



# Arboricultural Assessment

## 35 - 39 Regent Street, Mount Waverley

Prepared for: Japara HealthCare

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**tree**logic

*Tree management for the urban forest*

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### Title Page Images

Left: View to the south-east of the site showing the relative size, condition and location of tree 8, a Monterey Pine (*Pinus radiata*) and tree 9, A Golden Elm (*Ulmus glabra* 'Lutescens').

Above View to the south-west showing trees 12 and 13, both Evergreen Alders (*Alnus acuminata* subsp. *glabrata*) and tree 16, an unknown tree species that was akin to a large shrub or small tree.

Below Right: View to the north-east from the tennis court showing trees 23 and 24, both Californian Palms (*Washingtonia filifera*) to the left and right of the image.

## 1. Objectives

- 1.1. To provide an arboricultural assessment and report for trees located within two adjacent sites at 35 - 39 Regent Street, Mount Waverley.
- 1.2. To provide information on the species, origin, dimensions, health and structure of the trees and their appropriateness for retention.
- 1.3. To offer recommendations regarding the management of the trees, including tree protection measures for retained trees.
- 1.4. Determine the Tree Protection Zones (TPZ) for assessed trees compliant with *AS 4970 2009 Protection of trees on development sites*.

## 2. Method

- 2.1. A site inspection was carried out on Thursday February 11, 2016 at 35 – 37 Regent Street and a second site inspection was undertaken at 39 Regent Street, Mount Waverley on Thursday May 5, 2016. The trees were inspected from the ground and observations were made of the growing environment and surrounding area. The trees were not climbed and no samples of the tree or site soil were taken.
- 2.2. Assessment details of individual trees are listed in the Tree Assessment Table in Appendix 1. A copy of the tree plan can be seen in Appendix 2.
- 2.3. Observations were made of the assessed trees to determine species, origin, age category, and condition. Measurements were taken to establish tree crown height (measured with a height meter), crown width (paced) and trunk dimensions (measured 1.4m up the trunk with a diameter tape unless otherwise stated). Descriptors used in the tree assessment can be seen in Appendix 3.
- 2.4. Only trees were assessed. A tree is generally a plant with a height greater than 5 metres and has a single trunk diameter greater than 150 mm at a height of 1.4 m above ground level.
- 2.5. Trees located in the adjoining properties were observed from within the subject sites. Tree dimensions were estimated and observations were limited to what could be seen from particular vantage points. The trunk and buttress of trees 31, 32 and 33 and the buttresses of tree group 4 were obscured by a paling fence and a DBH and /or basal measurement was not able to be recorded.
- 2.6. Each of the assessed trees was attributed an 'Arboricultural Rating'. The arboricultural rating correlates the combination of tree condition factors (health and structure) with tree amenity value. It should be noted that the arboricultural rating is different to the conservation/ecological values placed on trees by other professions. Definitions of arboricultural ratings can be seen in Appendix 3.
- 2.7. The assessed trees have been allocated tree protection zones (TPZ). The Australian Standard, *AS 4970-2009 Protection of trees on development sites*, has been used as a guide in the allocation of TPZs for the assessed trees. This method provides a TPZ that addresses both the stability and growing requirements of a tree. TPZ distances are measured as a radius, from the centre of the trunk at (or near) ground level. All TPZ measurements are provided in Appendix 1.

## 2.8. Documents reviewed include:

- Planning property reports and City of Monash planning zones and overlays. Both sites are scheduled to the General Residential Zone (GRZ2) ([www.dtpli.vic.gov.au/planning](http://www.dtpli.vic.gov.au/planning), cited 16/02/2016).
- Schedule 1 to the Vegetation Protection Overlay (VPO1) applies to both 35 -37 and 39 Regent Street, Mount Waverley.
- Under VPO1, a permit is required to remove or destroy vegetation with a trunk circumference greater than 500 mm (160 mm diameter) at 1200 mm above ground level and is higher than 10 metres.
  - An exemption to the permit applies to dead trees, Monterey Pines (*Pinus radiata*) and Evergreen Alders (*Alnus acuminata* subsp. *glabrata*).

## 2.9. The Monash Conservation Policy (22.05) applies to all land within the City of Monash.

- The aims of the policy are to retain existing semi-mature and mature canopy trees where possible, to retain and protect existing street trees and that semi-mature trees with a spreading crown are planted as part of any new development to reinforce the Garden City character of the area.

## 3. Observations

- 3.1. The site inspections were undertaken on two residential allotments existing side by side located on the western side of Regent Street, Mount Waverley. Residential allotments were located adjacent to the subject sites to the north and south with the south-east section of Valley Creek Reserve located to the west. See Figure 1 for aerial view of the subject site.
- 3.2. Both sites had been highly modified and were approximately 4052.1m<sup>2</sup> (35 – 37 Regent St) and 2, 000m<sup>2</sup> in size (39 Regent Street). The sites were generally dominated by dwellings, pools, tennis courts and hard surfaces. Canopy trees generally lined the front setback that contributed to the aesthetic value of the streetscape. Ornamental plantings were mostly found along the boundary perimeters with areas of turf grass and several trees were growing within the road reserves of both sites.





Figure 1: Red dashed outline indicates the subject site at 35 - 39 Regent Street, Mount Waverley.

- 3.3. As a result of the site modifications, the adjacent Valley Creek Reserve sloped away from 35 – 37 Regent Street to the south-west and there was a grade difference between the subject site and the northern property adjacent to several neighbouring trees. This grade difference may have prevented the roots from the adjacent trees from developing into the subject site.
- 3.4. The vegetation within 35 – 37 Regent Street consisted mostly of mature trees planted around the perimeter with understorey shrubs and herbaceous plantings. Several specimens of Monterey Pine and one Yellow Box (*Eucalyptus melliodora*) dominated the site in terms of canopy cover. Several group plantings were assessed where trees of the same species and size had been planted and developed in response to each other and the prevailing environmental conditions. Several Queen Palms (*Syagrus romanzoffiana*) and Californian Palm (*Washingtonia filifera*) had been planted around the pool area and entrance to the tennis court. The palm trees were a feature of the pool area, however they contributed a minor amount to the overall canopy cover.
- 3.5. The vegetation within 39 Regent Street consisted of several mature trees located within the front setback that contributed to the streetscape. Smaller trees, shrubs and a turfed area were landscape features within the rear setback. Close plantings of Late Black Wattles (*Acacia mearnsii*) were noted within Valley Reserve to the west.
- 3.6. Fifty (50) individual trees and four (4) tree groups (comprising 25 stems) in total were inspected. Refer to Appendix 1 for tree assessment detail and Appendix 2 for tree locations and numbering.
- 3.7. Trees 27, 31, 32, 33 and tree group 4 were located in the adjacent property to the north. Trees 35 – 37 and 50 were planted within the road reserve of Regent Street and trees 42 – 47 were located within Valley Reserve. The remaining trees were located within the subject sites.

3.8. The origin of all trees was assessed to identify trees native to Victoria or trees that were of other botanical significance.

- Eleven (11) trees, being trees 4, 26, 36, 37, 40 and 42 – 47 were all Victorian native tree species.
- Nine (9) trees, being trees 1, 27, 28, 33, 35, 38, 39, 49 and 50 were Australian natives.
- Nine (9) trees being trees 2, 3, 9, 14, 15, 22, 34, 41 and 48 were all exotic deciduous tree species.
- Twelve (12) trees, being trees 10 - 13, 16 – 21, 31, 32 and tree group 2 were all exotic evergreen tree species.
- Five trees, being trees 5 – 8, 25 and tree group 4 were all exotic conifer tree species.
- Four (4) trees, being trees 23, 24, 29, 30 and tree groups 1 and 3 were exotic palm species.

