Lend Lease

Appendix C
Arborist Report, prepared by Arboreport

arboreport™
Vegetation Management Consultants

JORDAN SPRINGS VILLAGE OVAL

ARBORICULTURAL IMPACT ASSESSMENT

PREPARED FOR:

LEND LEASE

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date	*revision*	*prepared*	*checked*
20/02/14	Issued Development Application	AM	AS

Executive Summary

This report was commissioned by Lend Lease to accompany their Development Application within the Penrith City Council area at Greenwood Parkway, Jordan Springs. The aim of this report is to provide an assessment of the impacts of the proposed development on eight trees.

This report collates and presents information collected by Andrew Morrison on the 11/02/14. The data collected is located at **7. Tree Survey Table** (page 15) also see **8. Tree Survey Table Notes** (page 17) for notes relating to tree survey table.

Generally the site's vegetation was observed to have a majority remnant tree canopy, with a remnant native exotic turf groundcover layer. The existing surveyed trees are shown at **9. Tree Location Plan** (page 22).

The proposed development is a local park containing areas for active and passive recreation and will involve the construction of an oval, various courts, exercise areas and track layouts, with associated amenity blocks, carparking, plantings, turf, paths and paving. This will involve regrading site levels through excavation, cutting and filling of soil on site. The extent of site works is also illustrated at **9. Tree Location Plan** (page 22).

- 2 trees are located adjacent to the proposed development and the proposed construction will provide a minor encroachment (less than 10% of the TPZ area) within the TPZ (Tree No.'s 1 & 7).

- 5 trees are located adjacent to the proposed development and the proposed construction will provide a major encroachment (greater than 10% of the TPZ area) within the TPZ (Tree No.'s 2, 3, 5, 6 & 8).

- 1 tree is located within the proposed amenities block footprint (Tree No. 4).

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the proposed construction on those trees proposed to be retained. This report specifically recommends:

- The removal of Tree No.'s 4 & 8, if the development is approved as there is an unavoidable major encroachment into the tree protection zone.
- The replacement planting of 2 locally native or deciduous canopy trees shall be installed in 25L pot size to offset the loss of trees on site.
- The retention of Tree No.'s 1 & 7. The construction will provide a minor encroachment into the tree protection zone.
- The retention of Tree No. 2. This tree is of medium significance and has required design modification to avoid and minimise impacts from the proposed major encroachment. Specifically the reduction of the Adizone area has been reduced to provide a major but sustainable encroachment within the TPZ.
- The retention of Tree No. 3. This tree is of medium significance and will require design modification to avoid and minimise impacts from the proposed major encroachment. Specifically, the path to the south should be piered and bridged over a distance of 10m to reduce encroachment from excavation within the TPZ of this tree to be as close to 10% as possible.
- The retention of Tree No. 5. This tree is of medium to high significance and will require design modification to avoid and minimise impacts from the

proposed major encroachment provided by the path encircling the oval. Specifically the path should be diverted from the TPZ if possible or piered and bridged over the 16m length of encroachment within the TPZ to achieve an encroachment of no more than 10%.

- The retention of Tree No. 6. This tree is of medium significance and will require design modification to avoid and minimise impacts from the proposed major encroachment. Specifically the fitness station should be relocated outside the TPZ and the nearby path should be diverted from the TPZ if possible or piered and bridged over the 19m length of encroachment within the TPZ to achieve an encroachment of no more than 10%.
- It is anticipated that due to construction activities, the tree protection fence will not be able to be installed around the entire TPZ. It should be installed to protect as much as practically possible of the TPZ.
- It is anticipated that due to construction activities, the tree protection fence will not be able to be installed around the entire TPZ. It should be installed to protect as much as practically possible of the TPZ.
- The landscape plan should indicate mulched areas (pits) extending to the drip line around each of the retained trees to reduce compaction and promote soil health. No additional fertiliser should be applied around these trees.
- This assessment should be revised prior to the preparation of construction certificate drawings.
- An action plan for control of the insect should be developed. It should be implemented should tree health deteriorate to a degree where tree viability is threatened, see **4.1 Grey Box Psyllid** (page 8).
- Hand excavation is required for all works located within the TPZ of all retained trees. These works shall be supervised by the project arborist.
- An AQF Project Arborist shall be engaged to certify the tree protection works in accordance with the hold points provided at **6.3. Hold Points** (page13).
- For additional tree protection notes see **10. General Tree Protection Notes** (page 24).

Table of Contents

1. Introduction

This report was commissioned by Lend Lease to accompany their Development Application within the Penrith City Council area at Greenwood Parkway, Jordan Springs. The aim of this report is to provide an assessment of the impacts of the proposed development on eight trees.

This report collates and presents information collected by Andrew Morrison on the 11/02/14. The data collected is located at **7. Tree Survey Table** (page 15) also see **8. Tree Survey Table Notes** (page 17) for notes relating to tree survey table.

2. Methodology

2.1. Limitations

Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible. However Adrian Swain - Consulting Arborist can neither guarantee nor be responsible for the accuracy of information provided by others. Unless stated otherwise:

- Information contained in this report covers only the tree/s examined and reflects the health and structure of the tree at the time of inspection. The documented, observations, results, recommendations and conclusions given may vary after the site visit due to environmental conditions. Liability will not be accepted for damage to person or property as a result of natural processes, unforeseeable actions or occurrences.
- Observations recorded for trees located within adjacent properties have been made without entering that property. As a result measurements for these trees are estimated. Similarly these trees were not subject to a complete visual inspection and defects or abnormalities may be present but not recorded.
- The inspection was limited to visual examination from the base of the subject tree without dissection, excavation, probing or coring (unless specifically noted otherwise).
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree may not arise in the future.

