TREE SURVEY

ARBORICULTURAL IMPACT ASSESSMENT & TREE PROTECTION PLAN

Norman Griffiths Sports Field
2 Lofberg Road, West Pymble
Version 2

Prepared for:
Turf One

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Document information

Title:	Norman Griffiths Sports Field
Report type:	Arboricultural Impact Assessment (AIA) & Tree Protection Plan (TPP)
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Document status

Document status	Date	Revision description
Version 1	21/11/24	Updates following KMC comments
Version 2	25/11/24	Final version

Abbreviations

Abbreviation	Description
AQF	Australian Qualifications Framework
AS	Australian Standards
DBH	Diameter at Breast Height
Id	Identification
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

Contents

1 Background

1.1 Introduction

Tree Survey was commissioned by Turf One to prepare an Arboricultural Impact Assessment (AIA) and Tree Protection Plan (TPP) for the proposed upgrade of Norman Griffiths Sports Field at 2 Lofberg Road, West Pymble.

The purpose of this report is to:

- Assess all trees within and adjacent to the development footprint.
- Evaluate the impacts of the proposed works and assess suitability for tree retention.
- Identify trees that require removal and specify protection for trees that will be retained.

1.2 The proposal

The key features of the proposal are summarised as follows:

- Construction of a new synthetic sports field.
- Associated civil works and landscaping.

1.3 Documents and plans referenced

The conclusions and recommendations of this report are based on the Australian Standard, AS 4970-2009, Protection of Trees on Development Sites (AS4970), the findings from the site inspections, and analysis of the documents/plans listed in **Table 1**.

Table 1: Documents and plans

Document	Author	Version	Date
Engineering Plans	Ku-Ring-Gai Council	K	20/08/24
Detail Survey	Bee & Lethbridge	00	12/03/18

The survey and engineering plans have been used as map layers in the Arboricultural Impact Assessment Drawings and Tree Protection Plan Drawings.

2 Method

2.1 Visual Tree Assessment (VTA)

The subject trees were assessed in accordance with a stage one visual tree assessment (VTA) as formulated by Mattheck & Breloer (1994) and practices consistent with modern arboriculture.

The following limitations apply to this methodology:

- Trees are inspected visually from ground level without the use of any invasive or diagnostic tools and testing.
- Trees within private properties or restricted areas were not subject to a complete visual inspection (i.e., defects and abnormalities may be present but not recorded).
- Diameter at breast height (DBH) has been accurately measured using a diameter tape (where access to the trees was available).
- Tree height and canopy spread are estimated unless otherwise stated.
- Tree protection zones have been calculated in accordance with AS4970 using the DBH and diameter at root buttress (DRB) measurements.
- Tree identification is based on broad taxonomical features present and visible from ground level at the time of inspection.

2.2 Significance of a Tree, Assessment Rating System (STARS).

The retention value of a tree or group of trees is determined using a combination of environmental, cultural, physical, and social values.

- **Low:** These trees are not considered important for retention, nor require special works or design modifications to be implemented for their retention.
- **Medium:** These trees are moderately important for retention. Their removal should only be considered if adversely affecting the proposed building/works.
- **High:** These trees are considered important for retention and should be considered for retention where possible. Design modification or relocation of building/s should be considered to accommodate the setbacks as prescribed by AS4970.

This tree retention assessment has been undertaken in accordance with the Institute of Australian Consulting Aboriculturalists (IACA) Significance of a Tree, Assessment Rating System (STARS). The system uses a scale of High, Medium, and Low significance in the landscape. Once the landscape significance of a tree has been defined, the retention value can be determined. Each tree must meet a minimum of three (3) assessment criteria to be classified within a category. Further details and the assessment criteria are in the **Appendices.**

3 Arboricultural Impact Assessment (AIA)

3.1 The impact footprint

Assessment of tree impacts requires a clear understanding and distinction between the construction footprint (or project footprint) and the impact footprint.