3.5 Tree health was assessed based on foliage colour, size and density as well as shoot initiation and elongation.

- In general, the majority of the assessed trees were in fair health displaying characteristics considered to be fair for the species growing under the current environmental conditions.
- Nine (9) trees displayed symptoms of reduced health including sparse canopy or reduced crown density, minor dieback or the presence of boring insects.
- Trees 2 and 9, both Golden Elms (*Ulmus glabra* 'Lutescens') and Tree 22, an English Elm (*Ulmus procera*) displayed signs of Elm leaf Beetle. The extent of the beetle population was more pronounced in the English Elm, however the beetles can be treated successfully to improve tree health and canopy density.
- Tree 46 located in the adjacent western reserve was displaying decline symptoms, including the presence of borer and minor dieback.

3.6 Tree structure was assessed for structural defects and deficiencies, likelihood of failures and risk to potential targets.

- In general, the tree population displayed Fair structure that could be considered typical for the tree species. Some structural deficiencies were present within these trees, however they had shown to adapt and optimise their structures to compensate for any weakness that was present.
- Structural deficiencies and defects were noted in the population and largely resulted from the close proximity of the plantings with the mature dominant trees suppressing lesser individuals. Other deficiencies included; acute or included unions or over-extended branches.
- Tree management recommendations are provided for trees 4 and 8 to address over-extended limbs. Pruning details can be seen in the Tree Assessment Table attached as Appendix 1. Any pruning recommendations must be undertaken by a suitably qualified and experienced arborist and comply with Australian Standard AS 4373-2007 - *Pruning of Amenity trees* to extend the useful life expectancy of retained trees.

- 3.7 The assessed trees were given an arboricultural rating. This rating relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics within an urban landscape context. It should be noted that the arboricultural rating is different to the conservation/ecological values placed on trees by other professions. See Table 1 for arboricultural rating attributed to each tree feature.

*Table 1: Summary of Arboricultural Rating.*

Arboricultural Rating	Total	Trees number
High	2	4, 38
Moderate	21	3, 5, 6, 7, 8, 9, 13, 18, 23, 24, 25, 27, 29, 30, 31, 32, 34, 35, 40, 47, 50, tree group 4
Low	27	1, 2, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22, 26, 28, 33, 36, 37, 39, 41, 42, 43, 44, 45, 46, 48, 49, tree group 1, 2, 3
<b>Total</b>	<b>50 and 4 tree groups</b>	

- 3.8 An overview of arboricultural ratings used by Tree Logic (April 2015). Descriptors used in the rating can be viewed in Appendix 3.
- High rated trees of high quality in good to fair condition. Retention of such trees is highly desirable and have the best potential to be medium to long term components of the landscape if managed appropriately.
  - Moderate rated trees represent trees of fair or better condition. They are suitable and desirable for retention as having the potential to be medium to long term features of the surrounding landscape if retained and managed appropriately.
  - Low rated trees were generally displayed below typical health and/or structure or of diminutive size. Low rated trees are not considered to be worthy of being a constraint on reasonable design intent and development within the site. Such trees may still contribute to the landscape amenity as an established tree resource and have the potential to be retained if appropriate tree protection measures and arboricultural maintenance is provided as required.

## 4. Permit Requirements

- 4.1 Tree controls apply to the site under Schedule 1 to the Vegetation Protection Overlay (VPO1).
- 4.2 Based upon the planning overlay covering the site, trees 4, 5, 6, 18, 22, 24, 27, 28, 29, 30, 31, 32, 34, 38, 40 and tree groups 1 and 4 would require a permit if they are to be removed, lopped or destroyed.
- 4.3 Trees 35 – 37, 42 – 47 and 50 are the property of the City of Monash and would require permission from the council if they are to be removed, lopped or destroyed.
- 4.4 No permit is required to undertake pruning works to maintain or improve a trees health, structure or appearance.

## 5. Tree Protection Zones (TPZ).

- 5.1. The Tree protection zones (TPZ's) provided for each tree in the Tree Assessment Table in Appendix 2 and referred to in this statement, are calculated using the formula provided in the Australian Standard AS4970 where the Radial TPZ = Trunk diameter (DBH) measured at 1.4m above grade (unless otherwise stated) and multiplied by 12. TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level. A TPZ should not be less than 2m nor greater than 15m.
- 5.2. The TPZ forms an area around a tree or group of trees that addresses both the stability and growing requirements of a tree. Construction and worksite activities within the TPZ need to be determined to assess their impacts in order to preserve tree condition.
- 5.3. Minor encroachment, up to 10% of the TPZ area, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Encroachment greater than 10% is considered major encroachment under AS4970 and is only permissible if it can be demonstrated that after such encroachment the tree would remain viable.
- 5.4. The structural root zone provided for each tree has been calculated using the method provided in AS4970. The Structural Root Zone (SRZ) is the area in which the larger woody roots required for tree stability are found close to the trunk and which then generally taper rapidly. This is the minimum area recommended to maintain tree stability but does not reflect the area required to sustain tree health. No works are permitted within the SRZ radius as tree stability could be compromised.
- 5.5. See Appendix 4 for TPZ establishment and types of encroachment.

## 6. Design Considerations

- 6.1. The pre-development arboricultural inspection report provides planners and designers with information on the measures required to protect trees suitable to be retained. At the time of undertaking the tree assessment there was no requirement to undertake a concept design review.
- 6.2. In the absence of formal design plans, it is not appropriate to speculate on which trees are most appropriate for retention beyond the general guide provided by the arboricultural ratings attributed to each tree feature. It is understood that an aged care facility is to be constructed on the site with a basement car park. Entry into the basement will require the construction of a retaining wall along the face of the excavation.
- 6.3. It is recommended that trees of High and Moderate arboricultural value be considered for retention and protection over trees of Low arboricultural value during any redevelopment of the site.
- 6.4. The Low rated trees within the site were either deficient in health or structure or were of small size and were not worthy of being a constraint on reasonable design intent.
  - 6.4.1. However not all Low rated trees should be dismissed altogether. Some Low rated trees can be retained as an established tree resource where they are not impacted directly by any proposed construction activity or where they perform a role such as screening neighbouring properties or the like or protect from erosion, winds, frosts or other actions.



6.5. Tree 4, a Yellow Box (*Eucalyptus melliodora*) and tree 38, a Lemon-scented Gum (*Corymbia citriodora*) were both prominent trees within the subject sites and attributed with an arboricultural rating of High. A non-destructive root investigation was carried out adjacent to both trees to ascertain the extent of root growth within the subject sites and to inform design intent. See Appendix 6 and 7. The following findings and recommendations were provided within the accompanied reports.

- Typically root growth was within the upper soil profile, however the roots of the Yellow Box (tree 4) were located at deeper soil depths. The roots associated with the Yellow Box were extending into the proposed basement footprint and would be lost as part of the proposed development. Yellow Box trees have a good tolerance to root loss and based upon the diameter and number of roots in relation to the size of the tree, it is expected for the tree to tolerate the amount of root loss from the proposed basement alignment.
- It was recommended that the excavation of the 3m deep basement adjacent to Tree 4 must not occur beyond the proposed alignment as stipulated in the ground Floor Plan, TP-04, dated 21/06/2016.
- The root investigation alignment identified higher order roots extending to the south-west of tree 38 that had developed with sinker roots as well as a number of smaller diameter roots. The sinker roots are important to stabilise the tree and aid water and nutrient uptake, particularly during extended dry periods. These sinker roots would be lost in relation to the proposed retaining wall alignment that could impact upon the health and stability of the tree.
- It is recommended Modify the design, so the retaining wall alignment, including drainage is no closer than 5m on the western side from tree 38. The 7.3m retaining wall alignment to the south of the tree can be maintained.
- Further recommendations have been provided within Appendix 6 and 7 in relation to control measures to be adopted and implemented during construction activity surrounding trees 4 and 38.