2.2. Site Inspection

A visual inspection of the tree/s was performed from ground level, data collected includes:

- Genus, Species, Common Name;
- Height, Width, DBH (Diameter at Breast Height), DRB (Diameter above Root Buttress);
- Age and Health;
- Amenity and Ecological Value;
- Crown Form and Condition;
- Visible Defects or Evidence of Wounding.

2.3. Measurement

- Tree locations are supplied on the client supplied survey plan or triangulated using a measuring tape.
- Diameter at breast height (DBH) and Diameter above Root Buttress (DRB) are measured using a diameter tape.
- Height is measured using a clinometer.
- Canopy width is estimated using a measured stride paced out on site.
- Structural Root Zone (SRZ) and Tree Protection Zone (TPZ) radii are measured (in accordance with AS 4970-2009) from the centre of the trunk.
- Development impact/setback is measured from the nearest face of the trunk to the face of the structure in Auto CAD using the perpendicular distance function. Generally this is measured without detailed foundation design.

2.4. Recording Data

Data collected is collated in the tree survey table located at **7. Tree Survey Table** (page 15). The tree survey table contains abbreviations for terms describing the trees characteristics; explanatory notes pertaining to these are located at **8. Tree Survey Table Notes** (page 17).

The physical data for tree locations, crown width and DRB is schematically described in **9. Tree Location Plan** (page 22).

2.5. Reference Documents

The report was written in coordination with:

- Architectural Site Plan and Landscape Plan prepared by Clouston Associates Revision 18/02/14.
- The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009)

No stormwater or hydraulic plans have been supplied.

2.6. Council Tree Preservation Order

The Penrith City Council tree preservation order defines a tree as being "a perennial plant with self-supporting stem which:

a. Has a girth of 30cm or more, measured at a distance of 40cm above the ground; and

Has a height in excess of 3m.

2.7. Determining a tree's significance

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. When determining a tree's significance within the landscape context, the following questions are asked of each tree. Significance may be expressed in increments of High, Medium or Low. For a High rating the majority (≥4) of the answers will be yes; for a Medium rating half (=3) of the answers will be yes; and for the Low rating the minority of answers will be yes (≤2).

1. Is the tree a locally native remnant; an endangered species; a part of an endangered ecological community; or does the tree provide critical habitat for an endangered species?

2. Is the tree of botanical interest; listed as a heritage item under the Federal State or Local Regulations?

3. Is the tree visually prominent in the locality?

4. Is the tree well structured?

5. Is the tree in good health and does it display signs of good vigour?

6. Is the tree typically formed for the species?

7. Is the tree located in a position that will accommodate future growth?

3. Observations

3.1. Site Description

The site currently contains a small number of mature, large canopy trees, numerous saplings and grassland. Earthworks have commenced in the vicinity of the subject trees. The site has a general southerly aspect.

3.2. Soil Landscape Map

The soils in this area are from the Luddenham Group [2]. They are generally shallow <100mm dark podzolic soils or massive earthy clays on crests, moderately deep red podzolic soils on upper slopes, moderately deep yellow podzolic soils and prairie soils on lower slopes and drainage lines.

Generally the landscape is characterised by undulating to rolling hills on Wianamatta group shales often associated with Minchinbury sandstone. There is local relief of 50-80m and slopes gradients of 5-20% across narrow ridges, hillcrests and valleys [2].

These soils are limited by high soil erosion hazard, localised impermeable highly plastic subsoil, and moderate reactivity. The critical soil characteristics of this soil type for trees growing on this site include erosion hazard.

3.3. Native Vegetation Map

The Shale Plains Woodland ecological community [12, 13] is generally dominated by *Eucalyptus moluccana* and *E. tereticornis* with *E. crebra, E. eugenioides* and *Corymbia maculata* occurring less frequently. These species often form a separate small tree stratum, occasionally including other species such as *Exocarpus cupressiformis, Acacia parramattensis subsp. parramattensis* and *Acacia decurrens*.

A shrub stratum is usually present and dominated by *Bursaria spinosa*. Common ground stratum species include *Dichondra repens, Aristida vagans, Microlaena stipoides var. stipoides, Themeda australis, Brunoniella australis, Desmodium varians, Opercularia diphylla, Wahlenbergia gracilis* and *Dichelachne micrantha*. [12, 13]

Shale Plains Woodland is the most widely distributed community on the Cumberland Plain however it is listed as endangered under the Threatened Species Conservation

Act 1995 [12, 13]. There appears to be species representative of this vegetation community located on this site. .

3.4. Summary of site inspection data

Generally the site's vegetation was observed to have a majority remnant tree canopy, with a remnant native exotic turf groundcover layer. The existing surveyed trees are shown at **9. Tree Location Plan** (page 22).

All trees assessed in this report are representative of the ecological community located in the area. They are large, mature specimens of the Grey Box (*Eucalyptus moluccana*). The trees on this site had recently achieved a flush of epicormic re-growth which did not exhibit visible psyllid damage at the time of inspection (with the exception of Tree No. 6).

These trees have large canopies and will continue to provide shade and a substantial contribution to the streetscape and park environment due to their large canopies if their health is maintained.

3.5. Summary of Proposed Development

The proposed development is a local park containing areas for active and passive recreation and will involve the construction of an oval, various courts, exercise areas and track layouts, with associated amenity blocks, carparking, plantings, turf, paths and paving. This will involve regrading site levels through excavation, cutting and filling of soil on site. The extent of site works is also illustrated at **9. Tree Location Plan** (page 22).