- **The construction footprint:** The construction footprint is commonly understood as the extent of the proposal, project area, or subject site. The construction footprint is typically defined by the project boundary or limit of works.
- **The impact footprint:** The impact footprint is located within the construction footprint but should only include elements of the proposal (areas of work) that are likely to impact trees.

It is important to identify elements of the proposal (areas of the construction footprint) that will impact trees and exclude elements of the proposal (areas of the construction footprint) that will not impact trees. The table below provides examples of common construction items that should be included in the impact footprint and excluded from the impact footprint.

Table 2: The impact footprint

Item	Included in the impact footprint	Excluded from the impact footprint
Excavation	Excavation greater than 150mm	Excavation less than 150mm.
Fill	Fill greater than 150mm	Fill less than 150mm.
Grading	Changes in soil level greater than 150mm	Changes in soil level less than 150mm
Hardstand	Impervious concrete or asphalt hardstand	Permeable hardstand with <150mm excavation
Services	Services installed with open-cut trenching	Services installed using directional drilling
Driveways	Impervious driveway with >150mm excavation	Permeable driveway with <150mm excavation
Pathways	Impervious pathway with >150mm excavation	Pathway with <150mm excavation
Building	Building or structure at existing grade	Suspended building with drainage to soil
Decks	Impervious deck at or above grade	Suspended deck with drainage to soil

Once the impact footprint is identified, it is compared with the existing trees and tree protection zones. The impact footprint is used to calculate impacts on trees and informs which trees can be retained, and which trees need to be removed.

3.2 Tree protection zones

The Australian Standard, Protection of Trees on Development Sites (AS4970), describes two zones that need to be considered when undertaking an arboricultural impact assessment:

- **Tree protection zone (TPZ):** The TPZ is the combination of crown and root area that requires protection during the construction process so that the tree can remain viable. The TPZ is calculated by measuring the DBH and multiplying it by twelve (12). The resulting value is applied as a radial measurement from the centre of the trunk to delineate the TPZ.
- **Structural root zone (SRZ):** The SRZ is the area of the root system used for stability, mechanical support, and anchorage of the tree.

Encroachment within the TPZ is acceptable, providing that the arborist can demonstrate that the tree will remain viable. There are three (3) levels of encroachment defined by AS4970.

Table 3: Levels of encroachment

Nil encroachment (0%)	Nil encroachment within the TPZ.
Minor encroachment (<10%)	The encroachment is less than 10% of the TPZ.
Major encroachment (>10%)	The encroachment is greater than 10% of the TPZ.