6.6. Trees located in the neighbouring northern property and within the Regent Street road reserve must be considered for retention within the site redevelopment.

6.6.1. Two non-destructive root investigations were carried out as part of ascertaining the extent of root growth into the subject site from neighbouring trees in the northern adjacent property (33 Regent Street). See Appendices 8 and 9. The investigations were undertaken adjacent to tree 27 and trees 33 and tree group 4 to inform design intent. The following findings and recommendations provided within the root investigation reports are noted below.

- The construction footprint is to be no closer than 2.4m from tree 27, which includes excavation for footings or trenching for the installation of utility services.
- Within proposed designs, the existing site conditions between the common boundary and construction footprint, and for the diameter of the 4.2m TPZ of tree 27 must be maintained. No soil grade changes are to occur within this area.
- If a path is proposed within the 4.2m TPZ of tree 27, all of the profiles, including the capping layer are to be permeable in design and construction and built above the existing soil grade.

- A minimal amount of tree roots from tree 33 and tree group 4 have developed within the subject site that have mostly deflected along the edge of paving. The loss of these roots is expected to have a negligible impact upon tree health and the ongoing condition of the trees is expected to be maintained.
- Proposed design plans should aim to locate the construction footprint, including excavation, the installation of utility services or construction of a retaining wall a minimum of 800 mm from the northern property boundary adjacent to tree 33 and tree group 4.
- Further recommendations have been provided within Appendix 8 and 9 in relation to control measures to be adopted and implemented during construction activity surrounding trees 27, 33 and tree group 4.

6.6.2. Trees 31 and 32 are also located within the adjacent northern property (33 Regent Street). An adjacent cement sheeting wall abutted the trees within the subject site providing some difficulty in obtaining measurements for these trees. Recommendations concerning these trees is limited to the existing site conditions that have prevented extensive root development into the subject site. A concrete slab had been poured around the edge of the swimming pool with a plastic root barrier installed along its edge. The edge of the concrete was approximately 2m from the property boundary. It is unlikely that roots from the neighbouring trees have extended beyond the concrete slab and this distance should be maintained within new designs to minimise impacts to trees 31 and 32. The existing soil grades must be maintained within the 2m area and extend for the length of the canopy widths.

6.7. The tree protection zones (TPZ) have been determined for each tree based on the Australian Standard for Protection of Trees on Development Sites (AS 4970-2009). The method for calculating, applying and managing the tree protection zone is described in Appendix 4.

6.7.1. Where palms are considered for retention within new designs, the TPZ should be no less than 1 m outside the crown projection. However based upon the root morphology or palms, encroachment within the canopy extent would be acceptable, but must be no closer than 1m from the edge of the root system.

6.7.2. Where construction related activity is confined to only one side of the tree, the nominal TPZ may be reduced by 10% of the TPZ area which is equivalent to approximately 1/3 radial distance providing additional area contiguous with the TPZ is available for new root development.

6.7.3. Encroachment beyond 10 % of the TPZ of any retained tree must be based on consultation with the site arborist or relevant authorities and the results of a non-destructive root investigation (NDRI) in conjunction with root sensitive construction methods.

6.8. Trees located within the section of Valley Creek Reserve adjacent to 35 – 37 Regent Street were not assessed, however the distance the trees are set back from the site and the sloping nature of the land suggests that the trees are unlikely to be affected by development within the site.

6.8.1. Trees 42 – 47 were located within Valley Reserve and it would be expected that their TPZs extend into the subject site. Based upon the close proximity of the trees to one another and other trees within the reserve there is expected to be strong competition between the trees for soil volume and essential elements (primarily air and water). The

proposed design should avoid encroachment into their TPZs so the available growing area is maintained for continued tree growth.

- 6.9. It is well understood that trees develop a relatively shallow lateral root system as opposed to a 'tap' root. Managing these surface roots must be considered with regard to any tree that is to be retained. Ensuring that existing soil levels are maintained within the nominated tree protection zone is important and any construction proposed within the TPZ of a retained tree must adopt a root sensitive design and construction method approved under consultation with the site arborist or the relevant authorities.
- 6.10. It is recommended that exclusion fencing be established around all retained trees, including street trees and where TPZs extend into the subject site prior to any works occurring on site including demolition, bulk earthworks, excavation for footings or installation of underground services or any construction related activity to prevent damage to roots, buttress, trunk or limbs and to prevent soil compaction. See Figure 2 for example of TPZ fencing.

6.10.1. The area within the TPZ should be mulched to 100mm depth with matured wood chip mulch with a particle size of 25mm for 75% of the volume.



Figure 2. Example of tree protection fencing and signage for a street tree. This type of fencing is suitable for trees to be retained within the subject site.

- 6.11. To successfully retain all suitable trees, tree protection measures must be adopted including the following:
- All conditions of the tree protection guidelines attached as Appendix 5 must be adopted and applied for the duration of the site redevelopment including demolition, bulk earthworks, excavation or installation of underground services or any construction related activity. This is to prevent damage to roots, buttress, trunk or limbs and to prevent soil compaction that may have an adverse impact on retained trees.
  - All underground services, including power, telecommunication, gas, water, drainage must be designed to avoid the TPZ of any retained tree. Where it is unavoidable to place services within the TPZ, they must be bored at a minimum of 600 mm below the existing soil grade to the top of the bore head. Bore entry and exit pits must be located outside the TPZ of retained trees.
  - Existing soil grades must remain unaltered within any tree protection zone adopted on site.
  - Trenching for services or the placement of soil fill greater than 100 mm in depth must not occur within the TPZ of retained trees.



## 7. Photographs



*Figure 3: Shows the street frontage at 35 – 37 Regent Street, Mount Waverley. The mature trees along the front setback made a valuable contribution to the streetscape of Regent Street.*



*Figure 4: Shows the relative size, condition and location of tree 4, a Yellow Box (Eucalyptus melliodora) of high arboricultural value.*





*Figure 5: Shows the relative size, condition and location of tree 25, a Monterey Pine (Pinus radiata) of moderate arboricultural value. The tree was a prominent specimen within the western extent of the site.*



*Figure 6: Shows the existing conditions along part of the northern boundary and tree 34, a Box Elder (Acer negundo). Where the alignment of the rock retaining wall is maintained within new designs, the impacts to the trees 33, 34 and tree group 4 would be minimal.*





*Figure 7: Shows the Queen Palms (Syagrus romanzoffiana) of tree group 1 surrounding the pool area.*



*Figure 8: View to the east showing the existing site conditions.*





*Figure 9: Shows the adjacent trees in Valley Creek Reserve which are well set back from the subject site at 35 – 37 Regent Street, Mount Waverley.*



*Figure 10: Shows the street frontage at 39 Regent Street, Mount Waverley. The mature trees along the front setback made a valuable contribution to the streetscape of Regent Street.*





Figure 11: Shows the existing conditions along the existing driveway and the relative size, condition and location of tree 38, a Lemon-scented Gum (*Corymbia citriodora*) of high arboricultural value.



