



Hospital Road REF Works Arboricultural Impact Assessment

Health Infrastructure

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Template 2.8.1

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Abbreviations

| Abbreviation | Description |
|--------------|--|
| AQF | Australian Qualifications Framework |
| AS | Australian Standards |
| CCCC | Children's Comprehensive Cancer Centre |
| DBH | Diameter at Breast Height |
| ELA | Eco Logical Australia |
| IASB | Integrated Acute Services Building |
| m | Metre |
| mm | Millimetre |
| NDE | Non-Destructive Excavation |
| NO | Number |
| NSW | New South Wales |
| REF | Review of Environmental Factors |
| RHEP | Randwick Health and Education Precinct |
| RHW | Royal Hospital for Women |
| SCH | Sydney Children's Hospital |
| SP | Species |
| SRZ | Structural Root Zone |
| TPZ | Tree Protection Zone |
| VTA | Visual Tree Assessment |

1. Background

The Randwick Health and Education Precinct (RHEP) is one of the most comprehensive health innovation districts in Australia. While health care at RHEP has been evolving for over 160 years, the last five years has seen a strengthening of collaboration amongst a wide range of organisations in the precinct, including with government, universities and community.

Hospital Road is an important road that supports the precinct and provides access to existing buildings such as the Sydney Children's Hospital (SCH) and Royal Hospital for Women (RHW). Hospital Road provides access to the campus logistical hub located on Delivery Drive. Additionally, Hospital Road will become a key link for vehicles and pedestrians enabling the integration of the existing campus with the future Integrated Acute Services Building (IASB) and SCH Stage 1/ Children's Comprehensive Cancer Centre (CCCC).

Hospital Road provides access to Delivery Drive and is currently accessed by vehicles and pedestrians from Magill Street to the South and High Street to the North. Figure 1 below shows the area of Hospital Road that this report addresses.

The proposed works on Hospital Road will involve excavation works to enable the lowering of Hospital Road for vehicle access. These works are pivotal in allowing for the development of an interlinked campus and removing the interface between pedestrians and vehicles. To achieve this, key service infrastructure assets that are currently located in Hospital Road will need to be diverted.

The address of the subject site is in Table 1 and mapped in Figure 2.

The purpose of this report is to:

- identify the trees within the site that are likely to be affected by the proposed works
- undertake a visual tree assessment of the subject trees
- assess the current overall health and condition of the subject trees
- evaluate the retention value of the subject trees
- identify trees to be removed, retained or transplanted
- determine the likely impacts on trees to be retained
- recommend tree protection measures to minimise adverse impacts.

Features of the subject site are tabulated below.

Table 1: Development site

| Criteria | Description |
|-----------------------|-------------------------------------|
| Street address | Hospital Road, Randwick NSW 2031 |
| Local Government Area | Randwick City Council |
| General land use | Road, hospital land and residential |

The description of the proposed activity in Table 2 is based on information available at the time of preparing this report.

Table 2: Proposed activity

| Activities that can impact trees | Description of proposed activities |
|---|--|
| Clearing vegetation | Yes – five trees (Trees 1, 2, 3, 4 & 9) on Hospital Road are subject to high impact (>20% TPZ encroachment) and require removal to enable installation of cables. |
| Pruning vegetation | Yes – Minimal pruning of overhanging branches in accordance with AS4373-2007 prior to using piling rig to avoid tearing tree branches during piling. |
| Earthworks including regrading, excavation and trenching <ul style="list-style-type: none"> For building For services | Yes – <ul style="list-style-type: none"> Excavation of Hospital Road North to depths up to 10 m at the northern end and reducing in height towards the southern end. The lowered Hospital Road will slope from about RL 51.0 m at the southern end down to RL 45.8 m at the northern end (FFL = Finished Floor Levels). Relocation of the underground electrical cabling from the western side to the eastern side of Hospital Road. Works will include piling, removing the concrete sidewalk and excavation of a 500 mm wide trench to install cables. |
| Compaction <ul style="list-style-type: none"> Storage of materials Installation of structures Stockpiling fill or materials Parking | Yes |
| Refuelling and chemical use (e.g. herbicides) | Yes |
| Erection of scaffolding | No |
| Vehicle movements | Yes |
| Changes to stormwater management | No |
| Landscaping | No |