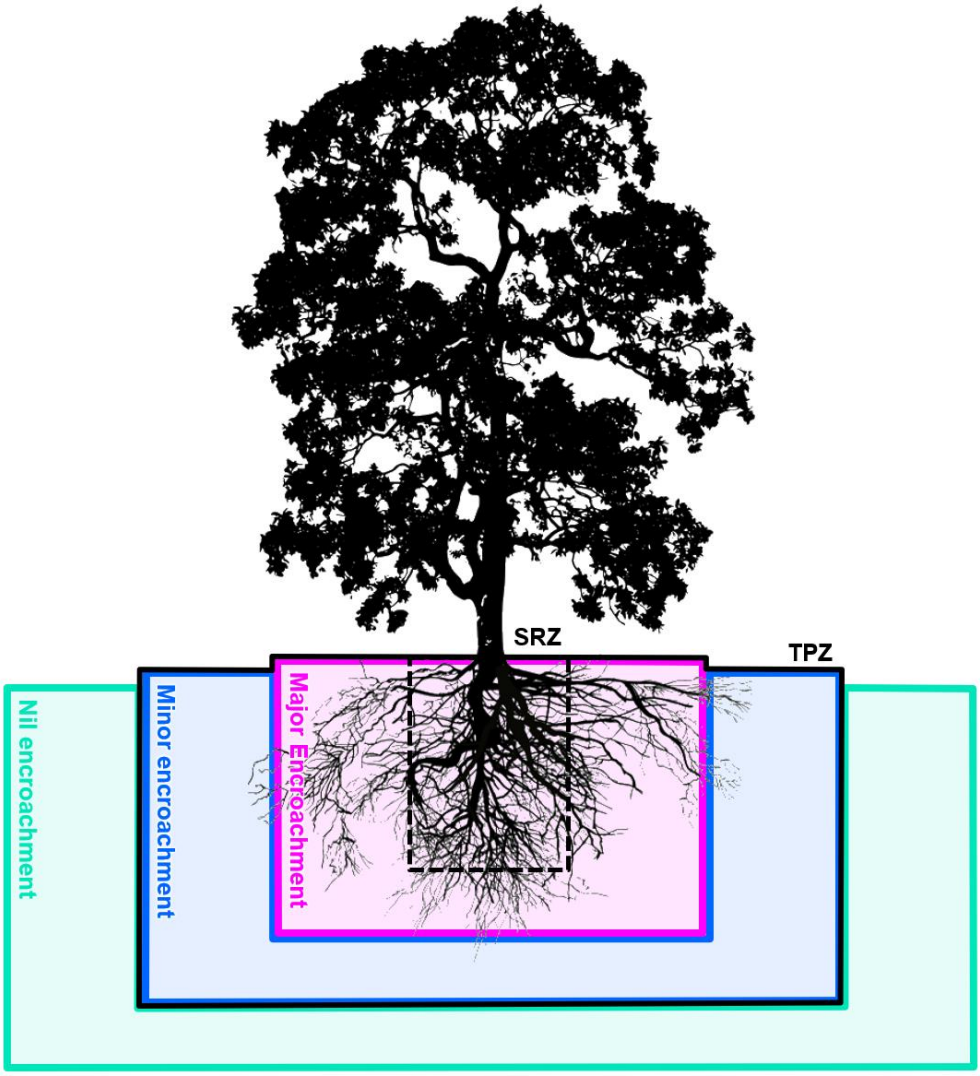


Figure 1: Three (3) levels of encroachment

4 Results

A total of **224** trees were assessed and included in this report. The results are as follows:

4.1 Encroachment within the TPZ

A summary of trees impacted by the proposed construction footprint is outlined below.

Table 4: Encroachment summary

Nil encroachment (0%)	A total of **179** trees will be subject to nil encroachment.
Minor encroachment (<10%)	A total of **25** trees will be subject to minor encroachment.
Major encroachment (>10%)	A total of **20** trees will be subject to major encroachment.

4.2 Tree removal and retention

A summary of proposed tree removal and retention is outlined below.

