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ARBORICULTURAL ASSESSMENT – BUILDING B

s. 96 Proposal for Approved Development:

Stage 1 Works, 120-128 Herring Road, Macquarie Park, NSW

Prepared for Toga Macquarie Developments Pty Ltd

45 Jones Street, Ultimo. NSW

Prepared by Catriona Mackenzie

10 August, 2012

INTRODUCTION

1. The development approval issued by City of Ryde ("Council") in January 2012 for the application to undertake basement excavation works for an approved residential development at 120-128 Herring Road, Macquarie Park ("Site"), includes the retention of a number of trees ("the trees") identified on an approved Tree Management Plan.

2. Prior to the commencement of approved works on the site, conflicts between the retention of the trees and the excavation and construction of the approved buildings and ancillary structures were identified by members of the project management team of Toga Group.

3. An on-site meeting in April, 2012 was arranged between consulting arboriculturist Catriona Mackenzie of Urban Forestry Australia ("UFA") and Toga Group Design Manager Donna Pye and Project Manager Stephen Jakubiw, to consider the issues raised regarding construction and tree retention.

4. UFA undertook limited, ground level inspections of the potentially affected trees, a general assessment of the current site features, and reviewed documentation pertaining to the approved site development.

5. This report assesses the approved development in relation to concerns raised by Toga Group in regards to the impacts of approved works on the safe and viable retention of Trees 21, 22 and 23. This report provides recommendations for the removal or retention of the trees based on the findings of UFA.

6. This report is not intended to replace or supersede the recommendations for protection of trees in the Tree Report by Treescan ("TS"), March 2010, prepared for the initial development application.

DOCUMENT REVIEW

7. I have reviewed the following documentation in preparation of this Report:
   - 7.1 Development Consent LDA2011/0578, January, 2012, City of Ryde Council,
   - 7.2 Tree Management Plan ("TMP"), Dwg. L5, Rev. E, dated 05/03/10, Landscape Concept Plans L1-L11, dated 25/10/11 and TMP, Dwg LP-3, Rev. C, dated 09.08.12, prepared by Turf Design Landscape Architects.
   - 7.3 Tree Report, dated March, 2010, prepared by Treescan,
   - 7.4 Section BB, Dwg. No. A-B 232, Rev. T1, dated 17/02/2012 by Turner & Associates.
   - 7.5 Marked up excerpts of Set-out plans for works near the subject trees, provided by Donna Pye of Toga Group.

OBSERVATIONS AND DISCUSSION

8. Trees 21, 22 and 23 – *Eucalyptus punctata* (Grey Gum)
These three (3) Grey Gums are located in the northeast side landscape setback between building B and the adjoining property. During the site inspection and review of the TMP, UFA noted these trees are to be retained.

9. The three trees are growing within 2 – 3m of each other and each has an asymmetrical branch arrangement due to the proximity of its neighbour. Each tree protects its neighbour from winds, but also inhibits branch growth towards each tree. The tree crowns do not interconnect, but essentially form one main crown supported on three stems. For that reason, UFA has determined the potential impacts of development and how they affect the group, rather than individually.

10. The trees are the same age and size, and all are of good vigour. Tree 22 has the greatest stem diameter, which was used to determine the theoretical *Structural Root Zone* ("SRZ")[1] and *Tree Protection Zone* ("TPZ")[2] offsets for the trees.

11. The TS report does not specifically address these trees in its assessment of potential development impacts and how they are to be protected from those impacts. The TS report notes in the last paragraph, page 3;

> *"Within the 6m setback from the eastern boundary there are a few semimature specimens of planted native trees which could possibly be retained. The root systems of these trees are not widespread and given care during initial excavation some could be retained……"*

12. There is no explanation as to how the author arrived at the conclusion the trees do not have widespread root systems, but does note only that trees could possibly be retained.

13. In the absence of any supporting material UFA has based its estimation of development impacts on the guidelines of Australian Standard 4970-2009 *Protection of trees on development sites* ("AS4970"). Under AS4970 encroachments less than 10% of the TPZ are considered to be minor. This 10% figure is taken to be a threshold and trigger where arboricultural investigations into TPZ encroachments beyond this figure need to be considered. The potential extent of impacts to these trees can be generally rated using table 1, below.