3.6. Summary of tree impacts

- 2 trees are located adjacent to the proposed development and the proposed construction will provide a minor encroachment (less than 10% of the TPZ area) within the TPZ (Tree No.'s 1 & 7).
- 5 trees are located adjacent to the proposed development and the proposed construction will provide a major encroachment (greater than 10% of the TPZ area) within the TPZ (Tree No.'s 2, 3, 5, 6 & 8).
- 1 tree is located within the proposed amenities block footprint (Tree No. 4).

4. Discussion

4.1. Grey Box Psyllid

Extensive foliage damage has been observed since 2011 throughout the endemic population of Grey Box located in the Cumberland Plain Catchment area resulting in canopy decline and in some cases, death. Effects on populations and individual trees vary throughout the greater Sydney area.

The damage is widely acknowledged to be caused by an outbreak of the sap-sucking insect called '*Grey Box Psyllid*'.

Typical symptoms include the extensive damage to foliage throughout the crown of the tree resulting in temporary defoliation or 'dieback'. This is typically followed by the epicormic re-growth of foliage. This cycle is repeated throughout the growth season.

The cycle of damage and re-growth appears to be most extensive in large mature specimens in the mid to upper canopy and may cause sparse crowns and, if prolonged, results in a depletion of energy stores. A tree with depleted energy stores is less likely to withstand the impact of development.

The mid to long term effects of the current psyllid outbreak is yet to be determined on tree populations in general and individual specimens in particular.

Damage to crowns of the trees on site has impacted upon the rating of significance for the trees in this report. All trees intended for retention are vulnerable to recurring outbreaks of Grey Box Psyllid.

If the recurrences are persistent and the tree(s) observed to be in declining health and vigour, consideration should be given to prepare a plan for control of the insect, based on the latest Grey Box Psyllid research information.

Individual specimen trees have been known to respond to treatment by products such as SilvaShield® however approval as such for this chemical to be used in this way on this tree species to combat this insect has not been approved and this treatment is considered environmentally problematic.

We understand that the current control options presently available are limited to application of this chemical via injection or in-ground pills and both Environmental impacts of chemical options should be carefully considered prior to implementation. Such an assessment should be carried out by a Level 5 arborist to be reviewed by an environmental scientist.

In view of the age and health of the trees, encroachments within the TPZ of trees to be retained should not provide a major encroachment to the TPZ area.

4.2. Trees with a Minor TPZ Encroachment

The proposed construction encroaches within the TPZ by 10% or less.

- Earthworks associated with the proposed basketball courts are indicated to extend within the TPZ of Tree 1. The earthworks plan should be adjusted to limit earthworks to outside the TPZ as much as possible. This tree is considered to be of medium to high significance and should be retained and protected.

  An area equivalent to the encroachment is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

  Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*. Similarly excavation works required to be undertaken within the TPZ should be performed by hand under the supervision of the project arborist.

- Tree 7 is located 8.36m from the proposed fitness station, providing a 3.9% encroachment within the TPZ. This tree is considered to be of medium significance and should be retained and protected.

An area equivalent to the encroachment is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Similarly excavation works required to be undertaken within the TPZ should be performed by hand under the supervision of the project arborist.

This tree was observed to have two trunk wounds (one of which had almost fully occluded) and be heavily infested with mistletoe. Reduction of mistletoe by pruning will help improve the vigour of the tree and assist with the biological functions of wound occlusion.

4.3. Trees with a Major TPZ Encroachment

The proposed construction encroaches within the TPZ by more than 10%.

- Tree 2 is located 5.36m from the proposed Adizone and 6.99m from the proposed seating area providing a 11.8% encroachment within the TPZ. This tree is considered to be of medium significance and is suitable for retention. Whilst a major encroachment, this is considered to provide a low to medium impact and is sustainable by the tree.

  Design and/or siting modifications have been carried out to accommodate the setbacks as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*. Specifically, the reduction of the Adizone area.

  An area equivalent to the *encroachment* is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

- Tree 3 is located 5.62m from the proposed Adizone area and varying distances from paths to the east, south and west, providing a 19.9% encroachment within the TPZ. This tree is considered to be of medium significance and is suitable for retention.

  Design and/or siting modification should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*. Specifically, the path to the south should be piered and bridged over a distance of 10m to reduce encroachment from excavation within the TPZ of this tree to be as close to 10% as possible. If bridging is implemented we anticipate that the encroachment would be reduced to a more acceptable level.

  An area equivalent to the *encroachment* is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

- Tree 5 is located 4.6m from the proposed pathway encircling the oval, providing an 18.2% encroachment within the TPZ. This tree is considered to be of medium to high significance and should be retained and protected.

Design and/or siting modification should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*. Specifically the path should be diverted from the TPZ if possible or piered and bridged over the 16m length of encroachment within the TPZ to achieve an encroachment of no more than 10%. If bridging is implemented we anticipate that the encroachment would be reduced to a more acceptable level.

An area equivalent to the *encroachment* is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

- Tree 6 is located 0.36m from the proposed fitness station and 10.2m from the proposed path, providing a 29.3% encroachment within the TPZ. This tree is considered to be of medium significance and suitable for retention.

  Design and/or siting modification should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*. Specifically the fitness station should be relocated outside the TPZ and the nearby path should be diverted from the TPZ if possible or piered and bridged over the 19m length of encroachment within the TPZ to achieve an encroachment of no more than 10%. If relocation of the fitness station is moved as above and bridging is implemented we anticipate that the encroachment would be reduced to a more acceptable level.