Figure 12: View to the north showing the relative size, condition and location of tree 40, a Yellow Box (*Eucalyptus melliodora*) of Moderate arboricultural value.





*Figure 13: Shows the existing conditions within the rear setback. Trees 42 –45 located within Valley Reserve and trees 48 and 49 can be seen to the left of the image.*



*Figure 14: Shows the relative size, condition and location of tree 47, a Blackwood (Acacia melanoxylon). The tree should be conventionally surveyed to determine its exact location.*

## 8. Conclusions.

- 8.1. Fifty (50) individual trees and four (4) tree groups (comprising 25 stems in total) were inspected within the adjoining sites at 35 – 39 Regent Street, Mount Waverley.
- 8.2. Schedule 1 to the Vegetation Protection Overlay (VPO1) applies to the site. Under VPO1, trees 4, 5, 6, 18, 22, 24, 27, 28, 29, 30, 31, 32, 34, 38, 40 and tree groups 1 and 4 would require a permit if they are to be removed, lopped or destroyed.
- An exemption to the permit applies to Monterey Pines and Evergreen Alders.
  - No permit is required to undertake pruning of vegetation to maintain or improve a trees health, structure or appearance.
  - Trees 35 – 37, 42 – 47 and 50 are the property of the City of Monash and would require permission from the council if they are to be removed, lopped or destroyed.
- 8.3. The assessed trees were attributed with an arboricultural rating which relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value.
- Two (2) trees, being trees 4 and 38 were attributed with a High arboricultural rating. High rated trees are highly desirable to be retained within the context of the site redevelopment and have the potential to be medium to long term components of the landscape if managed appropriately.
  - Twenty-one (21) trees being trees 3, 5, 6, 7, 8, 9, 13, 18, 23, 24, 25, 27, 29, 30, 31, 32, 34, 35, 40, 47, 50 and tree group 4 were attributed with a Moderate arboricultural value. Moderate trees were in fair condition and desirable to be retained within the context of the site redevelopment.
  - Twenty-seven (27) trees being trees 1, 2, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22, 26, 28, 33, 36, 37, 39, 41, 42, 43, 44, 45, 46, 48, 49 and tree groups 1, 2, 3 were attributed with a Low arboricultural value. Low rated trees generally displayed below typical health and/or structure or were of diminutive size. Low rated trees are not considered to be worthy of being a constraint on reasonable design intent and development within the site.
- 8.4. Tree protection zones (TPZ) have been determined for each tree based on the Australian Standard for Protection of Trees on Development Sites (AS 4970-2009). TPZ distances can be seen in the Tree Assessment Table attached as Appendix 1. Where construction related activity is confined to only one side of the tree, the nominal TPZ may be reduced by 10% of the TPZ area and the TPZ for palms should be no closer than 1 m from the edge of the root ball.
- 8.5. Four non-destructive root investigations were carried out to ascertain the extent of root development within the subject sites and to inform design intent (See Appendices 6 – 9). It is understood that an aged care facility is to be constructed on the site with a basement car park. Entry into the basement will require the construction of a retaining wall along the face of the excavation.
- 8.6. Design considerations include;
- It was recommended that the excavation of the 3m deep basement adjacent to Tree 4 must not occur beyond the proposed alignment as stipulated in the ground Floor Plan, TP-04, dated 21/06/2016.

- It is recommended Modify the design, so the retaining wall alignment, including drainage is no closer than 5m on the western side from tree 38. The 7.3m retaining wall alignment to the south of the tree can be maintained.
- The construction footprint is to be no closer than 2.4m from tree 27, which includes excavation for footings or trenching for the installation of utility services.
- Proposed design plans should aim to locate the construction footprint, including excavation, the installation of utility services or construction of a retaining wall a minimum of 800 mm from the northern property boundary adjacent to tree 33 and tree group 4.
- Proposed designs are to maintain a minimum distance of 2m from the northern property boundary and extend for the canopy widths of trees 31 and 32, ensuring the existing soil grades are also maintained.
- Proposed designs should avoid encroachment into the TPZs of trees 42 – 47 located in Valley Reserve so the available growing area is maintained for continued tree growth.

8.7. Tree management recommendations are provided for trees 4 and 8 which can be seen in the Tree Assessment Table attached as Appendix 1.

8.8. To successfully retain suitable trees, tree protection measures as set out in Appendix 5 must be implemented prior to commencing any construction related activity including; demolition, bulk earthworks and must be maintained for the duration of the construction process including landscaping.

- All underground services, including power, telecommunication, gas, water, drainage must be designed to avoid the TPZ of any retained tree. Where it is unavoidable to place services within the TPZ, they must be bored at a minimum of 600 mm below the existing soil grade to the top of the bore head. Bore entry and exit pits must be located outside the TPZ of retained trees.
- Existing grades within the TPZ of retained trees must be maintained. Trenching or the placement of soil fill greater than 100 mm depth must not occur within the TPZ of retained trees.
- Where trees are to be retained on site, tree protection zones must be appropriately fenced to prevent vehicle access, excavation, trenching, soil contamination or raised soil levels occurring within the TPZ.
- All pruning recommendations must be undertaken by a suitably qualified and experienced arborist and comply with Australian Standard AS 4373-2007 Pruning of amenity trees to extend their useful life expectancy.

Under no circumstance shall this report be reproduced unless in full.

I am available to answer any questions arising from this report.



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### References:

Australian Standard (4970-2009) Protection of trees on development sites. Standards Australia, Homebush, NSW.

Clark, J.R. & Matheny, N.P (1998), Trees and Development: A technical guide to preservation of trees during land development. ISA, Champaign, Illinois.

Harris R.W., Clark J.R., Matheny N.P. (1997), Arboriculture – Integrated Management of Landscape Trees, Shrubs and Vines, Prentice Hall, New Jersey.



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## Appendix 1: Tree Assessment Table: 35 - 39 Regent Street, Mount Waverley.

DBH = Diameter at Breast Height (measured in centimetres at 1.4m above ground unless otherwise stated).  
TPZ = Tree Protection Zone (metre radius). Radius distances measured in metres from the centre of the trunk.  
For tree location and numbering refer Appendix 2. See Appendix 3 for Tree descriptors.

Refer to following 6 pages.