IMPACT LEVEL RATING	
-	0 – 0.9% of root zone impacted – ***no*** impact of significance
L	1 to 10% of root zone impacted – ***low*** level of impact
L - M	>10 to 15% of root zone impacted – ***low to moderate*** level of impact
M	>15 to 20% of root zone impacted – ***moderate*** level of impact
M – H	>20 to 25% of root zone impacted – ***moderate to high*** level of impact
H	>25 to 35% of root zone impacted – ***high*** level of impact
S	>35% of root zone impacted – ***significant*** level of impact

Table 1: Guideline to the rating of impacts on trees to be retained.
Note: The table has been developed by IACA to assist its members in the assessment of TPZ encroachments over the prescribed 10%. The figures are intended to be a general guide only as they may vary due to the specific conditions and constraints on a particular site, tree species tolerance to impacts, age, vigour, condition of the tree, etc.

14. Tree 22 has a *Diameter at Breast Height* ("DBH")[3] of 600mm. Using the formula in s.3.3.5 of AS4970 the SRZ is a radial offset of 2.9m from the centre of each tree[4].

15. The TPZ for each tree is a radial offset of 7.2m from the centre of each tree.

16. A number of fundamental conflicts were identified by UFA during the site meeting with TG, and upon subsequent detailed review of approved development plans.
    16.1 The trees are currently buffered from strong westerly winds by several trees that are to be removed.
    16.2 Tree 22 in particular has *co-dominant*[5] stems with a distinct *compression fork*[6] in the main stem, and other compression forks in large branches. These defects will be exposed after removal of protective trees and be prone to failure.
    16.3 Excavation within the SRZ of the trees may lead to tree instability.
    16.4 Excavation encroachment into the TPZ of the trees is highly likely to lead to tree decline.
    16.5 Substantial pruning of the trees will be required to accommodate the pile rig and scaffolding necessary to construct the building.
    16.6 The approved building will be several times higher than the trees and essentially remove any direct light on to the south and west sides of the trees. This overshadowing, combined with significant tree root loss and substantial pruning, will result in the trees having a substantially reduced capacity for sustained growth.

17. The presence of co-dominant stems in Trees 21 and 22, whilst a common feature of trees, is also an identifiable defect that has a higher than normal risk of failure, which is exacerbated by the presence of a compression fork. Sudden exposure to unaccustomed wind forces after removal of protecting trees raises the risk of failure of such defective tree parts.

18. In terms of construction access and safety there is a requirement for some batter of the excavation. The batter shown in Figures 1 and 2 below could potentially be reduced, but this would not be sufficient to avoid a substantial SRZ encroachment.