  An area equivalent to the *encroachment* is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

  Three x 20kg bags of muriate of potash fertilizer (unopened) and 1¼ x 20kg bags of granular urea fertilizer were observed to be stored at the base of this tree. This species is highly sensitive to excess nutrients. If the bags are damaged and/or if heavy rain is experienced, the contents would enter the soil in potentially lethal quantities to the tree. These should be removed as soon as possible to a secure, whether proof and appropriate storage facility.

  This tree demonstrated moderate to heavy foliage damage, indicating stress.

- Tree 8 is located 0.97m from the proposed bike path and play ground, providing a 39.3% encroachment within the TPZ. This tree is considered to be of medium significance, however it has compromised form and structural condition due to a dead central stem and congested scaffolds attached to the northern stem. It should not be a constraint on the development. This tree cannot be retained if the proposed development is approved in its current form.

4.4. Trees within the development footprint

Tree 4 is located within the proposed amenities block. This tree is considered to be of medium significance and suitable for retention, however it cannot be retained if the development is approved in its current form. Other alternatives have been considered, however they involve unsustainable encroachment into the TPZ of Tree 5, a tree exhibiting superior health and structural condition to that of Tree 4.

5. Recommendations

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the proposed construction on those trees proposed to be retained. This report specifically recommends:

- The removal of Tree No.'s 4 & 8, if the development is approved as there is an unavoidable major encroachment into the tree protection zone.
- The replacement planting of 2 locally native or deciduous canopy trees shall be installed in 25L pot size to offset the loss of trees on site.
- The retention of Tree No.'s 1 & 7. The construction will provide a minor encroachment into the tree protection zone.
- The retention of Tree No. 2. This tree is of medium significance and has required design modification to avoid and minimise impacts from the proposed major encroachment. Specifically the reduction of the Adizone area has been reduced to provide a major but sustainable encroachment within the TPZ.
- The retention of Tree No. 3. This tree is of medium significance and will require design modification to avoid and minimise impacts from the proposed major encroachment. Specifically, the path to the south should be piered and bridged over a distance of 10m to reduce encroachment from excavation within the TPZ of this tree to be as close to 10% as possible.
- The retention of Tree No. 5. This tree is of medium to high significance and will require design modification to avoid and minimise impacts from the proposed major encroachment provided by the path encircling the oval. Specifically the path should be diverted from the TPZ if possible or piered and bridged over the 16m length of encroachment within the TPZ to achieve an encroachment of no more than 10%.
- The retention of Tree No. 6. This tree is of medium significance and will require design modification to avoid and minimise impacts from the proposed major encroachment. Specifically the fitness station should be relocated outside the TPZ and the nearby path should be diverted from the TPZ if possible or piered and bridged over the 19m length of encroachment within the TPZ to achieve an encroachment of no more than 10%.
- It is anticipated that due to construction activities, the tree protection fence will not be able to be installed around the entire TPZ. It should be installed to protect as much as practically possible of the TPZ.
- It is anticipated that due to construction activities, the tree protection fence will not be able to be installed around the entire TPZ. It should be installed to protect as much as practically possible of the TPZ.
- The landscape plan should indicate mulched areas (pits) extending to the drip line around each of the retained trees to reduce compaction and promote soil health. No additional fertiliser should be applied around these trees.
- This assessment should be revised prior to the preparation of construction certificate drawings.
- An action plan for control of the insect should be developed. It should be implemented should tree health deteriorate to a degree where tree viability is threatened, see **4.1 Grey Box Psyllid** (page 8).
- Hand excavation is required for all works located within the TPZ of all retained trees. These works shall be supervised by the project arborist.
- An AQF Project Arborist shall be engaged to certify the tree protection works in accordance with the hold points provided at **6.3. Hold Points** (page13).

- For additional tree protection notes see **10. General Tree Protection Notes** (page 24).

6. Tree Management

6.1. Tree Management Objectives

The general tree management objectives include:

- Appointment of a Project Arborist who has a minimum Level 5 AQF Arboriculture qualification and experience in managing trees on construction sites.
- Installation of additional root, trunk and branch protection as required to protect retained trees where minor encroachments within the TPZ are anticipated.
- The installation of a Tree Protection Fence to enclose and protect the TPZ.
- Monitoring, inspection and certification of tree protection as per the below hold points.

6.2. Management Objective Priorities

The prioritisation of the above objectives is integral for the successful management of site trees:

1. Protection of the TPZ of retained trees;
2. Protection of the trunk and branches of retained trees;
3. Reduction of stress related to construction impacts;
4. The ongoing viability of retained trees after practical completion.

6.3. Hold Points, Inspection and Certification

To ensure this plan is implemented hold points (**HP**) have been specified in the schedule of works (below). 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.

6.4. Schedule of Works and Responsibilities

Hold Point	Task	Responsibility	Certification	Timing of Inspection
1	Complete foundation design so to avoid woody roots greater than 40mm	Principal Contractor	Project Arborist	Prior to construction certificate application
2	Indicate clearly (with spray paint on trunks) trees approved for removal only	Principal Contractor	Project Arborist	Prior to demolition and site establishment.
3	Install TPF and additional root, trunk and/or branch protection	Principal Contractor	Project Arborist	Prior to demolition and site establishment.
4	Supervise all excavation works proposed within the TPZ	Principal Contractor	Project Arborist	As required prior to the works proceeding adjacent to tree
5	Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Monthly during construction period
6	Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Following the removal of tree protection measures from HP 1
7	Final Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Prior to issue of occupation certificate.