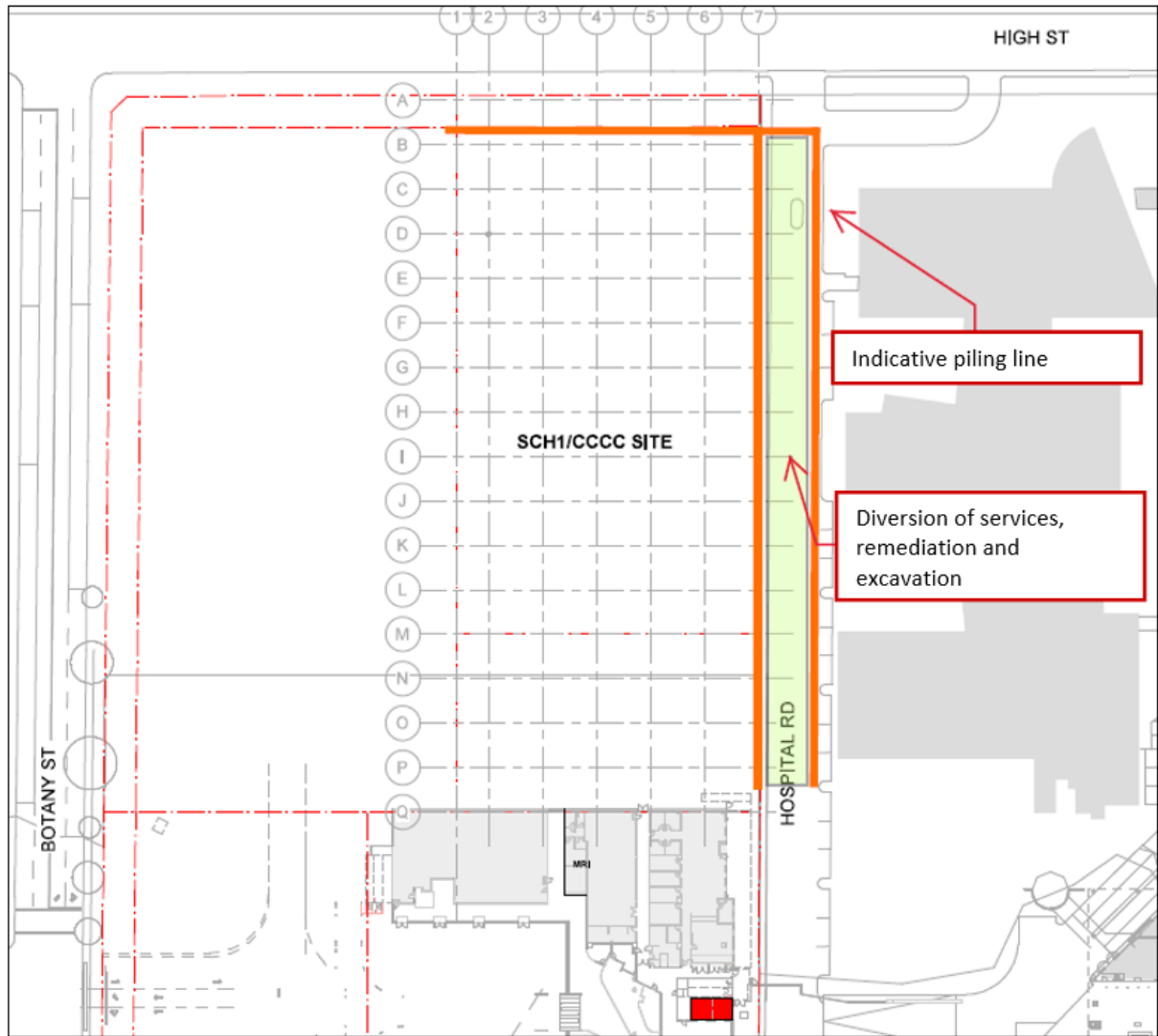


Figure 1: Context of the study area

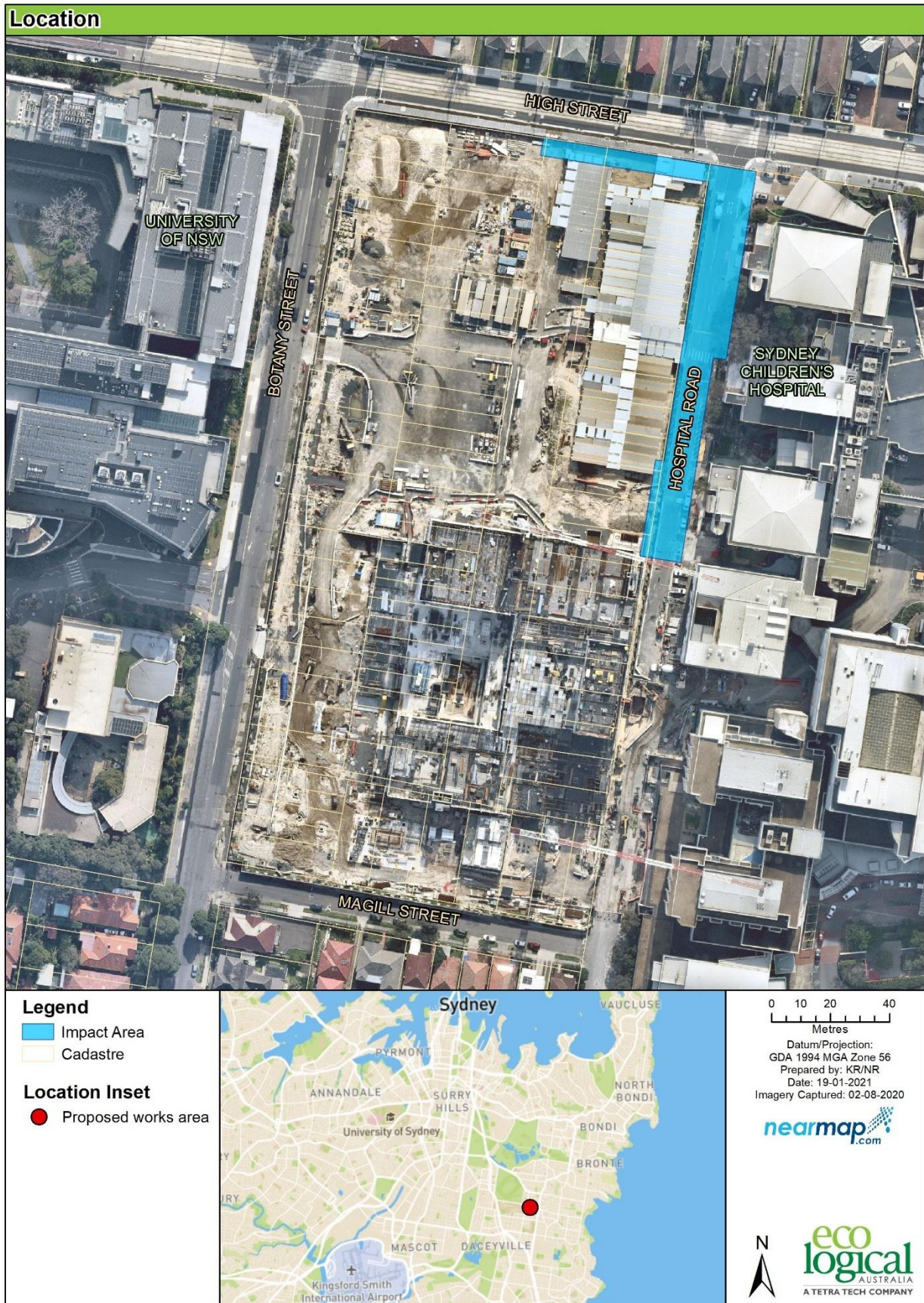


Figure 2: Location of the study area

2. Method

2.1 Definition of a tree

A tree is defined under the Australian Standard, AS 4970-2009, *Protection of Trees on Development Sites* as a long lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks.

Randwick City Council defines a tree as having a:

'height equal to or exceeding 6 m; a canopy width equal to or exceeding 4 m; for a single trunk tree species, a trunk circumference equal to or exceeding 1 m at a height of 1 m above ground level; or for a multi-trunk tree species, a combined trunk circumference (measured around the outer girth of the group of trunks) equal to or exceeding 1 m at a height of 1 m above ground level' (Randwick City Council 2013).

2.2 Visual tree assessment

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

A total of 9 subject trees were inspected on 14 August 2020 by AQF Level 5 Consulting Arborist, Sophie Diller.

The following limitations apply to this methodology:

- Trees were inspected from ground level, without the use of any invasive or diagnostic tools and testing.
- Trees were inspected within limits of site access.
- No aerial inspections or root mapping was undertaken.
- Tree heights, canopy spread and diameter at breast height (DBH) were estimated, unless otherwise stated.
- Tree identification was based on broad taxonomical features present and visible from ground level at the time of inspection.

2.3 Retention value

The retention value or importance of a tree or group of trees, is determined in accordance with the Institute of Australian Consulting Arborists (IACA) Significance of a Tree Assessment Rating System (STARS®), which is summarised in Appendix A. The method considers the Useful Life Expectancy (ULE) and landscape significance of a tree. Trees are provided one of the following ratings:

- **High - priority for retention:** 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 AS 4970–2009 Protection of trees on development sites.
- **Medium - consider for retention:** 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.

- **Low - consider for removal:** These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
- **Priority for removal:** These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

2.4 Protection zones

2.4.1 Tree protection zone (TPZ)

The TPZ is a specific area above and below ground and at a distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by the development. The TPZ (as defined by AS 4970-2009) requires restriction of access during the development process. Groups of trees with overlapping TPZs may be included within a single protection area. Tree sensitive measures must be implemented if works are to proceed within the TPZ.

2.4.2 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.