Table 5: Tree removal summary

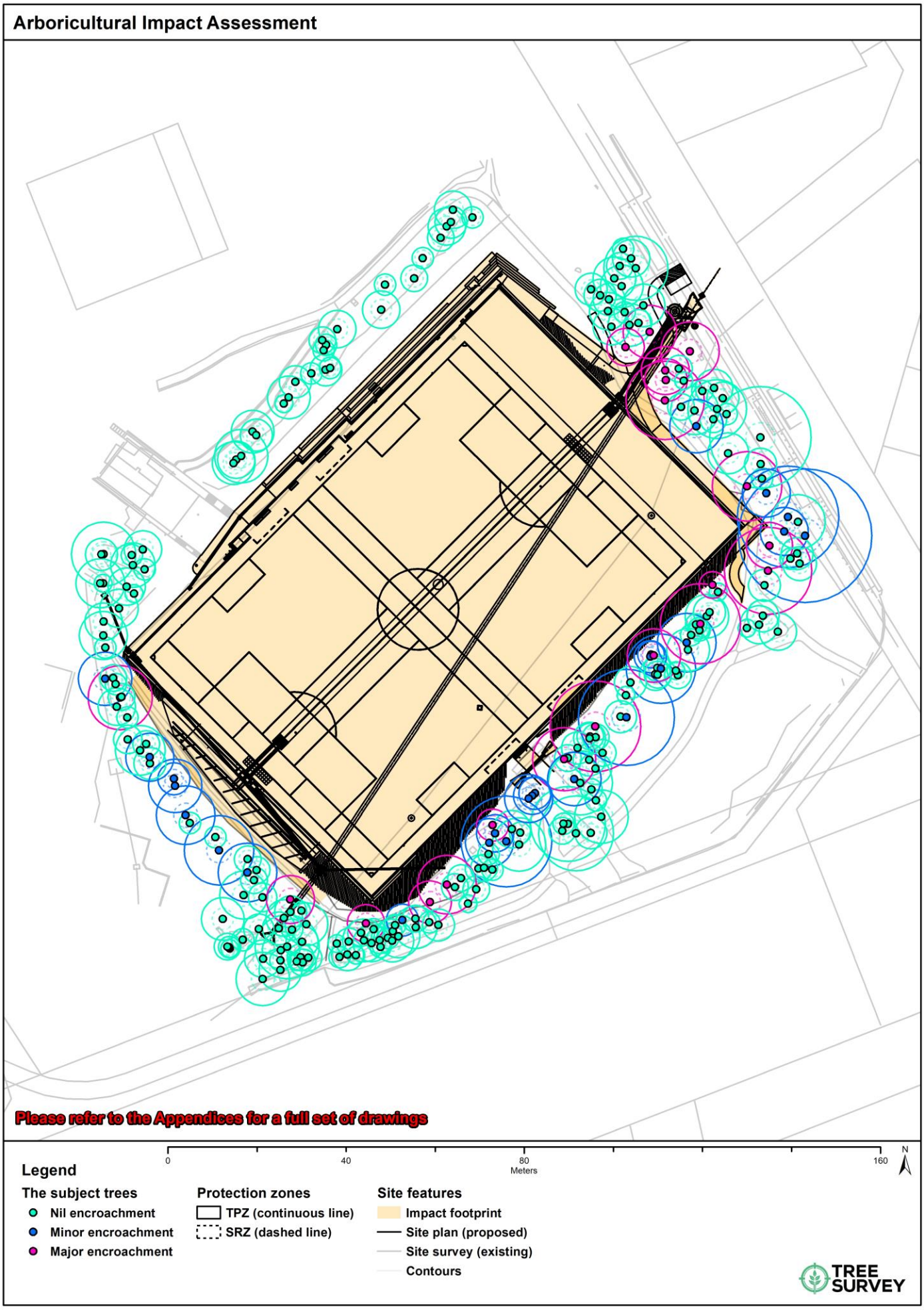
Retain	A total of **224** trees are proposed for retention.
Remove	A total of **0** trees are proposed for removal.

A full set of tree data can be found in the supplementary PDF document "Appendix I - Tree Data".

5 Discussion

Table 7: Discussion of impacts

Nil encroachment (0%) Total trees: **179**	**Retain** A total of **179** trees will be subject to nil encroachment. No impacts on these trees are foreseeable under the current proposal.
	Remove No trees within the category of “nil encroachment” are proposed for removal.
Minor encroachment (<10%) Total trees: **25**	**Retain** A total of **25** trees will be subject to a minor encroachment of less than 10% within the TPZ. The encroachments are highly unlikely to impact the overall health or condition of these trees. Under the current proposal, these trees can be successfully retained.
	Remove No trees within the category of “minor encroachment” are proposed for removal.
Major encroachment (>10%) Total trees: **20**	**Retain** A total of **20** trees will be subject to a major encroachment of between 20%-40% within the TPZ. KMC has a policy of zero tree removals for this project, therefor, the only option is to mitigate and minimise impacts wherever possible. Several site-specific mitigations for these encroachments have been outlined in the Tree Protection Plan.
	Remove No trees within the category of “major encroachment” are proposed for removal.