7. Tree Survey Table

NO#	TAG#	Genus	Species	Common Name	Height	Spread	Trunk Dia	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi-cance	Am	Eco	Form	Development Setback and Encroachment	Comments
1	1675	*Eucalyptus*	*moluccana*	Grey Box	27	20	865	865	940	3224	10380	M	F	Av	M-H	H	H	D,B	Fill within TPZ indicated associated with Badketball/netball courts appears to be less than 10% of area of TPZ	Crown almost entirely epicormic growths. Deadwood to 100mm diameter
2	1676	*Eucalyptus*	*moluccana*	Grey Box	24	14	770	770	850	3091	9240	M	F	Av-F	M	M-H	H	D,U, M	5.36m from proposed Adizone and 6.99m from proposed seating area, together providing a major (11.8%) encroachment within TPZ	Twin trunks from 4m. Wound; exposed column of hardwood, extending on south side from base to 9m. Crown more than 50-75% epicormics. Deadwood present
3	-	*Eucalyptus*	*moluccana*	Grey Box	25	22	825	825	895	3159	9900	M	F	Av-F	M	M	H	CD,B	5.62m from proposed Adizone and 5.27/9.05m from proposed pathway, together providing a major (19.9%) encroachment within TPZ	Sparse crown, 100% epicormics. Deadwood to 90mm diameter
4	-	*Eucalyptus*	*moluccana*	Grey Box	22	22	840	840	920	3195	10080	M	F	Av-F	M	M	H	CD,L, B	Within development footprint	Light lean to north. 75-100% epicormics. Deadwood present
5	1696	*Eucalyptus*	*moluccana*	Grey Box	24	26	830	830	920	3195	9960	M	Av	Av	M-H	H	H	CD,B	4.60m from proposed pathway, major (18.2%) encroachment within TPZ	Deadwood to 80mm diameter. 25-50% epicormic growth. Light lean to north. Deadwood present
6	1672	*Eucalyptus*	*moluccana*	Grey Box	26	22	930	930	1010	3323	11160	M	F	Av-F	M	M	H	D,B, M	0.36m from proposed fitness station and 10.2m from proposed path, together providing a major (29.3%) encroachment within TPZ and SRZ	Crown is 90% epicormic growth (up to less than 0.5m long) New growth is subject to heavy damage. Fungal fruiting body (150mm wide) at base, south. Deadwood present . Bags of fertiliser have been stored against the trunk base
7	-	*Eucalyptus*	*moluccana*	Grey Box	25	15	850	850	935	3217	10200	M	F	F	M	M	H	D,B	8.36m from proposed fitness station, minor (3.9%) encroachment within TPZ	Heavy mistletoe infestation. Light lean and skew to east. Previous re-grading within TPZ. Basal wound, northwest with associated exposed dead hardwood. Deadwood to 100mm. Basal wound at southwest, linear and spiralling, narrow to 6m almost occluded entirely above 500mm above ground. Consistent with lighting strike
8	1697	*Eucalyptus*	*moluccana*	Grey Box	25	26	850	850	940	3224	10200	M	Av-F	F	M	L-M	H	CD,B ,M	0.97m from proposed bike path, major (39.9%) encroachment within TPZ and SRZ	Twin trunked at 1.5m. Dead stub of central major stem. Congested scaffolds attached to north stem. 50% epicormic growth. Deadwood to 100mm diameter

No impact
Minor encroachment
Major encroachment
Within development footprint

8. Tree Survey Table Notes

8.1. Tag#

Numbers have been assigned to trees on site and have been tagged in the course of previous arboricultural surveys. Where a tag has been found to remain attached to the tree, it has been recorded in the Survey Table for the purposes of cross reference to previous reports.

8.2. Genus, Species and Common Name

The botanical and common name of each tree is identified and recorded. Occasionally the exact species name is unknown; *sp.* is recorded to indicate this.

8.3. Height, Spread, Trunk Dia, DBH and DRB

- The tree's height and spread is recorded in metres.
- The tree **DBH** is recorded in millimetres. DBH is an abbreviation of Diameter (of the trunk) measured at Breast Height (or 1.2m from the base of the trunk). If more than one trunk is present the DBH is calculated in accordance with AS4970-2009 Protection of Trees on Development Sites.
- If the tree has multiple trunks multiple trunks each trunk DBH (**Trunk Dia**) will be recorded individually.
- The tree **DRB** is recorded in millimetres. DRB is an abbreviation of Diameter (of the trunk) measured above the Root Buttress. It is required to calculate the SRZ in accordance with AS4970-2009 Protection of Trees on Development Sites when there is major encroachment within the TPZ, ie. greater than 10% is encroached upon or if there is an encroachment within the SRZ.

8.4. Age

The age class of each tree is estimated as either:

- **J** – Juvenile, a young sapling, easily replaced from nursery stock.
- **SM** - Semi Mature, a tree that has not grown to mature size.
- **M** - Mature, a tree that has reached mature size and will slowly increase in size over time.
- **OM** - Over Mature, a tree that has been mature for a long period and is beginning to display signs of decline, e.g. large dead branches.
- **S** - Senescent, an over mature tree that is now in decline.

8.5. Health and Vigour

The trees health and vigour is recorded as a measurement of:

- **G** - Good the tree does not appear stressed with no excessive dieback, insect infestation, decay, dead wood or epicormic shoots.
- **Avg** - Average Health the tree appears stressed and have some crown dieback, and/or a few epicormic shoots, and/or some dead wood in the crown and some new growth at branch tips. These trees may benefit from remediation of the growing environment to reduce stress and return it to good health.

