for a proposed rezoning to be assessed under Part 3 of the EP&A Act at 600 – 660 Elizabeth Street, Redfern. This report addresses the study requirements outlined in the State Significant Precinct study scope (DP&E 2018) and the Council Planning Proposal Checklist (City of Sydney 2020). All high retention value trees are considered worthy of preservation and consideration should be given to their retention as a priority. Proposed site design and placement of buildings and infrastructure should consider the tree protection zones of these trees. The extent of the canopy should also be considered for these trees, particularly in relation to high rise buildings proposed.

Table 2: Mitigation measures

Impact	Requirements under AS 4970-2009	Mitigation (design phase)	Mitigation (construction phase)
Low impact (<10%)	<p>The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ.</p> <p>Detailed root investigations should not be required.</p>	N/A	<p>The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ.</p> <p>Tree protection must be installed.</p>
Medium impact (<20%)	<p>The project arborist must demonstrate the tree(s) would remain viable.</p> <p>Root investigation by non-destructive methods may be required.</p> <p>Consideration of relevant factors including: Root location and distribution, tree species, condition, site constraints and design factors.</p> <p>The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ.</p>	<p>The following design changes should be considered to retain trees where practicable, considering the retention value of the tree and the complexity and cost of the change.</p> <p>Relocate services/pathways outside of tree protection zones</p> <p>Design services to be installed at a minimum depth of 1200mm below ground to avoid impact to the root zones of trees.</p> <p>Design pathways to be installed on or above grade, minimising/eliminating excavation within tree protection zones.</p> <p>Design pathways using porous materials (eco-paving, porous asphalt, decomposed granite) to allow water and oxygen to reach the root zone.</p> <p>Design pathways using tree sensitive techniques (pier and beam, suspended slabs).</p> <p>The area lost to encroachment should be compensated for elsewhere, contiguous with the TPZ.</p>	<p>The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ.</p> <p>The project arborist would be consulted for any works within the TPZ.</p> <p>Tree protection must be installed.</p> <p>Tree sensitive techniques can be used to install services within the TPZ. Horizontal directional drilling (HDD), boring, non-destructive excavation (NDE).</p> <p>Location and distribution of roots may be determined through non-destructive excavation (NDE) methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation.</p>

High impact (>20%)

The project arborist must demonstrate the tree(s) would remain viable.

Root investigation by non-destructive methods may be required.

Consideration of relevant factors including: Root location and distribution, tree species, condition, site constraints and design factors.

The area lost to this encroachment should be compensated for elsewhere, contiguous with the TPZ.

Relocate services/pathways outside of tree protection zones

Design services to be installed at a minimum depth of 1200mm below ground to avoid impact to the root zones of trees.

Design pathways to be installed on or above grade, minimising/eliminating excavation within tree protection zones.

Design pathways using porous materials (eco-paving, porous asphalt, decomposed granite) to allow water and oxygen to reach the root zone.

Design pathway using tree sensitive techniques (pier and beam, suspended slabs).

The area lost to encroachment can be compensated for elsewhere, contiguous with the TPZ.

As above

Removal of existing hard surfaces should be undertaken manually to avoid root damage.

Tree sensitive techniques can be used to install the services: Horizontal directional drilling (HDD), boring, non-destructive excavation (NDE).

5. References

5.1 General references

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5.2 Project specific references

City of Sydney Council *Sydney Development Control Plan 2012 Section 3 – General Provisions*

Appendix A Maps



Figure 5: Results of Arboricultural Impact Assessment

Appendix B Tree retention assessment method

B1 Tree Significance Assessment Criteria - STARS[®]

Low	Medium	High
The tree is in fair-poor condition and good or low vigour.	The tree is in fair to good condition	The tree is in good condition and good vigour
The tree has form atypical of the species	The tree has form typical or atypical of the species	The tree has a form typical for the species
The tree is not visible or is partly visible from the surrounding properties or obstructed by other vegetation or buildings	The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area	The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age.
The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area	The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street	The tree is listed as a heritage item, threatened species or part of an endangered ecological community or listed on Council's significant tree register
The tree is a young specimen which may or may not have reached dimensions to be protected by local Tree Preservation Orders or similar protection mechanisms and can easily be replaced with a suitable specimen	The tree provides a fair contribution to the visual character and amenity of the local area	The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity.
The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ – tree is inappropriate to the site conditions	The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ	The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values.
The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms		The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ – tree is appropriate to the site conditions.
The tree has a wound or defect that has the potential to become structurally unsound.		
The tree is an environmental pest species due to its invasiveness or poisonous/allergenic properties.		
The tree is a declared noxious weed by legislation		

B2 Matrix assessment

		Tree significance			
		High	Medium	Low	
Useful Life Expectancy	Long >40 years				
	Medium 15-40 years				
	Short <1-15 years				
	Dead				

Legend:

	Priority for retention (High): Tree considered important so should be retained and protected. Design modification or re-location of structure should be considered to accommodate the setbacks as prescribed by the <i>Australian Standard AS4970 Protection of trees on development sites</i> . Tree sensitive construction measures must be implemented if works are to proceed within the Tree Protection Zone.
	Consider for retention (Medium): Tree considered less important, however, retention should remain priority. Removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	Consider for removal (Low): Tree not considered important for retention, nor requiring special works or design modification to be implemented for their retention.
	Consider for removal (Low): Tree not considered important for retention, nor requiring special works or design modification to be implemented for their retention.