Arboricultural Impact Assessment
Please refer to the Appendices for a full set of drawings
0
40
80
Meters
160
N
Legend
The subject trees
Nil encroachment
Minor encroachment
Major encroachment
Protection zones
TPZ (continuous line)
SRZ (dashed line)
Site features
Impact footprint
Site plan (proposed)
Site survey (existing)
Contours
TREE SURVEY

6 Tree Protection Plan (TPP)

6.1 Tree removal and retention

A summary of proposed tree removal and retention is outlined below.

Table 7: Tree removal summary

Retain	A total of **224** trees are proposed for retention.
Remove	A total of **0** trees are proposed for removal.

6.2 Tree pruning

Minor vegetation trimming may be required to accommodate construction clearances. Standard pruning specifications are outlined below:

- Pruning must not exceed 10% of the overall canopy volume.
- No limbs greater than 150mm in diameter are to be removed.
- Any tree pruning must be in accordance with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373).

If the proposed vegetation trimming does not meet the specifications outlined above, the project arborist must undertake an assessment of impacts on a case-by-case basis.

6.3 Tree protection fencing

Tree protection fencing must be established at the locations shown in the TPP. Existing fencing, site hoarding, or structures (such as a wall or building) may be used as tree protection fencing, providing the TPZ remains isolated from the construction footprint. Tree protection fencing must be installed prior to site establishment and remain intact until the completion of works. Once erected, protective fencing must not be removed or altered without the approval of the project arborist. Specifications for the tree protection fencing are as follows:

- Temporary mesh panel fencing (minimum height of 1.8m).
- Installed prior to site establishment and remain intact until the completion of works.
- Protective fencing must not be removed or altered without the approval of the project arborist.
- Prominently signposted with 300mm x 450mm boards stating, “NO ACCESS - TREE PROTECTION ZONE.”
- Certified and inspected by the project arborist.

If tree protection fencing is not practical due to site constraints, tree protection delineation must be installed as an alternative. Specifications for tree protection barriers are as follows:

- Star pickets spaced at 2m intervals,
- Connected by a continuous high-visibility barrier/hazard mesh or flagging rope.
- Maintained at a minimum height of 1m.

Where approved works are required within the TPZ, fencing may be setback to provide construction access. Trunk, branch, and ground protection shall be installed and must comply with AS4970. Any additional construction activities within the TPZ of the subject trees must be assessed and approved by the project arborist.

6.4 Restricted activities within the TPZ

The TPZ is an area that is isolated from the work zone to ensure no disturbance or encroachment occurs in this zone. Activities generally excluded from the TPZ (unless otherwise approved under the development consent) include, but are not limited to:

- Machine excavation and trenching.
- Ripping or cultivation of the soil.
- Storage of building materials, waste, and waste receptacles.
- Disposal of waste materials, chemicals, paint, solvents, cement slurry, fuel, or other toxic liquids.
- Movement and storage of plant, equipment, and vehicles.
- Soil level changes, including the placement of fill material.
- Any other activity that is likely to cause damage to the tree.

6.5 Trunk protection

Trunk protection must be established at the locations shown in the TPP. Where the provision of tree protection fencing is impractical or must be temporarily removed, trunk protection shall be installed to avoid accidental mechanical damage.

Specifications for trunk protection are as follows:

- A thick layer of carpet underfelt, geotextile fabric, or similar wrapped around the trunk to a minimum height of 2m.
- 1.8m lengths of softwood timbers aligned vertically and spaced evenly around the trunk (with a small gap of approximately 50mm 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.

6.6 Ground protection

If temporary access for vehicle, plant, or machinery is required within the TPZ, ground protection shall be installed. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Where possible, areas of the existing pavement shall be used as ground protection.

Specifications for light traffic access (<3.5 tonne) are as follows:

- Permeable membrane such as geotextile fabric.
- A layer of mulch or crushed rock (at a minimum depth of 100mm)

Specifications for heavy traffic access (>3.5 tonne) are as follows:

- Permeable membrane such as geotextile fabric.
- A layer of lightly compacted road base (at a minimum depth of 200mm)
- Geotextile fabric shall extend a minimum of 300mm beyond the edge of the road base.
- Heavy vehicle track mats, road plates, access mats, or similar.