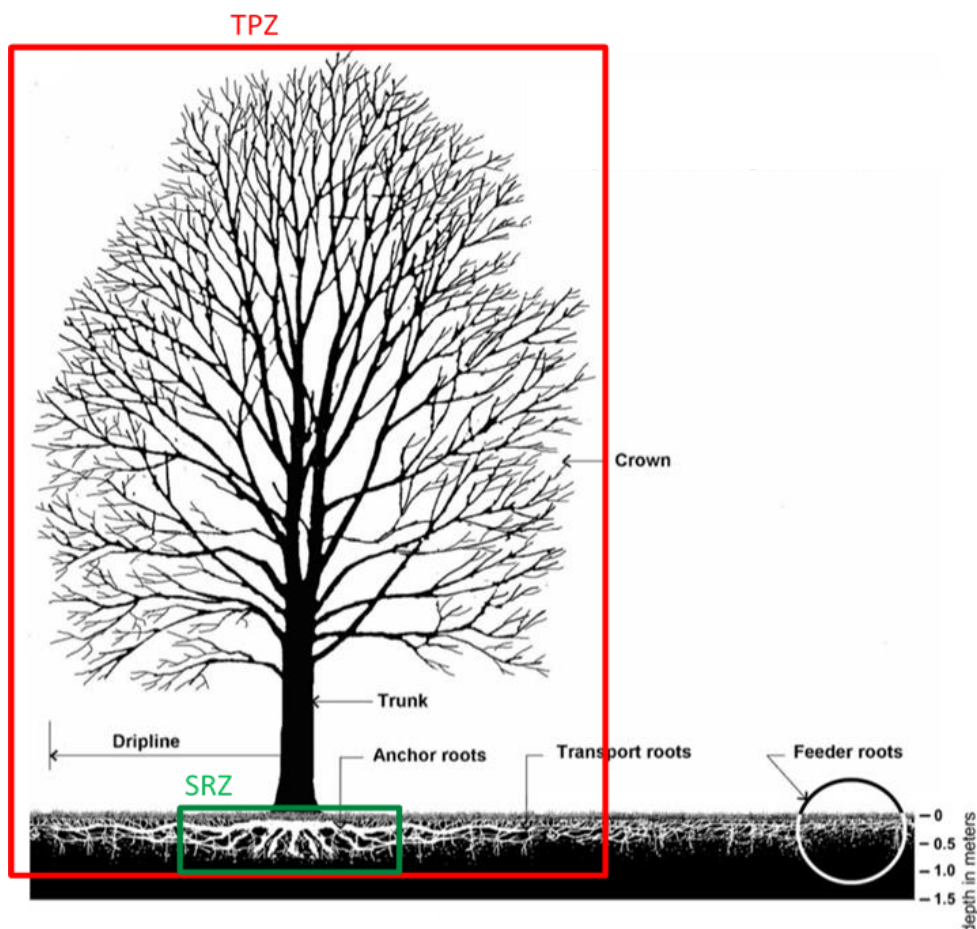


Figure 3: Representative tree structure and indicative TPZ and SRZ

2.5 Potential impacts

Trees may be impacted by physical or chemical damage to roots or above tree parts. Examples include impacts associated with site grading, soil compaction, excavation, stock piling within TPZ as well as changes in site hydrology, changes in soil level and site contamination. The extent of encroachment to the TPZ and SRZ determines the level of potential impact. AS 4970-2009 defines types of encroachment as follows and as illustrated in Appendix B:

- **Major encroachment** - If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ, the project arborist must demonstrate that the tree(s) would remain viable. The location and distribution of roots may be determined through non-destructive excavation (NDE) methods such as hydro-vacuum excavation (sucker truck), Air Spade or manual extraction. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.
- **Minor encroachment** – If the proposed encroachment is less than 10% of the TPZ, and outside of the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

For the purposes of this Arboricultural Impact Assessment, impacts are defined as follows:

- **High impact:** The SRZ is directly affected or the proposed encroachment is greater than 20% of the TPZ. Trees may not remain viable if they are subject to high impact. These trees cannot be retained unless the proposal is changed.
- **Medium impact:** If the proposed encroachment is greater than 10% of the TPZ (but less than 20% 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. These trees may be retained subject to further investigation and mitigation measures.
- **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. These trees can be retained.
- **No impact:** No likely or foreseeable encroachment within the TPZ. These trees can be retained.

Impacts are calculated using geographic information systems techniques.

2.6 Proposed action

The proposed actions to either retain or remove each tree are determined by the impact from the proposed design footprint, conversations of intent with the client and corresponding mitigation measures. The following are the definition of these actions:

- **Remove:** Trees that are to be impacted by the proposed development to the extent whereby retention is not suitable and / or incompatible if the current plans are approved. All tree removal must comply with guidelines specified in section 4 of this report and subject to regulatory approval.

- **Retain:** Trees that are suitable for retention granted they follow the specific mitigation measures discussed in section 3 and / or the tree protection measures outlined in section 4 and / or the tree protection guidelines outlined in Appendix E.

3. Results and discussion

Results of the arboricultural assessment are summarised in Table 3. Detailed results are included in Appendices C and D. Tree protection guidelines are provided in Appendix E, civil works plans as provided by the client are provided in Appendix F and site photos are provided in Appendix G.

Table 3: Summary of tree retention values and impacts

| Retention value | High Impact | Medium Impact | Low Impact | No Impact | Total |
|---------------------------------|-------------|---------------|------------|-----------|-------|
| Priority for retention (High) | 2 | - | - | - | 2 |
| Consider for retention (Medium) | 2 | 2 | - | 2 | 6 |
| Consider for removal (Low) | 1 | - | - | - | 1 |
| Total | 5 | 2 | 0 | 2 | 9 |

3.1 Trees proposed to be removed

A total of five trees (Trees 1, 2, 3, 4 and 9) are proposed for removal. Details of development impacts on subject trees are outlined below.

- **High Impact (>20% TPZ Encroachment):** a total of four trees will be highly affected by the proposed works and cannot be retained under the current proposal. Tree retention values are as follows:
 - High retention value: two high retention value trees (Tree 1 and 4) will be highly affected by the proposed works.
 - Medium retention value: two medium retention value tree (Tree 2 and 3) will be highly affected by the proposed works.
 - Low retention value: one low retention value tree (Tree 9) will be highly affected by the proposed works.

Any loss of trees should be offset with replacement planting in accordance with the relevant offset policy.

3.2 Trees proposed to be retained subject to further investigation

A total of two trees (Trees 7 and 8) are proposed to be retained subject to further investigation. Details of development impacts on subject trees are outlined below.

- **Medium Impact (<20% TPZ Encroachment):** two medium retention value trees (Trees 7 and 8) will be subject to medium impact from the proposed works. These trees may be able to be retained subject to root mapping investigation.

If trees are to be retained, non-destructive excavation techniques such as air spading or hydro vacuuming are recommended to be undertaken within the TPZ in order to minimise root disturbance and support tree retention.

3.3 Trees proposed to be retained

A total of two medium retention value trees (Trees 5 and 6) are proposed to be retained. These trees will be subject to no impact (0% TPZ encroachment) from the proposed development.

3.4 Recommendations

- Stockpiling within the TPZ of Tree 5 needs to be relocated outside the TPZ. No stockpiling of materials or contamination is to be within the TPZ or SRZ of subject trees.
- Tree trunk protection is to be installed on trees to be retained.
- Consider some minimal pruning of overhanging branches in accordance with AS4373-2007 prior to using piling rig to avoid tearing tree branches during piling.
- Avoiding the cutting or removal of tree roots larger than 25 mm in diameter to maintain tree health and stability.
- Retain roots and install electrical cabling underneath tree roots where possible.