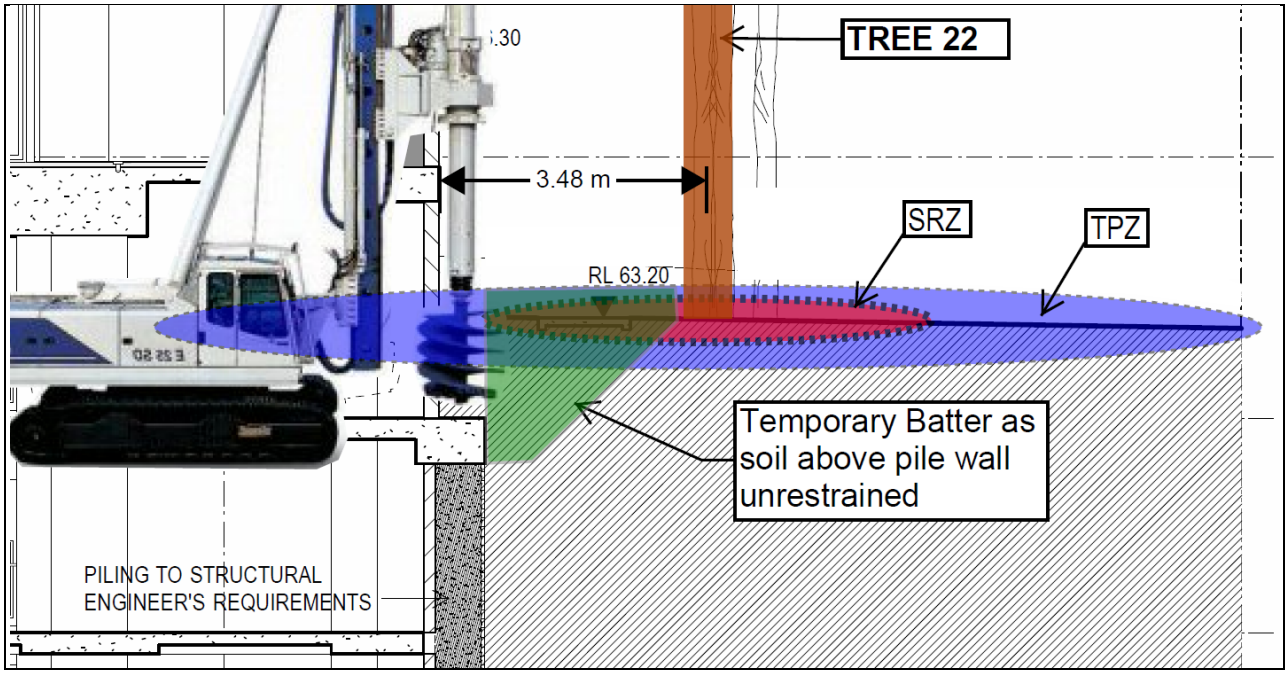

Figure 1 Shows the SRZ and TPZ of T22 and the likely encroachments dues to piling and excavation batter.
Drawing ref.A_B 232, Section BB, marked up by C. Mackenzie. Drawing not to scale.

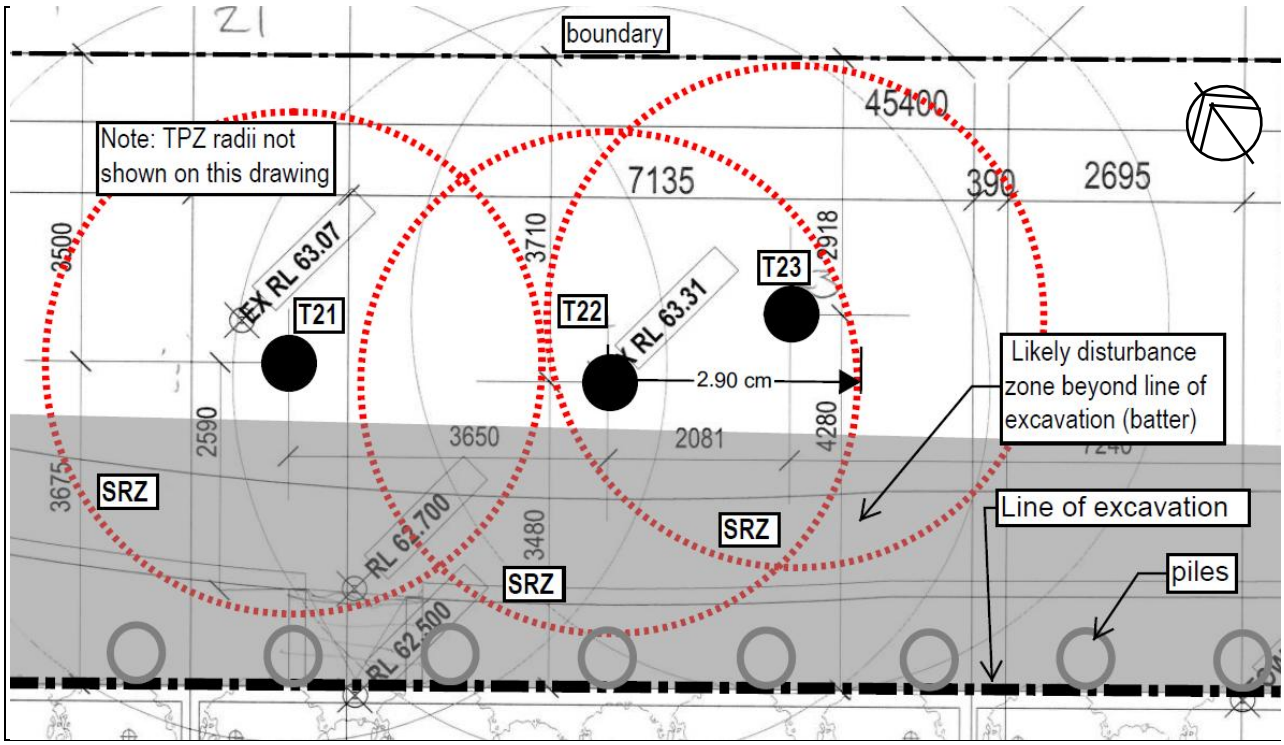

Figure 2
Shows the SRZ 's of the three trees (red, dashed circles) and the identified encroachments.
Set-out plan, marked up by C. Mackenzie. Drawing not to scale.

19. *Root mapping*[7] was discussed during the onsite meeting between UFA and TG. Whilst UFA believes there is potential to reduce the excavation batter slightly and root mapping within the SRZ would confirm whether significant *woody roots*[8] anchoring the trees would be affected, it is the opinion of UFA that the trees will suffer substantial *non-woody root*[9] loss due to the building location within large portions of the tree's TPZ's.

20. The TPZ encroachments (including excavation batter) are estimated to be in the vicinity of 68m^2 or 41.75% (slightly more for T21 and slightly less for T23) which is a significant level of root loss from which the trees are unlikely to recover.