Pedestrian, vehicular, and machinery access within the TPZ shall be restricted solely to areas where ground protection has been installed.

6.7 Demolition

The demolition of all existing structures inside or directly adjacent to the TPZ of trees to be retained must be undertaken in consultation with the project arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection will be required. The demolition should be undertaken inwards into the footprint of the existing structures, sometimes referred to as the 'top-down, pull back' method.

6.8 Excavations

The project arborist must supervise and certify that all excavations and root pruning are in accordance with AS4373 and AS4970. All excavations (including root investigations) within the TPZ must be carried out using tree-sensitive methods under the supervision of the project arborist. These methods may include:

- **Manual excavation:** Use of hand tools such as spades, trowels, and brushes.
- **Air spade:** Use of a pressurised air device that blows the soil away and leaves roots intact.
- **Hydro-vacuum excavation:** Use of pressurised water to remove soil from around roots.

The recommended techniques for common types of excavations have been outlined below:

- **Continuous strip footings:** Manual excavation, air spade, or hydro-vacuum is utilised excavation lines within the TPZ prior to the commencement of mechanical excavation. Excavation should be a depth of 1 metre (or to unfavourable root growth conditions such as bedrock or heavy clay, if agreed by the project arborist). Any conflicting roots shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning must be documented and carried out by the project arborist. After all root pruning is completed, machine excavation is permitted within the footprint of the structure.
- **Post or pier footings:** Manual excavation, air spade, or hydro-vacuum is utilised at the location of pier footings within the TPZ. Any conflicting roots shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning must be documented and carried out by the project arborist. After all root pruning is completed, machine excavation is permitted within the footprint of the structure.

No over-excavation, battering, or benching shall be undertaken beyond the footprint of any structure unless approved by the project arborist.

6.9 Underground services

Where possible, underground services should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they must be installed using tree-sensitive excavation methods under the supervision of the project arborist. Alternatively, boring methods such as horizontal directional drilling (HDD) may be used for underground service installation, providing the installation is at a minimum depth of 800mm below grade. Excavations for entry/exit pits must be located outside the TPZ.

6.10 Root pruning

Any conflicting roots greater than 50mm in diameter identified during the supervised excavations shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning (>50mm) must be documented and carried out by the project arborist.

6.11 Site inspections

In accordance with AS4970, inspections must be conducted by the project arborist at the following key project stages:

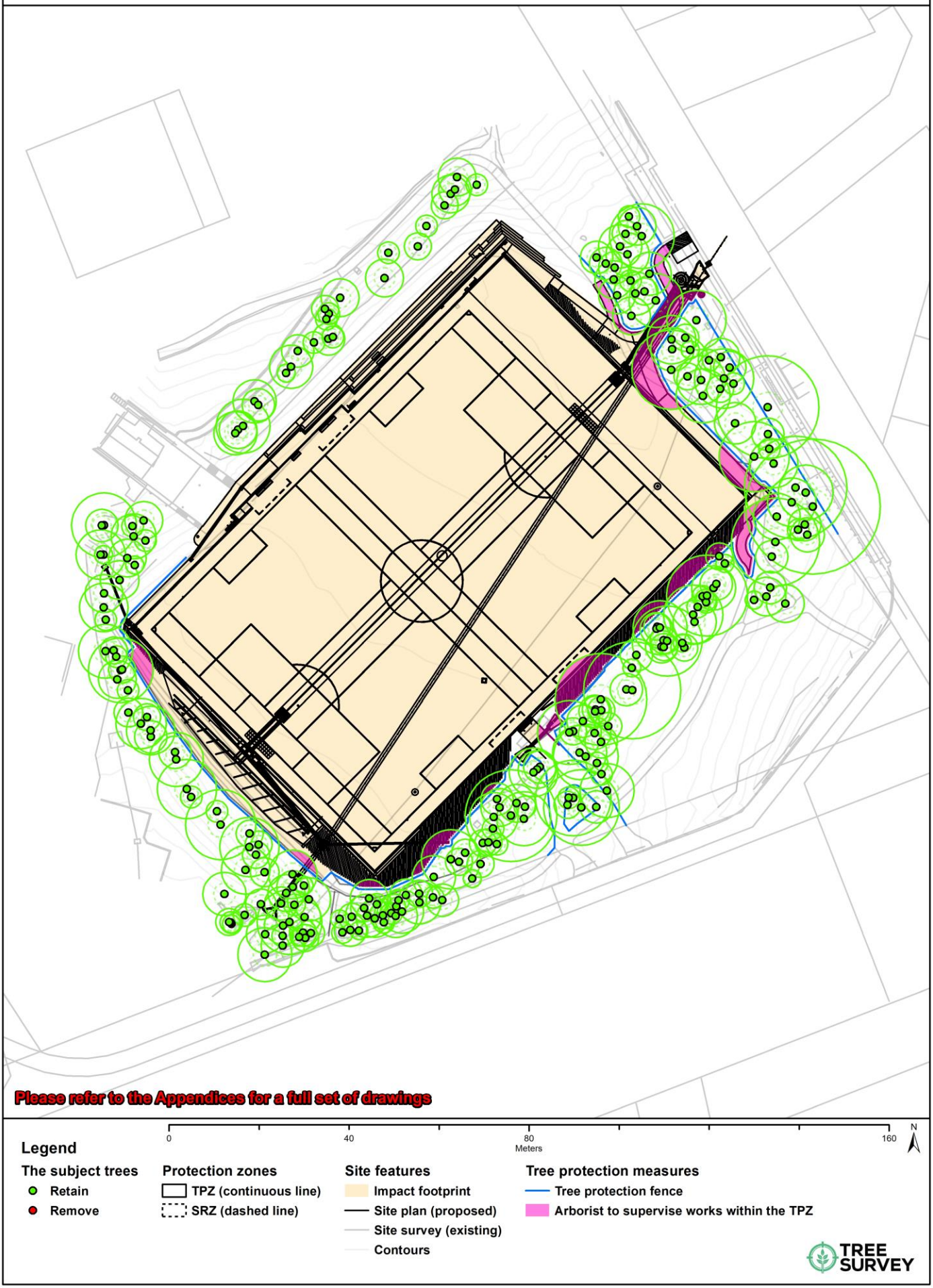
- Prior to any work commencing on-site (including demolition, earthworks, or site clearing) and following the installation of tree protection.
- During any excavations, building works, and any other activities carried out within the TPZ of any tree to be retained & protected.
- A minimum of once month during the construction phase for trees with a major encroachment within the TPZ.
- After all major construction has ceased, following the removal of tree protection.

It shall be the responsibility of the project manager to notify the project arborist prior to any works within the TPZ of any protected tree at a minimum of 48 hours' notice. To ensure the tree protection plan is implemented, hold points have been specified in the schedule of work (**Table 4**).

Table 9: Schedule of work

Construction Stage	Hold point	Remove
Pre-construction	**1**	Tree protection (for trees that will be retained) shall be installed prior to demolition and site establishment. This may include the mulching of areas within the TPZ. The project arborist shall inspect and certify tree protection.
During Construction	**2**	Project arborist to supervise and document any significant works carried out within the TPZ of trees to be retained.
	3	Scheduled inspection of trees by the project arborist should be undertaken monthly during the construction period.
Post Construction	**4**	Final inspection of trees by project arborist.

Tree Protection Plan



References

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Roberts, J., Jackson, N. and Smith, D. (2006). Tree roots in the built environment.