Refer to section 4 for the tree protection plan and section 5 for the hold points, inspection and certification.

4. Tree protection plan

- Permission must be granted from the relevant consent authority prior to removing or pruning of any of the subject trees. Approved tree works should not be carried out before the installation of tree protection measures.
- All tree pruning and removal 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).
- 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*.

Tree protection measures are summarised in Table 4 and further information is in Appendix E.

Table 4: Summary of tree protection measures

| Type | More details | Comment |
|-----------------------------------|--------------|---|
| Signage | Appendix E1 | Prominently sign posted with 300 mm x 450 mm boards stating, "NO ACCESS - TREE PROTECTION ZONE". |
| Tree protection fencing | Appendix E1 | Protective cyclone chain wire link fence to be erected around the TPZ to protect and isolate retained trees from the construction works. Existing boundary fencing may be used. |
| Crown protection | Appendix E2 | Where required, crown protection may include the installation of a physical barrier, pruning selected branches to establish clearance, or the tying/bracing of branches. |
| Trunk and branch protection | Appendix E3 | When fencing is not practical or prior to any activities within the TPZ, trunk protection is required and consist of a layer geotextile fabric or similar followed by 1.8 m lengths of softwood timbers spaced evenly around the trunk and secured with a galvanised hoop strap. |
| Ground protection | Appendix E4 | Install and maintain 100mm thick layer of mulch around tree in TPZ. For machine or vehicle access within TPZ geotextile fabric beneath crushed rock or rumble boards may be required. |
| Soil moisture | | Soil moisture levels should be regularly monitored by the project arborist. Temporary irrigation or watering may be required within TPZ. |
| Root protection and investigation | Appendix E5 | 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 using non-destructive excavation (NDE) methods. |
| Underground services | Appendix E6 | 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), non-destructive excavation (NDE) methods such as hydro-vacuum, Air Spade or manually excavated trenches. |

5. Hold points, inspection and certification

An AQF Level 5 Consulting Arborist needs to be engaged to supervise work within the TPZ, provide advice regarding tree protection and monitor compliance. 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.

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. Installation of tree trunk protection on trees in accordance with *AS 4970-2009 - Protection of trees on development sites* and minimal pruning to be undertaken in accordance with *the Australian Standard AS 4373-2007, Pruning of Amenity Trees*.

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 TPZ, with supervision by the project arborist of any work undertaken in this zone. Non-destructive excavation techniques such as air spading or hydro-vacuuming is recommended to be undertaken within the TPZ of trees to be retained in order to minimise root disturbance support tree retention. Avoid the cutting or removal of tree roots larger than 25 mm in diameter to maintain tree health and stability. Retain roots and install electrical cabling underneath tree roots.

Post-construction

Final inspection of trees by project arborist after all major construction has ceased and following the removal of tree protection measures.

6. References

6.1 General references

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- Harris, R.W., Matheny, N.P., and Clark, J.R., 1999. *Arboriculture: integrated management of landscape trees, shrubs, and vines*, Prentice Hall, Upper Saddle River, New Jersey.
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- IACA 2010. *IACA Significance of a Tree, Assessment Rating System (STARS)*, Institute of Australian Consulting Arboriculturalists, Australia, www.iaca.org.au.
- Robinson L, 2003. *Field Guide to the Native Plants of Sydney*, 3rd ed, Kangaroo Press, East Roseville NSW
- Standards Australia 2003. *Composition, Soil and Mulches, AS 4454 (2003)*, Standards Australia, Sydney.
- Standards Australia 2007. *Australian Standard: Pruning of amenity trees, AS 4373 (2007)*, Standards Australia, Sydney.
- Standards Australia 2009. *Australian Standard: Protection of trees on development sites, AS 4970 (2009)*. Standards Australia, Sydney.

6.2 Project specific references

- Meinhardt Bonacci Pty Ltd n.d. *Sydney Children's Hospital Stage 1 & Comprehensive Cancer Centre, Preliminary Hospital Road Retention Plan and Sections*. Proj. no. 12221. Dwg. no. SCH-ST-DG-SK 201127.
- Randwick City Council 2013. *B5 Preservation of Trees and Vegetation, Randwick Comprehensive Development Control Plan 2013*. Pg 3

Appendix A Tree retention assessment method

A1 Tree Significance Assessment Criteria - STARS©

The tree is to have a minimum of three criteria in a category to be classified in that group.