# Appendix 1: Tree Assessment Detail: 35 - 39

## Regent Street, Mount Waverley (Tree Logic, 2016).

Tree No.	Common Name (Botanical Name)	Origin	Lifestage	DBH	Height x Width	Health	Structure	Arb rating	Comments	TPZ (m radius)	SRZ (m radius)	Permit Required
1	Snow in Summer ( <i>Melaleuca linariifolia</i> )	Australian native	Early-mature	42 @0.5m	4 x 6	Fair to poor	Fair☐	Low☐	Reduced foliage density	5.0	2.3	No
2	Golden Wych Elm ( <i>Ulmus glabra</i> 'Lutescens')	Exotic deciduous	Semi-mature	8,9,6 @ 1m	5 x 4	Fair to poor	Fair☐	Low☐	Elm leaf beetle damage, part suppressed to north.	1.6	1.5	No
3	Narrow-leaved Ash ( <i>Fraxinus angustifolia</i> ssp. <i>oxycarpa</i> 'Raywood')	Exotic deciduous	Semi-mature	15,22 @ 1m	9 x 8	Fair	Fair☐	Moderate		3.2	1.9	No
4	Yellow Box ( <i>Eucalyptus melliodora</i> )	Victorian native	Mature	89	27 x 23	Fair	Fair☐	High	Prominent tree. Minor over-tension of lower northeast branch & western heading branch.	10.7	3.4	Yes
5	Leighton Green Leyland Cypress ( <i>XCupressocyparis Leylandii</i> 'Leighton Green')	Exotic conifer	Early-mature	36	15 x 9	Fair	Fair☐	Moderate	Growing under canopy of Yellow Box	4.3	2.5	Yes
6	Leighton Green Leyland Cypress ( <i>XCupressocyparis Leylandii</i> 'Leighton Green')	Exotic conifer	Early-mature	21	11 x 5	Fair	Fair☐	Moderate	Growing under canopy of Yellow Box	2.5	2.0	Yes
7	Monterey Pine ( <i>Pinus radiata</i> )	Exotic conifer	Mature	63	18 x 11	Fair	Fair☐	Moderate	Crown bias to south east, growth influenced by Yellow box	7.6	2.9	No
8	Monterey Pine ( <i>Pinus radiata</i> )	Exotic conifer	Mature	57,77	16 x 17	Fair	Fair to poor☐	Moderate	End weight on north-east limb. Weight reduce north-east limb.	11.5	4.0	No
9	Golden Wych Elm ( <i>Ulmus glabra</i> 'Lutescens')	Exotic deciduous	Semi-mature	25,20	9 x 9	Fair to poor	Fair☐	Moderate	Elm leaf beetle damage.	3.8	2.5	No

# Appendix 1: Tree Assessment Detail: 35 - 39

Regent Street, Mount Waverley (Tree Logic, 2016).

Tree No.	Common Name (Botanical Name)	Origin	Lifestage	DBH	Height x Width	Health	Structure	Arb rating	Comments	TPZ (m radius)	SRZ (m radius)	Permit Required
10	Kohuhu ( <i>Pittosporum tenuifolium</i> )	Exotic evergreen	Early-mature	15	8 x 5	Fair to poor	Fair☐	Low☐	Reduce foliage density	2.0	1.6	No
11	Shining Privet ( <i>Ligustrum lucidum</i> )	Exotic evergreen	Maturing	23,19	9 x 9	Fair	Fair to poor☐	Low☐	Weed species	3.6	2.0	No
12	Evergreen Alder ( <i>Alnus acuminata</i> subsp. <i>glabrata</i> )	Exotic evergreen	Semi-mature	24	11 x 4	Fair to poor	Fair☐	Low☐	Partly suppressed, Shining Privet growing at base.	2.9	2.0	No
13	Evergreen Alder ( <i>Alnus acuminata</i> subsp. <i>glabrata</i> )	Exotic evergreen	Maturing	64	15 x 12	Fair	Fair☐	Moderate		7.7	3.0	No
14	Japanese Maple ( <i>Acer palmatum</i> )	Exotic deciduous	Maturing	9,7,7,9 @ 1m	4 x 4	Fair	Fair to poor☐	Low☐		2.0	1.9	No
15	Silver Birch ( <i>Betula pendula</i> )	Exotic deciduous	Semi-mature	13,12	7 x 5	Fair to poor	Fair☐	Low☐	Sparse canopy	2.1	1.9	No
16	Unknown species	Exotic evergreen	Early-mature	26	8 x 7	Fair	Fair to poor☐	Low☐	Minor possum grazing. Tree with smoothish grey bark, leaves discolourous with undulate margins, hairy oval shaped orange to red axillary buds. Suckering at base.	3.1	2.1	No
17	Mirror Bush ( <i>Coprosma repens</i> )	Exotic evergreen	Mature	25,23	5 x 8	Fair	Fair to poor☐	Low☐	Weed species	4.1	2.3	No
18	Variiegated Tarata ( <i>Pittosporum eugenioides</i> 'Variiegatum')	Exotic evergreen	Mature	17,18	10 x 6	Fair	Fair☐	Moderate		3.0	2.1	Yes
19	Variiegated Tarata ( <i>Pittosporum eugenioides</i> 'Variiegatum')	Exotic evergreen	Mature	14,16	8 x 5	Fair	Fair to poor☐	Low☐	Suppressed	2.6	2.0	No

# Appendix 1: Tree Assessment Detail: 35 - 39

## Regent Street, Mount Waverley (Tree Logic, 2016).

Tree No.	Common Name (Botanical Name)	Origin	Lifestage	DBH	Height x Width	Health	Structure	Arb rating	Comments	TPZ (m radius)	SRZ (m radius)	Permit Required
20	Variegated Tarata ( <i>Pittosporum eugenioides</i> 'Variegatum')	Exotic evergreen	Mature	12,12	5 x 4	Fair	Fair to poor ☐	Low ☐		2.0	1.9	No
21	Variegated Tarata ( <i>Pittosporum eugenioides</i> 'Variegatum')	Exotic evergreen	Mature	17,14	7 x 5	Fair	Fair to poor ☐	Low ☐		2.6	2.0	No
22	English Elm ( <i>Ulmus procera</i> )	Exotic deciduous	Semi-mature	22	13 x 10	Fair to poor	Fair ☐	Low ☐	Moderate infestation of elm leaf beetle.	2.6	2.1	Yes
23	California Palm ( <i>Washingtonia filifera</i> )	Palm	Semi-mature	45	8 x 3	Fair	Fair ☐	Moderate		5.4	2.8	No
24	California Palm ( <i>Washingtonia filifera</i> )	Palm	Early-mature	55	10 x 4	Fair	Fair ☐	Moderate		6.6	3.0	Yes
25	Monterey Pine ( <i>Pinus radiata</i> )	Exotic conifer	Mature	137	24 x 24	Fair	Fair ☐	Moderate	Prominent tree approaching senescence, could become problematic in context of urban development.	16.4	3.8	No
26	Bracelet Honey-myrtle ( <i>Melaleuca armillaris</i> )	Victorian native	Mature	12,20,13	9 x 9	Fair	Fair to poor ☐	Low ☐	Supressed to east by Pine tree.	3.2	2.3	No
27	Brush Box ( <i>Lophostemon confertus</i> )	Australian native	Semi-mature	35	14 x 7	Fair	Fair to poor ☐	Moderate	Neighbours tree, 1.5m approx from boundary.	4.2	2.4	Yes
28	Variegated Port Jackson Fig ( <i>Ficus rubiginosa</i> 'Variegata')	Australian native	Early-mature	46	12 x 8	Fair	Fair to poor ☐	Low ☐	Variegated variety, branches lopped over adjacent out building, lost approx 1/3 of canopy.	5.5	2.5	Yes
29	Queen Palm ( <i>Syagrus romanzoffiana</i> )	Palm	Early-mature	27	11 x 6	Fair	Fair ☐	Moderate		3.2	2.1	Yes