- **F** - Fair the tree may have areas of crown dieback, and/or epicormic shoots, and/or areas of decay, and/or reduced new growth at branch tips. These trees have been stressed for a short period of time, remediation of the growing environment may improve the trees health.
- **P** - Poor the tree may have large areas of crown dieback, and/or many epicormic shoots, and/or reduced new growth at branch tips. These trees have been stressed for a long time, remediation of the growing environment would not return the tree to good health.
- **D** – Dead the tree is dead

8.6. Crown Condition

The crown condition of each tree is assessed and recorded as either:

- **G** - Good Condition: the tree appears to have no visible indication of inherent structural defects.
- **Avg** - Average Condition: the tree has minor structural defects which may be corrected with remedial works or pruning, allowing the tree to return to Good Condition.
- **F** - Fair Condition: the tree has visible structural defects such as (but not limited to) dead branches, and/or an unbalanced crown, and/or leaning trunk and/or areas of decay. These trees do not demonstrate the typical form of their species, or have been damaged or have begun to deteriorate. Remedial works or pruning may return the tree to Average Condition.
- **P** - Poor Condition: the tree has significant structural defects such as (but not limited to) very large dead branches, and/or extremely unbalanced crown, and/or subsiding trunk and/or large areas of decay. These trees do not demonstrate the typical form of their species, or have been severely damaged or have deteriorated significantly. Remedial pruning would not return the tree to Fair Condition.

8.7. Significance

Measured as High, Medium or Low, see **2.7. Determining a tree's significance** (page 6).

8.8. Amenity Value

Amenity value is a subjective measurement based on the tree's contribution to the landscape, it may be based on the tree's visual form, however it also includes non visual attributes such as provision of shade for a seat, screening of poor views or for privacy, or if it has historical significance. The amenity value is recorded as:

- **H** - High, the trees form is an excellent example of its species and it makes a great specimen and/or it has other attributes such screening, or is historical significance. These trees are visually prominent and valuable to the community or public domain.
- **M** - Medium, the tree may have an altered form and/or it has attributes that provides amenity to local residents only.
- **L** – Low, the tree is not a good specimen and it does not provide substantial benefit to local residents or the community.

8.9. Ecological Value

Ecological value is a measurement of the trees contribution to the environment. It is determined by the trees area of origin, its potential to provide habitat to native fauna and its potential to become an environmental pest. The ecological value is recorded as:

- **H** - High, the tree is locally native or remnant and/or it has habitat value for native fauna.
- **M** - Medium the tree is native but not locally native.
- **L** - Low, the tree is not native and/or it may be a listed nuisance or weed species.
- **Ha** – Habitat, is the tree valued by fauna for food (ie. foliage fruit or sap) or shelter (ie. nesting, roosting, dray or hollow).

8.10. Form

The form, structure or shape of each tree is assessed and recorded as either one or a combination of several of the below terms; (**U**) Upright, (**B**) Broad, (**C**) Conical, (**Sh**) Shrub, (**CS**) Crown Shy (also referenced is the adjacent dominant tree canopy ie. **T4**), (**V**) Vase, (**D**) Dome, (**P**) Palm, (**S**) Spreading, (**L**) Leaning or (**BM**) Basal Multi Trunked.

Crown form may also be assessed in accordance with the relationship with the neighbouring tree and recorded as either: **S** - Suppressed, the crown is located beneath another larger crown and is leaning away (Crown Shy); **CD** - Codominant, the crown is adjacent to another crown of similar size, their crown areas may appear joined; **D** - Dominant, the crown is above other lower crowns; **E** - Emergent, the crown emerges from a lower canopy formed by other dominant or codominant crowns.

8.11. Defects

The presence of one or a combination of several defects is recorded (**W**) Wound, (**D**) Decay, (**F**) Fungus, (**B**) Bulge, (**FB**) Fibre Buckling, (**C**) Cracks, (**S**) Split, (**H**) Hollow, (**DB**) Die Back, (**E**) Epicormic shoots, (**DW**) Dead Wood, (**I**) Inclusion, (**CA**) Cavities, (**PF**) Previous Failure, (**R**) Root Damage, (**P**) Pruning wound, (**PD**) Pests and diseases, (**ST**) Storm Damage.

8.12. SRZ (Structural Root Zone)

The SRZ is a radial area extending outwards from the centre of the trunk. This area contains the majority of the structural woody roots. This area is responsible primarily for stability. Root damage or root loss within this zone greatly increases the opportunity for decay fungi to ingress into the heartwood, causing internal decay in addition to destabilising the tree's structural integrity. The SRZ is calculated as follows (This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites):

$$\textbf{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

8.13. TPZ (Tree Protection Zone)

The TPZ is a circular area with a radius measured by multiplying the DBH by twelve (12), or a circular area the size of the tree's drip line whichever is greater. This area contains the majority of the essential structural and feeder roots responsible for stability,

gaseous exchange and water and nutrient uptake. Excavation, back filling, compaction or other disturbance should not occur in this area.

The TPZ is used to identify the minimum area required for the safe retention of a given tree. This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites. An incursion to 10% within the TPZ is potentially acceptable if no other option is available. A major encroachment (in excess of 10%) is required to be clearly justified by the project Arborist and compensated for elsewhere. Justification methodology may vary depending on site or the individual tree's health, vigour and ability to withstand disturbance and may require root investigation.

8.14. Development Setback / Impact

The successful retention of trees on construction sites is dependent on the adequate allocation and management of the space above, below and around trees to be retained.

The trunk and canopy of trees to be retained must be protected to ensure the trunk and branches are not damaged during construction. The removal of bark and / or branches allows the potential ingress of micro organisms which may cause decay. Similarly the removal of bark restricts the tree's ability to distribute water, mineral ions and glucose.