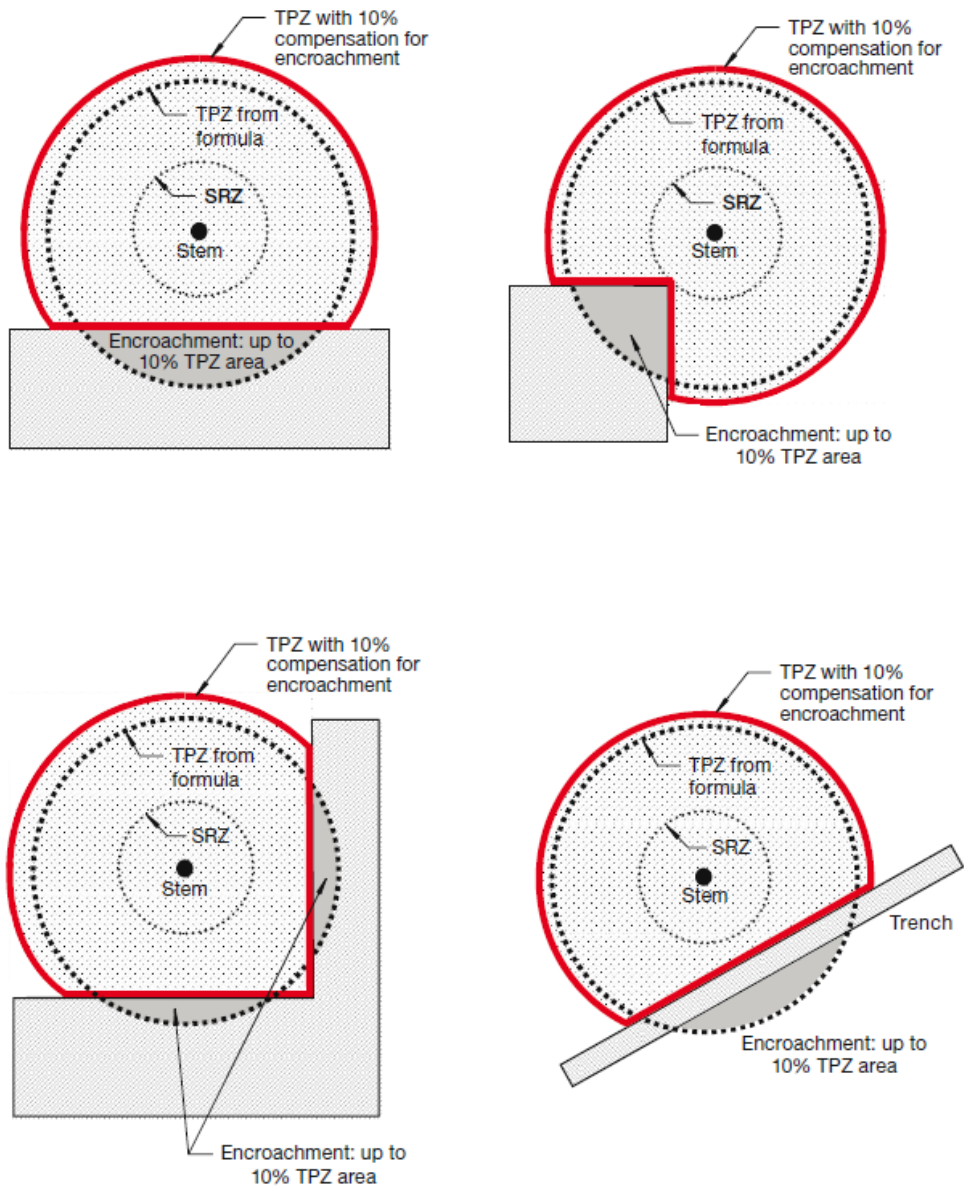
| Low | Medium | High |
|---|---|--|
| <p>The tree is in fair-poor condition and good or low vigour.</p> <p>The tree has form atypical of the species</p> <p>The tree is not visible or is partly visible from the surrounding properties or obstructed by other vegetation or buildings</p> <p>The tree provides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

A2 Matrix assessment - STARS©

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

| | |
|--|---|
| | 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. |
| | Priority for removal: These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development. |

Appendix B Encroachment into tree protection zones - AS 4970-2009



Appendix C Maps



Figure 4: Tree locations



Figure 5: Retention value subject trees



Figure 6: Arboricultural impact assessment

Appendix D Tabulated results of arboricultural assessment

| Tree | Botanical name | Height (m) | Spread (m) | Health | Structure | ULE | Landscape Significance | DBH (mm) | TPZ (m) | SRZ (m) | Retention value | Impact | Proposed action | Notes |
|------|------------------------|------------|------------|--------|-----------|----------------------|------------------------|----------|---------|---------|-----------------|---------------|---|--|
| 1 | Angophora costata | 15 | 7 | Good | Good | Medium (15-40 years) | High | 400 | 4.8 | 2.3 | High | High impact | Remove | Pruned, tree located in first garden bed |
| 2 | Syzygium jambos | 9 | 8 | Fair | Fair | Medium (15-40 years) | Medium | 300 | 3.6 | 2.0 | Medium | High impact | Remove | Significant dead wood, tree located in first garden bed |
| 3 | Angophora costata | 13 | 4 | Fair | Good | Medium (15-40 years) | Medium | 300 | 3.6 | 2.0 | Medium | High impact | Remove | Tree located in first garden bed 1 |
| 4 | Ulmus parvifolia | 15 | 12 | Good | Good | Medium (15-40 years) | High | 600 | 7.2 | 2.7 | High | High impact | Remove | Tree located in fairy garden and is 5 m of proposed construction works with a large overhanging canopy |
| 5 | Angophora costata | 13 | 7 | Fair | Fair | Medium (15-40 years) | Medium | 300 | 3.6 | 2.0 | Medium | No impact | Retain | Stockpiling occurring within TPZ, tree located in second garden bed |
| 6 | Angophora costata | 13 | 6 | Fair | Fair | Medium (15-40 years) | Medium | 360 | 4.3 | 2.2 | Medium | No impact | Retain | Canker on trunk, tree located in second garden bed |
| 7 | Angophora costata | 10 | 6 | Fair | Good | Medium (15-40 years) | Medium | 300 | 3.6 | 2.0 | Medium | Medium impact | Retain subject to further investigation | Pruned, recent excavation near tree, tree located in third garden bed |
| 8 | Syzygium australe | 6 | 4 | Fair | Fair | Medium (15-40 years) | Medium | 400 | 4.8 | 2.3 | Medium | Medium impact | Retain subject to further investigation | Multi stemmed, one sided prune, located at the drive exit near entrance to SCH |
| 9 | Tristaniaopsis laurina | 4 | 1 | Fair | Poor | Short (5-15 years) | Medium | 120 | 2.0 | 1.5 | Low | High impact | Remove | Heavily pruned located on construction site |

Appendix E Tree protection guidelines

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

E1 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 any machinery or material are brought to site and before the commencement of works.
- Prominently sign posted with 300 mm x 450 mm boards stating, "NO ACCESS - TREE PROTECTION ZONE".