# Appendix 1: Tree Assessment Detail: 35 - 39

## Regent Street, Mount Waverley (Tree Logic, 2016).

Tree No.	Common Name (Botanical Name)	Origin	Lifestage	DBH	Height x Width	Health	Structure	Arb rating	Comments	TPZ (m radius)	SRZ (m radius)	Permit Required
30	Queen Palm ( <i>Syagrus romanzoffiana</i> )	Palm	Early-mature	26	11 x 6	Fair	Fair□	Moderate		3.1	2.1	Yes
31	Variegated Tarata ( <i>Pittosporum eugenioides</i> 'Variegatum')	Exotic evergreen	Mature	0	10 x 7	Fair	Fair to poor□	Moderate	Neighbours tree, trunk obscured by fence.	0.0	0.0	Yes
32	Variegated Tarata ( <i>Pittosporum eugenioides</i> 'Variegatum')	Exotic evergreen	Mature	0	10 x 8	Fair	Fair to poor□	Moderate	Neighbours tree, trunk obscured by fence.	0.0	0.0	Yes
33	Willow-leaved Hakea ( <i>Hakea salicifolia</i> )	Australian native	Mature	0	6 x 4	Fair	Fair to poor□	Low□	Neighbours tree, crown bias to south-west, existing grade difference between sites likely to prevent root growth into site.	0.0	0.0	No
34	Box Elder ( <i>Acer negundo</i> )	Exotic deciduous	Early-mature	24	13 x 9	Fair	Fair□	Moderate	Located top of bank. Root growth likely to be restricted from within site.	2.9	2.1	Yes
35	Red-flowering Gum ( <i>Corymbia ficifolia</i> )	Australian native	Semi-mature	24	4 x 4	Fair to poor	Fair□	Moderate	Street tree, Past service line clearance	2.9	2.0	Council approval required
36	Blackwood ( <i>Acacia melanoxylon</i> )	Victorian native	Semi-mature	8	3 x 2	Fair to poor	Fair□	Low□	Street tree, borer.	2.0	1.5	Council approval required
37	Blackwood ( <i>Acacia melanoxylon</i> )	Victorian native	Young	2	2 x 1	Fair	Fair□	Low□	Small size, street tree	2.0	1.5	Council approval required
38	Lemon-scented Gum ( <i>Corymbia citriodora</i> )	Australian native	Mature	61	20 x 17	Fair	Fair	High	Strong presence in streetscape	7.3	2.9	Yes
39	Wattle Tree ( <i>Acacia</i> sp.)	Australian native	Mature	13,14 @ 1m	5 x 6	Fair	Fair-poor	Low	Shrub	2.3	2.0	No
40	Yellow Box ( <i>Eucalyptus melliodora</i> )	Victorian native	Mature	62	18 x 13	Fair	Fair	Moderate	Over extending limb developing to south west. Weight reduce south-west branch	7.4	2.9	Yes

# Appendix 1: Tree Assessment Detail: 35 - 39

## Regent Street, Mount Waverley (Tree Logic, 2016).

Tree No.	Common Name (Botanical Name)	Origin	Lifestage	DBH	Height x Width	Health	Structure	Arb rating	Comments	TPZ (m radius)	SRZ (m radius)	Permit Required
41	European Golden Ash ( <i>Fraxinus excelsior</i> 'Aurea')	Exotic deciduous	Early mature	15,13,10 @ 1m	5 x 8	Fair	Fair-poor	Low	Previous reduction pruning	2.7	2.1	No
42	Late Black Wattle ( <i>Acacia mearnsii</i> )	Victorian native	Over-mature	40	13 x 12	Fair-poor	Poor	Low	Borer damage, Neighbouring tree	4.8	2.5	Council approval required
43	Late Black Wattle ( <i>Acacia mearnsii</i> )	Victorian native	Mature	38	14 x 11	Fair	Fair-poor	Low	Neighbouring tree	4.6	2.5	Council approval required
44	Late Black Wattle ( <i>Acacia mearnsii</i> )	Victorian native	Mature	27	14 x 7	Fair	Fair-poor	Low	Neighbouring tree	3.2	2.1	Council approval required
45	Late Black Wattle ( <i>Acacia mearnsii</i> )	Victorian native	Mature	29	13 x 8	Fair	Fair-poor	Low	Neighbouring tree	3.5	2.2	Council approval required
46	Late Black Wattle ( <i>Acacia mearnsii</i> )	Victorian native	Early mature	20	10 x 6	Fair	Fair-poor	Low	Neighbouring tree	2.4	1.8	Council approval required
47	Blackwood ( <i>Acacia melanoxylon</i> )	Victorian native	Early mature	28	13 x 8	Fair	Fair-poor	Moderate	Neighbouring tree	3.4	2.2	Council approval required
48	Weeping Cherry ( <i>Prunus subhirtella</i> 'Pendula')	Exotic deciduous	Mature	28	3 x 5	Fair	Fair	Low	Weeping form	3.4	2.0	No
49	Willow-leaved Hakea ( <i>Hakea salicifolia</i> 'Gold Medal')	Australian native	Early mature	10,12	4 x 4	Fair	Fair-poor	Low	Variegated Shrub	2.0	1.8	No
50	Snow in Summer ( <i>Melaleuca linariifolia</i> )	Australian native	Early mature	45 @0.5m	4 x 6	Fair	Fair-poor	Moderate	Street tree	5.4	2.4	No
Tree Group 1	Queen Palm ( <i>Syagrus romanzoffiana</i> )	Palm	Early-mature	26	11 x 5	Fair	Fair	Low	9 x stems	3.1	2.5	Yes
Tree Group 2	Variegated Tarata ( <i>Pittosporum eugenioides</i> 'Variegatum')	Exotic evergreen	Early-mature	10,12	6 x 4	Fair	Fair to poor	Low	7 x stems	2.0	1.9	No

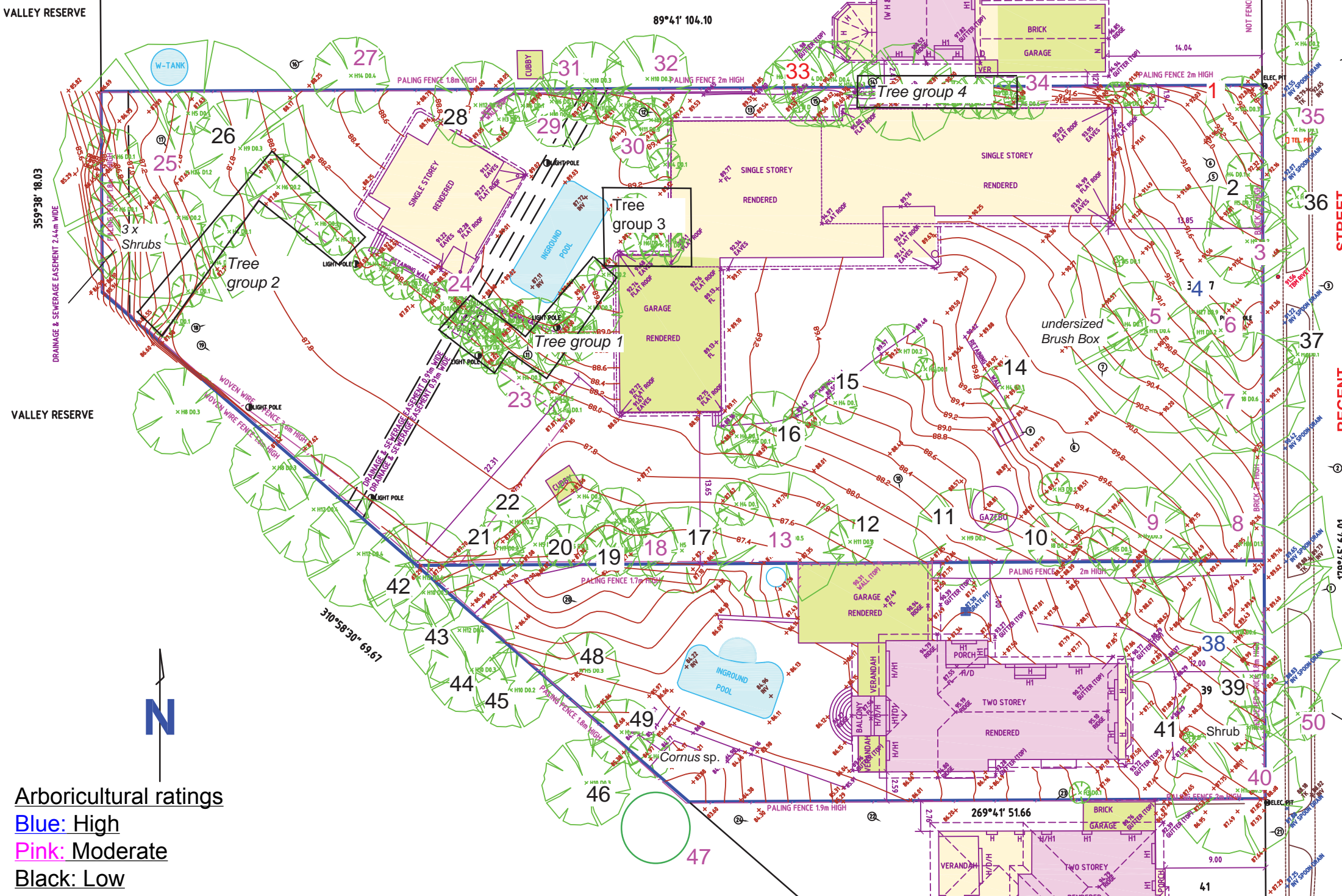
Appendix 1: Tree Assessment Detail: 35 - 39  
 Regent Street, Mount Waverley (Tree Logic, 2016).