It is essential to prevent the disturbance of the soil beneath the drip line of each tree, because this is the area where oxygen, water and mineral ions are absorbed by tree roots. Oxygen, water and mineral ions are essential for healthy plant growth. If soil becomes compacted, the ability of roots to function correctly is greatly reduced. Similarly the removal or damage of roots will reduce the ability of roots to function correctly. Woody roots provide stability for the tree and they also transport nutrients to the leaves.

The potential implications of removing or damaging roots are threefold:

1. The risk of whole tree failure is increased, as tree roots anchor and stabilise the tree. Woody roots are developed to assist in the support of the tree in prevailing wind, with these roots removed wind throw may occur, which would result in the mass failure of the tree.
2. The ability of the tree to absorb and transfer the essential nutrients, oxygen and water from the soil to the leaves is greatly affected. This will place the tree under stress and reduce the tree's ability to photosynthesise, and in turn cause the tree to use up stored energy reserves. These energy reserves are used to fight infection and insect attack, for new growth, maintenance of existing tissues and also for healing wounds. Once energy reserves become depleted a tree is much more susceptible to drought, disease and pest attack.
3. Open wounds are sites by which decay-causing pathogens can enter the tree. The severance or damage of woody roots creates sites where pathogens may gain ingress. Whilst the effect of decay may not be immediately apparent, the long term health and structure of the tree will be compromised.

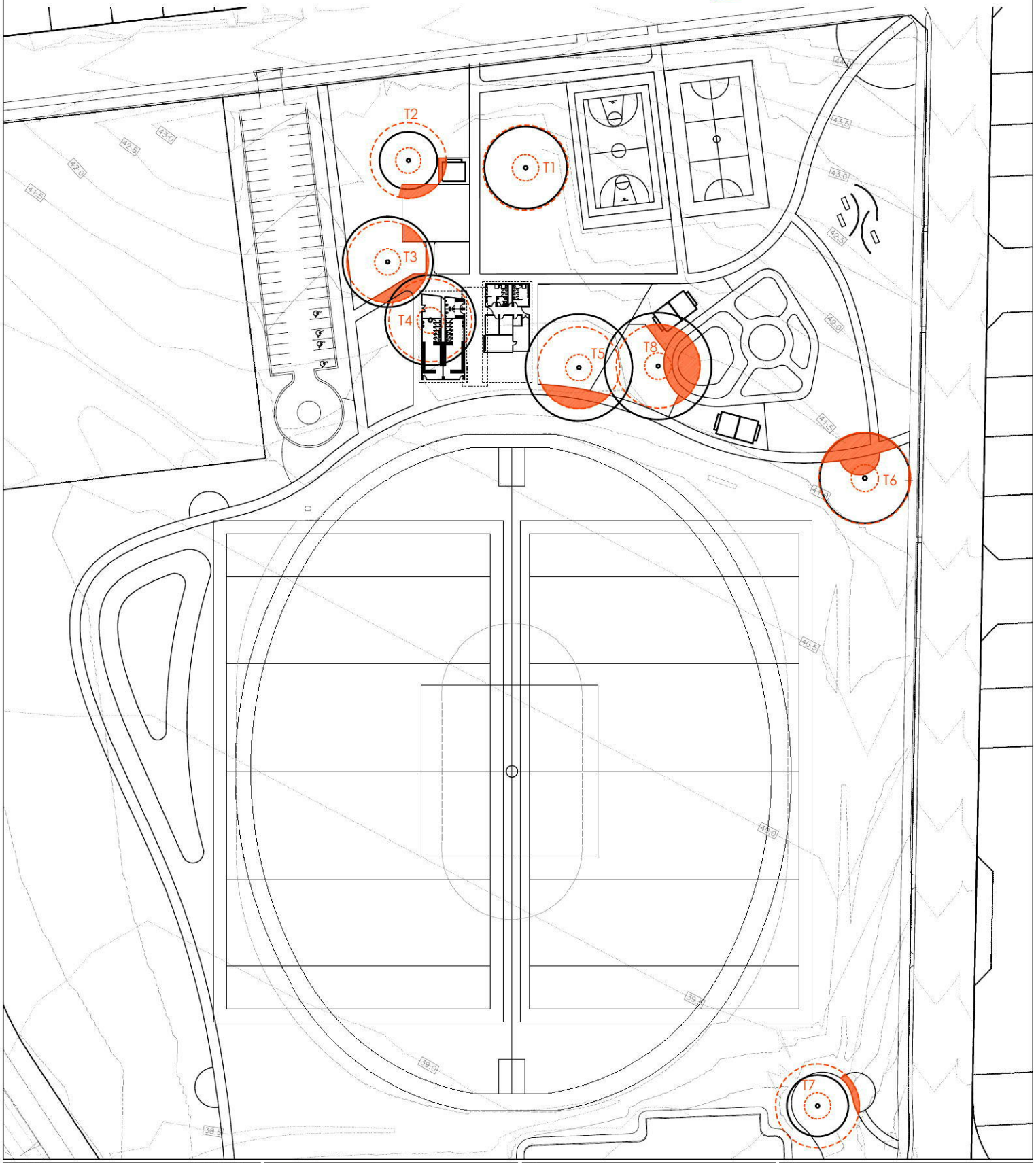
8.15. Comments

Comments generally relate to the suitability for retention. The comments allow for a brief notation of other factors relevant to the assessment of the tree.