E2 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.

E3 Trunk protection

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

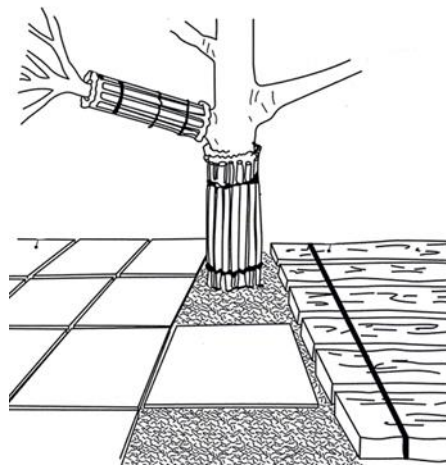
The removal of bark or branches allows the potential ingress of micro-organisms which may cause decay. Furthermore, the removal of bark restricts the trees' ability to distribute water, mineral ions (solutes), and glucose.

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

E4 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. Maintain a thick layer of mulch around all retained trees to a depth of 100 mm using coarse pine bark or wood chip material that complies with AS 4454. Where the existing landscape within the TPZ is to remain unaltered (e.g. garden beds or turf) mulch may not be required.

For heavy vehicle access within TPZ, ground protection may include a permeable membrane such as geotextile fabric beneath a layer of 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.

E5 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.

E6 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), non-destructive excavation (NDE) methods such as hydro-vacuum, Air Spade or manually excavated trenches. The horizontal drilling/boring must be at minimum depth of 600 mm below grade. Trenching for services is to be regarded as “excavation”. The project arborist should assess the likely impacts of boring and bore pits on retained trees.

Appendix F Early Works REF Civil Report (Meinhardt Bonacci Pty Ltd n.d.)