21. Pruning of the trees to accommodate the pile rig and construction scaffolding will potentially remove up to 30% - 40% of the current foliage on the trees. This will leave the trees severely stressed, with little ability to compensate for root loss from excavation.

22. Root loss, and unbalanced crowns due to pruning, will leave the trees unstable and at risk of falling and causing property damage or personal injury, although it is likely the trees will suffer severe decline via development impacts and overshadowing that their subsequent removal will likely occur before the trees fail.

CONCLUSIONS

23. The TS assessment did not take into account the cumulative effects of development activities on the viability and retention of the trees. However, the TS report appears to recognise adverse impacts were likely as the report states the trees *"could possibly be retained".* The more detailed tree impact assessment by UFA identified greater impacts that significantly affect tree viability and retention.
24. The approved development does not provide for adequate tree crown and root protection areas with suitable excavation offsets and construction access requirements.
25. The trees have identifiable defects that will be prone to failure under wind after the removal of nearby trees.
26. There is insufficient space to successfully retain Trees 21, 22 and 23 in good vigour and sound anchorage.
27. Replacing the trees with appropriate species will be a better and safer long term landscape outcome for the development.

RECOMMENDATIONS

28. Trees 21, 22 and 23 (Grey Gums) – Remove due to identified significant excavation and construction impacts resulting from the approved development.

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End Notes -Terms and Definitions

[1] **Structural Root Zone** (SRZ) Refers to the radial distance in metres, measured from the centre of the tree stem, which defines the critical area required to maintain stability of the tree. Only thorough investigation into the location of structural roots within this area can identify whether any minor incursions into this protection zone are feasible.
Note: The SRZ is calculated on the diameter measured immediately above the root/stem buttress (DAB). Where this measurement is not taken in the field, it is calculated by adding 12.5% to the stem diameter at breast height (DBH).(Based on averages calculated from DBH and DAB measurements taken from 20 mature Brush Box and Camphor Laurel).
Note: The SRZ may not be symmetrical in shape/area where there is existing obstruction/confinement to lateral root growth, e.g. structures such as walls, rocky outcrops, etc).

[2] **Tree Protection Zone** (TPZ). Refers to the radial distance in metres, measured from the centre of the tree stem which defines the tree protection zone for a tree to be retained. The TPZ is a combination of the root area and crown area to be protected. This is generally the minimum distance from the center of the tree trunk where protective fencing or barriers are to be installed to create an exclusion zone. The TPZ surrounding a tree aids the tree's ability to cope with disturbances associated with construction works. Tree protection involves minimising root damage that is caused by activities such as construction. Tree protection also reduces the chance of a tree's decline in health or death and the possibly damage to structural stability of the tree from root damage. To limit damage to the tree, protection within a specified distance of the tree's trunk must be maintained throughout the proposed development works. No excavation, stockpiling of building materials or the use of machinery is permitted within the TPZ. Note: In many circumstances the tree root zone does not occupy a symmetrically radial area from the trunk, but may be an irregular area due to the presence of obstructions to root or branch spread or inhospitable growing conditions.

[3] **Diameter at Breast Height** (DBH) refers to the tree trunk diameter at breast height, i.e. measured at 1.4 m above ground level.

[4] s.3.3.5 of AS4970 provides its formula for determining the SRZ radius as $R_{SRZ} = (D \times 50)^{0.42} \times 0.64$

[5] **Co-dominant** refers to stems or branches equal in size and relative importance.

[6] **Compression fork** A fork formed where two stems or branches with an acute branch crotch grow pressing against each other with included bark. Eventually the bark becomes enclosed bark where the stems flatten at their interface under increasing compression from each successive growth increment, forming a weak graft as a welded fork, which remains susceptible to tensile stress.

[7] **Root Mapping** The exploratory process of recording the location of roots usually in reference to a datum point where depth, root diameter, root orientation and distance from trunk to existing or proposed structures are measured. It may be slightly invasive (disturbs or displaces soil to locate but not damage roots, e.g. hand excavation, or use of air or water knife), or non-invasive (does not disturb soil, e.g. ground penetrating radar).

[8] **Woody roots** usually used in reference to the first order roots i.e. structural (anchor) roots and woody lateral roots within the Structural Root Zone. Damage, disturbance to, or severing of these roots can compromise the stability of the tree

[9] **Non-woody roots.** Roots where the primary function is the absorption of water and nutrients in solution. Smallest non-woody roots also referred to as 'fibrous' or 'fine' roots. Protection and retention of these roots is important to tree viability. Some non-woody root loss is tolerable, depending on the tree's age, vigour, species tolerance, growing conditions, etc.