Tree No.	Common Name (Botanical Name)	Origin	Lifestage	DBH	Height x Width	Health	Structure	Arb rating	Comments	TPZ (m radius)	SRZ (m radius)	Permit Required
Tree Group 3	Queen Palm (Syagrus romanzoffiana)	Palm	Semi-mature	18	9 x 4	Fair	Fair	Low	4 x stems, 2 stems of small dimensions.	2.2	1.9	No
Tree Group 4	Leighton Green Leyland Cypress (Xcupressocyparis Leylandii 'Leighton Green')	Exotic conifer	Maturing	37	14 x 8	Fair	Fair to poor	Moderate	Neighboring trees, 3 x stems, grade difference between sites expected to restrict root growth into site. Base of trees obscured by fence.	4.4	0.0	Yes

## **Appendix 2: Tree numbers and locations: 35 - 39 Regent Street, Mount Waverley.**



# Appendix 2: Tree numbers & location: 35 - 39 Regent Street, Mount Waverley (Tree Logic, 2016).



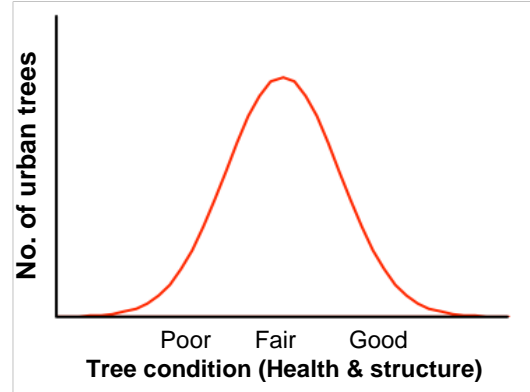
**Arboricultural ratings**  
**Blue:** High  
**Pink:** Moderate  
**Black:** Low

## Appendix 3: Arboricultural Descriptors (April 2015)

Note that not all of the described tree descriptors may be used in a tree assessment and report. The assessment is undertaken with regard to contemporary arboricultural practices and consists of a visual inspection of external and above-ground tree parts.

### 1. Tree Condition

The assessment of tree condition evaluates factors of health and structure. The descriptors of health and structure attributed to a tree evaluate the individual specimen to what could be considered typical for that species growing in its location under current climatic conditions. For example, some species can display inherently poor branching architecture, such as multiple acute branch attachments with included bark. Whilst these structural defects may technically be considered arboriculturally poor, they are typical for the species and may not constitute an increased risk of failure. These trees may be assigned a structural rating of fair-poor (rather than poor) at the discretion of the assessor.



**Diagram 1:** Indicative normal distribution curve for tree condition

Diagram 1, provides an indicative distribution curve for tree condition to illustrate that within a normal tree population the majority of specimens are centrally located within the condition range (normal distribution curve). Furthermore, that those individual trees with an assessed condition approaching the outer ends of the spectrum occur less often.

### 2. Tree Name

Provides botanical name, (genus, species, variety and cultivar) according to accepted international code of taxonomic classification, and common name.

### 3. Tree Type

Describes the general geographic origin of the species and its type e.g. deciduous or evergreen.

Category	Description
Indigenous	Occurs naturally in the area or region of the subject site. Remnant.
Victorian native	Occurs naturally within some part of the State of Victoria (not exclusively) but is not indigenous (component of EVC benchmark). Could be planted indigenous trees.
Australian native	Occurs naturally within Australia but is not a Victorian native or indigenous
Exotic deciduous	Occurs outside of Australia and typically sheds its leaves during winter
Exotic evergreen	Occurs outside of Australia and typically holds its leaves all year round
Exotic conifer	Occurs outside of Australia and is classified as a gymnosperm
Native conifer	Occurs naturally within Australia and is classified as a gymnosperm
Native Palm	Occurs naturally within Australia. Woody monocotyledon
Exotic Palm	Occurs outside of Australia. Woody monocotyledon

#### 4. Height and Width

Indicates height and width of the individual tree; dimensions are expressed in metres. Crown heights are measured with a height meter where possible. Due to the topography of some sites and/or the density of vegetation it may not be possible to do this for every tree. Tree heights may be estimated in line with previous height meter readings in conjunction with assessor's experience. Crown widths are generally paced (estimated) at the widest axis or can be measured on two axes and averaged. In some instances the crown width can be measured on the four cardinal direction points (North, South, East and West).

Crown height, crown spread are generally recorded to the nearest half metre (crown spread would be rounded up) for dimensions up to 10 m and the nearest whole metre for dimensions over 10 m. Estimated dimensions (e.g. for off-site or otherwise inaccessible trees where accurate data cannot be recovered) shall be clearly identified in the assessment data.

#### 5. Trunk diameters

The position where trunk diameters are captured may vary dependent on the requirements of the specific assessment and an individual trees specific characteristics. DBH is the typical trunk diameter captured as it relates to the allocation of tree protection distances. The basal trunk diameter assists in the allocation of a structural root zone. Some municipalities require trunk diameters be captured at different heights, with 1.0 m above grade being a common requirement. The specific planning schemes will be checked to ascertain requirements.

Stem diameters shall be recorded in centimetres, rounded to the nearest 1 cm (0.01 m).

##### ***Diameter at Breast Height (DBH)***

Indicates the trunk diameter (expressed in centimetres) of an individual tree measured at 1.4m above the existing ground level or where otherwise indicated, multiple leaders are measured individually. Plants with multiple leader habit may be measured at the base. The range of methods to suit particular trunk shapes, configurations and site conditions can be seen in Appendix A of Australian Standard AS 4970-2009 *Protection of trees on development sites*. Measurements undertaken using foresters tape or builders tape.

##### ***Basal trunk diameter***

The basal dimension is the trunk diameter measured at the base of the trunk or main stem(s) immediately above the root buttress. Used to ascertain the Structural Root Zone (SRZ) as outlined in AS4970.

#### 6. Health

Assesses various attributes to describe the overall health and vigour of the tree.