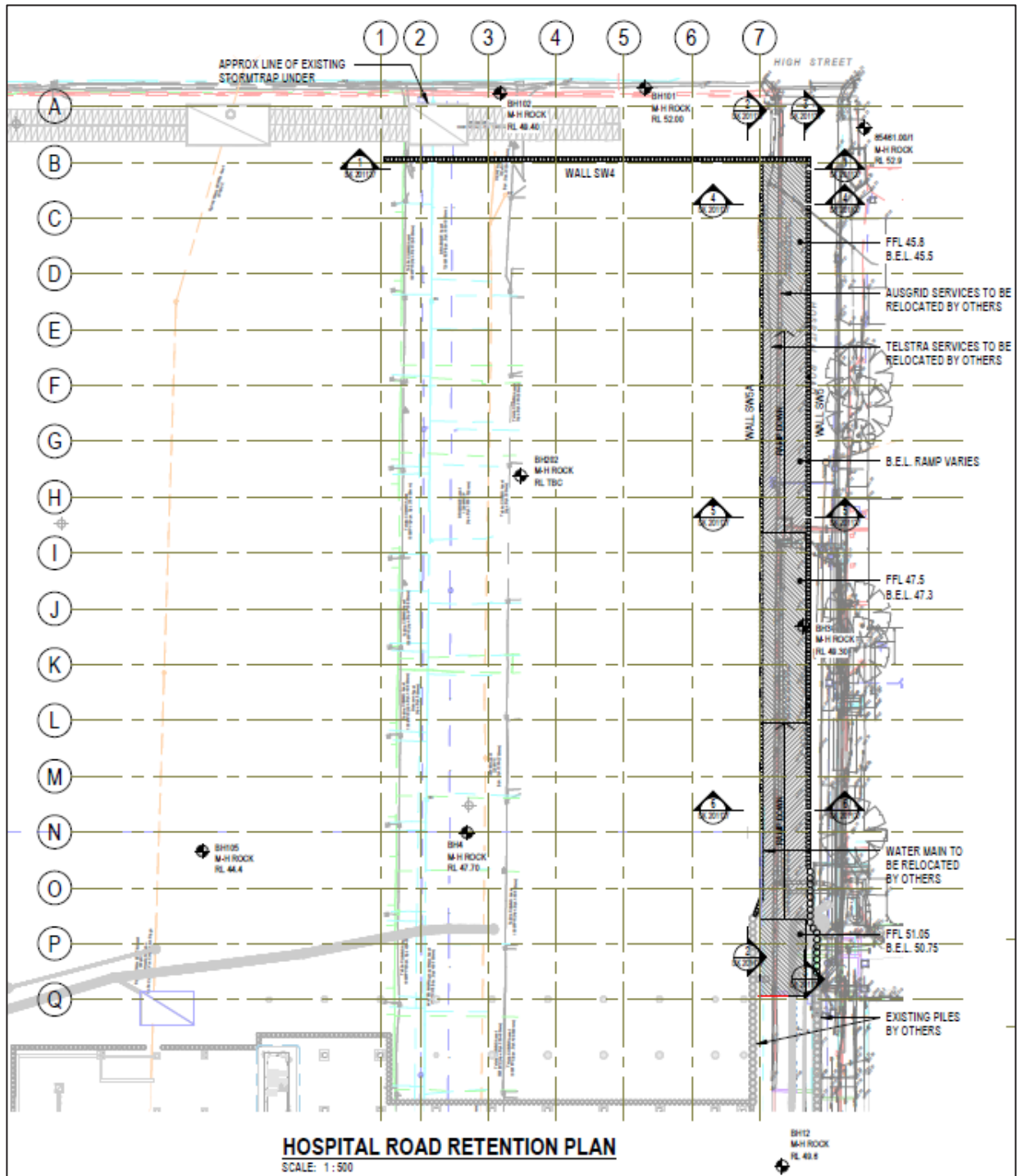


Figure 7: Hospital road retention plan

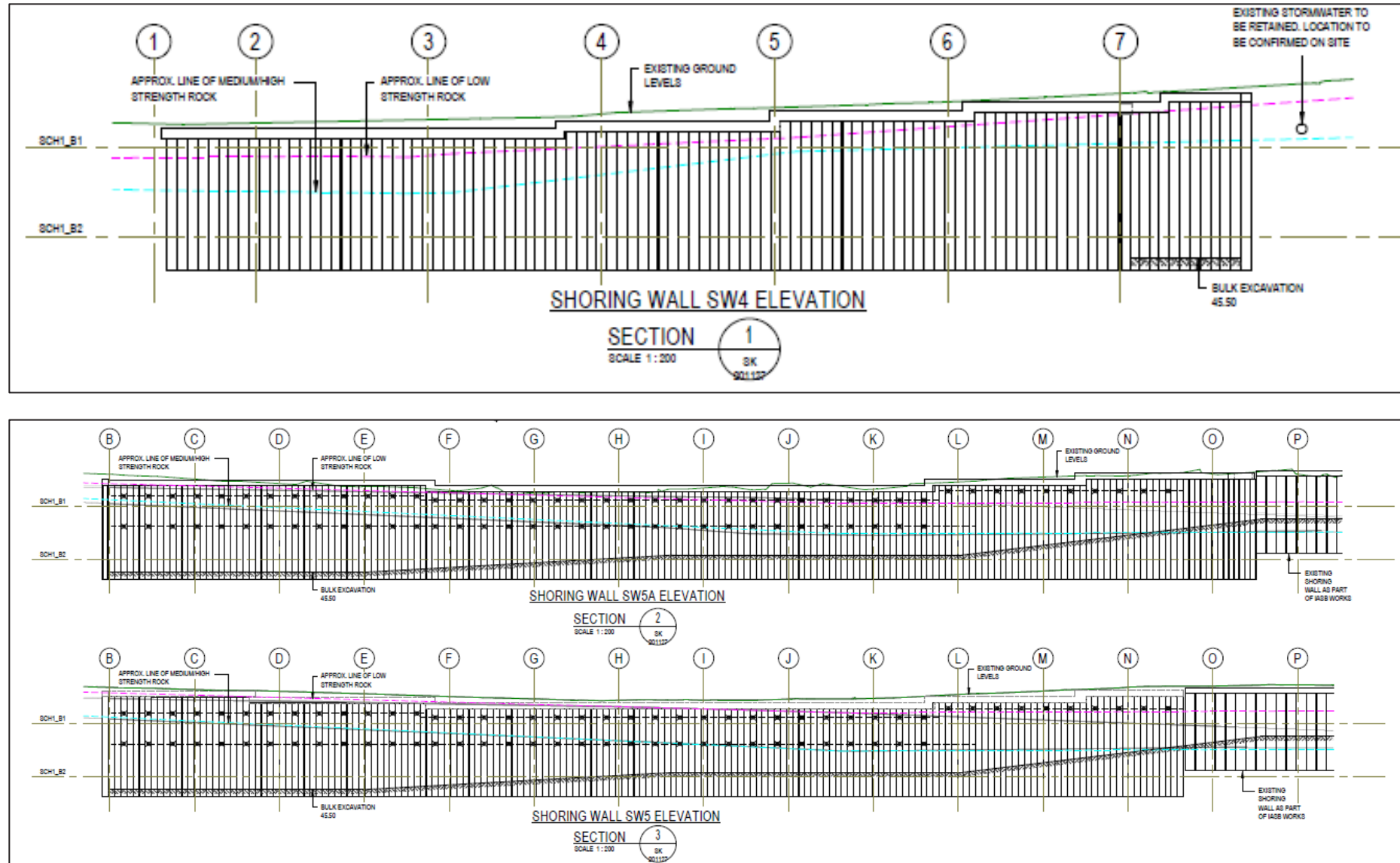


Figure 8: Elevation

Appendix G Site photos



Figure 9: Trees 1 to 8 on the east side of Hospital Road and Tree 9 on west side of Hospital Road



Figure 10: Tree 9



Figure 11: No trees remaining on the construction site



Figure 12: Construction work occurring in proximity to trees recommended for trunk protection within the garden bed



Figure 13: Tree 1



Figure 14: Tree 2



Figure 15: Tree 3



Figure 16: Tree 4



Figure 17: Tree 5



Figure 18: Tree 6



Figure 19: Tree 7



Figure 20: Tree 8



Figure 21: Tree 9