Appendix I - Tree Data

Please refer to the supplementary PDF document

Appendix II - Arboricultural Impact Assessment Drawings

Please refer to the supplementary PDF document

Appendix III - Tree Protection Plan Drawings

Please refer to the supplementary PDF document

Appendix IV - STARS© assessment matrix

The retention value of a tree or group of trees is determined using a combination of environmental, cultural, physical, and social values.

- **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 affecting the proposed building/works, and all other alternatives have been considered and exhausted.
- **High:** These trees are considered important for retention 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, AS4970-2009 Protection of trees on development sites.

This tree retention assessment has been undertaken in accordance with the Institute of Australian Consulting Aboriculturalists (IACA) Significance of a Tree, Assessment Rating System (STARS). The system uses a scale of High, Medium, and Low significance in the landscape. Once the landscape significance of a tree has been defined, the retention value can be determined. Each tree must meet a minimum of three (3) assessment criteria to be classified within a category.

Tree Significance - Assessment Criteria

Low Significance	Medium Significance	High Significance
The tree is in fair-poor condition and good or low vigour. The tree has form atypical of the species The tree is not visible or is partly visible from the surrounding properties or obstructed by other vegetation or buildings The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area 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'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 is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms The tree has a wound or defect that has the potential to become structurally unsound.	The tree is in fair to good condition The tree has form typical or atypical of the species The tree is a planted locally indigenous or a common species with its taxa commonly planted in 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 provides a fair contribution to the visual character and amenity of the local area 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 is in good condition and good vigour The tree has a form typical for the species 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 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 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 supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group, or has commemorative values. 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.
Environmental Pest / Noxious Weed		
The tree is an environmental pest species due to its invasiveness or poisonous/allergenic properties. The tree is a declared noxious weed by legislation		
Hazardous / Irreversible Decline		
The tree is structurally unsound and/or unstable and is considered potentially dangerous. The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.		

Useful Life Expectancy - Assessment Criteria			
Remove	**Short**	**Medium**	**Long**
Trees with a high level of risk that would need removing within the next 5 years. Dead trees. Trees that should be removed within the next 5 years. Dying or suppressed or declining trees through disease or inhospitable conditions. Dangerous trees through instability or recent loss of adjacent trees. Dangerous trees through structural defects, including cavities, decay, included bark, wounds, or poor form. Damaged trees that considered unsafe to retain. Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting. Trees that will become dangerous after removal of other trees for the reasons.	Trees that appear to be retainable with an acceptable level of risk for 5-15 years. Trees that may only live between 5 and 15 more years. Trees that may live for more than 15 years but would be removed to allow the safe development of more suitable individuals. Trees that may live for more than 15 years but would be removed during the course of normal management for safety or nuisance reasons. Storm damaged or defective trees that require substantial remedial work to make safe and are only suitable for retention in the short term.	Trees that appear to be retainable with an acceptable level of risk for 15-40 years. Trees that may only live between 15 and 40 more years. Trees that may live for more than 40 years but would be removed to allow the safe development of more suitable individuals. Trees that may live for more than 40 years but would be removed during the course of normal management for safety or nuisance reasons. Storm damaged or defective trees that require substantial remedial work to make safe and are only suitable for retention in the short term.	Trees that appear to be retainable with an acceptable level of risk for more than 40 years. Structurally sound trees located in positions that can accommodate future growth. Storm damaged or defective trees that could be made suitable for retention in the long term by remedial tree surgery. Trees of special significance for historical, commemorative, or rarity reasons that would warrant extraordinary efforts to secure their long-term retention.

Tree Significance

Useful Life Expectancy	High Significance	Medium Significance	Low Significance	Environmental Pest / Noxious Weed	Hazardous / Irreversible Decline
Long >40 years					
Medium 15-40 years					
Short <1-15 years					
Dead					

Legend for Matrix Assessment

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

Reference

IACA, 2010, IACA Significance of a Tree, Assessment Rating System (STARS)
Institute of Australian Consulting Arboriculturists
Australia, www.iaca.org.au