9. Tree Location Plan

LEGEND

- Existing levels (101.45)
- Proposed levels (+ RL 101.55)
- Proposed Top Of Wall levels (+ TOW 101.55)
- Boundary
- Fence
- To be removed / demolished
- Existing tree
- Tree Protection Zone
- Structural Root Zone
- Encroachment into Tree Protection Zone



REVISION	DESCRIPTION	DRAWN	CHECK	DATE
A	PRELIMINARY ADVICE	VF	AM	13-02-14
B	REVISED LANDSCAPE PLAN	VF	AM	19-02-14

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Member of the Institute of Australian Consulting Arboriculturists (IACA)

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7. All work to be performed by a suitably qualified tradesperson
8. For application purposes only - NOT FOR CONSTRUCTION

ADDRESS: JORDAN SPRINGS - VILLAGE OVAL

CLIENT: LEND LEASE

PROJECT: NEW RESIDENCE

DRAWING: TREE LOCATION PLAN

SCALE	ISSUE	SHEET
NTS @ A4	DA	T - 01

DRAWN	CHECK	DATE	REVISION
VF	AM	19-02-14	B

10. General Tree Protection Notes

10.1. Structural Root Zone (SRZ)

The SRZ is a radial area extending outwards from the centre of the trunk calculated as follows:

$$\textbf{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

10.2. Tree Protection Zone (TPZ)

The TPZ is a radial area extending outwards from the centre of the trunk equal to the DBH x 12. This area shall be protected by a TPF (*see below*). For all trees to be retained a TPZ is to be created and maintained.

The TPZ function is primarily to protect the root zone by restricting access however the canopy of the tree shall also be protected from damage or injury. The Project Arborist shall approve the extent of the TPZ.

The TPZ shall be mulched to a depth of 75mm with an approved organic mulch. Supplementary watering shall be provided in dry periods to reduce water or construction stress, particularly to those trees which may have incurred root disturbance.

In the TPZ the following activities shall be excluded:

- Excavation, compaction or disturbance of the existing soil.
- The movement or storage of materials, waste or fill.
- Movement or storage of plant, machinery, equipment or vehicles.
- Any activity likely to damage the trunk, crown or root system.
- Scaffolding.

10.3. Tree Protection Fencing (TPF)

Prior to site establishment, tree protection fencing shall be installed to establish the TPZ for trees to be retained. Tree protection fencing shall be maintained entire for the duration of the construction program.

Tree protection fencing shall be:

- To enclose as much of the TPZ as can reasonably be enclosed, allowing for pedestrian access and 1m offset around construction footprint and scaffolding.
- Cyclone chain link wire fence or similar, with lockable access gates.
- Certified and Inspected by the Project Arborist
- Installed prior to the commencement of the works.
- Prominently signposted with 300mm x 450mm boards stating "**NO ACCESS TO THIS AREA - TREE PROTECTION ZONE CONTACT PROJECT ARBORIST 0407 006 852**".

10.4. Trunk and Root Zone Protection

Other measures may be required in addition to tree protection fencing. These specific protection measures will be installed as directed by the Project Arborist to protect the canopy, trunk or branches from the risk of damage.

The Project Arborist shall be consulted if there is risk of damage to a retained tree. The Project Arborist may require:

- A 75mm layer of approved mulch to be installed to the TPZ.
- A temporary drip irrigation system to be installed to the TPZ.
- Additional root protection to be installed.
- Additional trunk and branch protection to be installed.

10.5. Tree Damage

In the event of damage to a tree or the TPZ of a tree to be retained the Project Arborist shall be engaged to inspect and provide advice on remedial action. This should be implemented as soon as practicable and certified by the Project Arborist.

10.6. Excavation within the TPZ

Excavation within the TPZ shall be avoided. All care shall be undertaken to preserve tree root systems. Excavation within the canopy drip line or TPZ shall subject to the approval and supervision of the Project Arborist. Excavation shall be executed by hand to avoid damage to roots.

If excavation within the TPZ is required a root mapping exercise is to be undertaken and certified by the Project Arborist. Root mapping shall be undertaken by either ground penetrating radar (GPR), air spade, water laser or by hand excavation. The purpose shall be to locate woody structural roots greater than 50mm in diameter.

Where roots 50mm dia. or greater are encountered, alternative construction method shall be considered to ensure roots are not severed. Adequate allowance must also be made for future radial root growth. In paved areas, consideration should be given to raising the proposed pavement level and using a porous fill material in preference to excavation.

If there is no avoiding placing services through the TPZ excavate outside the TPZ and underbore below the root ball of the tree as directed by the Arborist.

10.7. Fill

All fill material to be placed within the TPZ should be approved by Arborist and equal to 5-7mm Round River Pea Gravel to provide aeration and percolation to the root zone. Otherwise no fill should be placed within the TPZ of trees to be retained.

10.8. Pavements

Proposed paved areas within the TPZ should be placed on or above grade to minimise excavation, and avoid root severance and/or damage. Pavements should be permeable or avoided otherwise.

10.9. Pruning

All pruning work required (including root pruning) should be in accordance with Australian Standard No 4373-1996 - Pruning of Amenity Trees.

If required, roots should be severed with clean sharp implement flush with the face of the excavation and maintained in a moist condition. Root pruning shall be performed under the supervision of the Project Arborist.

10.10. Tree Removal

Tree removal work shall be carried out by an experienced tree surgeon in accordance with the NSW Work Cover Code of Practice for the Amenity Tree Industry (1998).

Care shall be taken to avoid damage to trees during the felling operation. Stumps shall be grubbed-out using a mechanical stump grinder to a minimum depth of 300mm without damage to other retained root systems.

10.11. Post Construction Maintenance

In the event of any tree deteriorating in health after the construction period, the Project Arborist shall be engaged to provide advice on any remedial action. Remedial action shall be implemented as soon as practicable and certified by the Project Arborist.

Tree protection fencing with additional trunk and root protection shall be removed following completion of construction. The mulch layer in the TPZ shall be retained and replenished where required to maintain a 75mm thickness.

11. References

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