Appendix C Tree protection guidelines

The following tree protection guidelines must be implemented during the construction period if no tree-specific recommendations are detailed.

C1 Tree protection fencing

The TPZ is a restricted area delineated by protective fencing or the use of an existing structure (such as a wall or fence).

Trees that are to be retained must have protective fencing erected around the TPZ (or as specified in the body of the report) to protect and isolate it from the construction works. Fencing must comply with the Australian Standard, AS 4687-2007, Temporary fencing and hoardings.

Tree protection fencing must be installed prior to site establishment and remain intact until completion of works. Once erected, protective fencing must not be removed or altered without the approval of the project arborist.

If the protective fencing requires temporary removal, trunk, branch and ground protection must be installed and must comply with AS 4970-2009, Protection of Trees on Development Sites.

Tree protection fencing shall be:

- Enclosed to the full extent of the TPZ (or as specified in the Recommendations and Tree Protection Plan).
- Cyclone chain wire link fence or similar, with lockable access gates.
- Certified and Inspected by the Project Arborist.
- Installed prior to the commencement of works.
- Prominently signposted with 300mm x 450mm boards stating “NO ACCESS - TREE PROTECTION ZONE”.

C2 Crown protection

Tree crowns/canopy may be injured or damaged by machinery such as; excavators, drilling rigs, trucks, cranes, plant and vehicles. Where crown protection is required, it will usually be located at least one meter outside the perimeter of the crown.

Crown protection may include the installation of a physical barrier, pruning selected branches to establish clearance, or the tying/bracing of branches.

C3 Trunk protection

Where provision of tree protection fencing is impractical or must be temporarily removed, truck protection shall be installed for the nominated trees to avoid accidental mechanical damage.

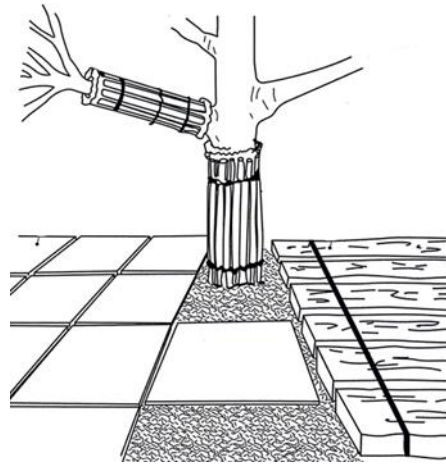
The removal of bark or branches allows the potential ingress of micro-organisms which may cause decay. Furthermore, the removal of bark restricts the trees’ ability to distribute water, mineral ions (solutes), and glucose.

Trunk protection shall consist of a layer of either carpet underfelt, geotextile fabric or similar wrapped around the trunk, followed by 1.8 m lengths of softwood timbers aligned vertically and spaced evenly around the trunk (with an approx. 50 mm gap between the timbers).

The timbers must be secured using galvanised hoop strap (aluminium strapping). The timbers shall be wrapped around the trunk but not fixed to the tree, as this will cause injury/damage to the tree.



Tree protection fencing



Trunk protection fencing

C4 Ground protection

Tree roots are essential for the uptake/absorption of water, oxygen and mineral ions (solutes). It is essential to prevent the disturbance of the soil beneath the dripline and within the TPZ of trees that are to be retained. Soil compaction within the TPZ will adversely affect the ability of roots to function correctly.

If temporary access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Ground protection may include a permeable membrane such as geotextile fabric beneath a layer of mulch, crushed rock or rumble boards.

If the grade is to be raised within the TPZ, the material should be coarser or more porous than the underlying material.

C5 Root protection and investigation

If incursions/excavation within the TPZ are unavoidable, root investigation may be needed to determine the extent and location of roots within the area of construction activity. The location and distribution of roots are found through non-destructive excavation (NDE) methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation. Root investigation does not guarantee the retention of the tree.

If the project arborist identifies conflicting roots that requiring pruning, they must be pruned with a sharp implement such as; secateurs, pruners, handsaws or a chainsaw back to undamaged tissue. The final cut must be a clean cut.

C6 Underground services

All underground services should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they should be installed using horizontal directional drilling (HDD). The horizontal drilling/boring must be at minimum depth of 600 mm below grade. Trenching for services is to be regarded as “excavation”.