Category	Vigour, Extension growth	Decline symptoms, Deadwood, Dieback	Foliage density, colour, size, intactness	Pests and or disease
<b>Good</b>	Above typical. Excellent. Full canopy density	Negligible	Better than typical	Negligible
<b>Fair</b>	Typical. 90-100% canopy density	Minor or expected. Little or no dead wood	Typical. Minor deficiencies or defects could be present.	Minor, within damage thresholds
<b>Fair to Poor</b>	Below typical - low vigour	More than typical. Small sub-branch dieback	Exhibiting deficiencies. Could be thinning, or smaller	Exceeds damage thresholds



Category	Vigour, Extension growth	Decline symptoms, Deadwood, Dieback	Foliage density, colour, size, intactness	Pests and or disease
Poor	Minimal - declining	Excessive, large and/or prominent amount & size of dead wood	Exhibiting severe deficiencies. Thinning foliage, generally smaller or deformed	Extreme and contributing to decline
Dead	N/A	N/A	N/A	N/A

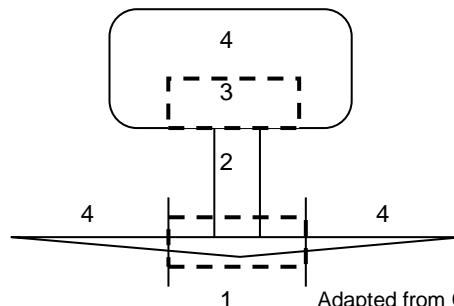
## 7. Structure

Assesses principal components of tree structure (Diagram 2).

Descriptor	Zone 1 - Root plate & lower stem	Zone 2 - Trunk	Zone 3 - Primary branch support	Zone 4 - Outer crown and roots
<b>Good</b>	No obvious damage, disease or decay; obvious basal flare / stable in ground	No obvious damage, disease or decay; well tapered	Well formed, attached, spaced and tapered. No history of failure.	No obvious damage, disease, decay or structural defect. No history of failure.
<b>Fair</b>	Minor damage or decay. Basal flare present.	Minor damage or decay	Generally well attached, spaced and tapered branches. Minor structural deficiencies may be present or developing. No history of branch failure.	Minor damage, disease or decay; minor branch end-weight or over-extension. No history of branch failure.
<b>Fair to Poor</b>	Moderate damage or decay; minimal basal flare.	Moderate damage or decay; approaching recognised thresholds	Weak, decayed or with acute branch attachments; previous branch failure evidence	Moderate damage, disease or decay; moderate branch end-weight or over-extension. Minor branch failure evident.
<b>Poor</b>	Major damage, disease or decay; fungal fruiting bodies present. Excessive lean placing pressure on root plate	Major damage, disease or decay; exceeds recognised thresholds; fungal fruiting bodies present. Acute lean. Stump re-sprout	Decayed, cavities or has acute branch attachments with included bark; excessive compression flaring; failure likely. Evidence of major branch failure.	Major damage, disease or decay; fungal fruiting bodies present; major branch end-weight or over-extension. Branch failure evident.
<b>Very Poor</b>	Excessive damage, disease or decay; unstable / loose in ground; altered exposure; failure probable	Excessive damage, disease or decay; cavities. Excessive lean. Stump re-sprout	Decayed, cavities or branch attachments with active split; failure imminent. History of major branch failure.	Excessive damage, disease or decay; excessive branch end-weight or over-extension. History of branch failure.

**Diagram 2:** Tree structure zones

1. Root plate & lower stem
2. Trunk
3. Primary branch support
4. Outer crown & roots



Adapted from Coder (1996)

Structure ratings will also take into account general branching architecture, stem taper, live crown ratio, crown symmetry (bias or lean) and crown position such as tree being suppressed amongst more dominant trees.

The lowest or worst descriptor assigned to the tree in any column could generally be the overall rating assigned to the tree. The assessment for structure is limited to observations of external and above ground tree parts. It does not include any exploratory assessment of underground or internal tree parts unless this is requested as part of the investigation. Trees are assessed and then given a rating for a point in time. Generally, trees with a poor or very poor structure are beyond the benefit of practical arboricultural treatments.

The management of trees in the urban environment requires appropriate arboricultural input and consideration of risk. Risk potential will take into account the combination of likelihood of failure and impact, including the perceived importance of the target(s).

## 8. Age class

Relates to the physiological stage of the tree's life cycle.

Category	Description
Young	Sapling tree and/or recently planted. Approximately 5 or less years in location.
Semi-mature	Tree increasing in size and yet to achieve expected size in situation. Primary developmental stage.
Early-mature	Tree established, generally growing vigorously. 50% of attainable age/size.
Mature	Specimen approaching expected size in situation, with reduced incremental growth.
Over-mature	Mature full-size with a retrenching crown. Tree is senescent and in decline. Significant decay generally present.

## 9. Arboricultural Rating

Relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics (Hitchmough 1994) within an urban landscape context. The presence of any serious disease or tree-related hazards that would impact risk potential are taken into account.

Category	Description
High	Tree of high quality in good to fair condition. Generally a prominent arboricultural/landscape feature. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is highly desirable.
Moderate	Tree of moderate quality, in fair or better condition. Tree may have a condition, and or structural problem that will respond to arboricultural treatment. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is generally desirable.

Category	Description
Low	<p>Unremarkable tree of low quality or little amenity value. Tree in either poor health or with poor structure or a combination.</p> <p>Tree is not significant because of either its size or age, such as young trees with a stem diameter below 15 cm. These trees are easily replaceable.</p> <p>Tree (species) is functionally inappropriate to specific location and would be expected to be problematic if retained.</p> <p>Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location.</p>
None	<p>Trees of low quality with an estimated remaining life expectancy of less than 5 years.</p> <p>Tree has either a severe structural defect or health problem or combination that cannot be sustained with practical arboricultural techniques and the loss of the tree would be expected in the short term.</p> <p>Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline. Tree infected with pathogens of significance to either the health or safety of the tree or other adjacent trees.</p> <p>Tree whose retention would not be viable after the removal of adjacent trees (includes trees that have developed in close spaced groups and would not be expected to acclimatise to severe alterations to surrounding environment – removal of adjacent shelter trees).</p> <p>Tree has a detrimental effect on the environment, for example, the tree is a recognised environmental woody weed with potential to spread into waterways or natural areas.</p> <p>Unremarkable tree of no material landscape, conservation or other cultural value.</p>

Trees have many values, not all of which are considered when an arboricultural assessment is undertaken. However, individual trees or tree group features may be considered important community resources because of unique or noteworthy characteristics or values other than their age, dimensions, health or structural condition. Recognition of one or more of the following criterion is designed to highlight other considerations that may influence the future management of such trees.

Significance	Description
Horticultural Value/ Rarity	Outstanding horticultural or genetic value; could be an important source of propagating stock, including specimens that are particularly resistant to disease or exposure. Any tree of a species or variety that is rare.
Historic, Aboriginal Cultural or Heritage Value	<p>Tree could have value as a remnant of a particular important historical period or a remnant of a site or activity no longer in action. Tree has a recognised association with historic aboriginal activities, including scar trees.</p> <p>Tree commemorates a particular occasion, including plantings by notable people, or having associations with an important event in local history.</p>
Ecological Value	<p>Tree could have value as habitat for indigenous wildlife, including providing breeding, foraging or roosting habitat, or is a component of a wildlife reserve.</p> <p>Remnant Indigenous vegetation that contribute to biological diversity</p>



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4. Pollard, A. H. (1974) Introductory statistics: a service course, Pergamon Press Australia, Australia.
5. Standards Australia (2009) Australian Standard AS 4970-2009 Protection of trees on development sites.

## Appendix 4: Tree Protection Zones

The most important consideration for the successful retention of trees is to allow appropriate above and below ground space for the trees to continue to grow. This requires the allocation of tree protection zones for retained trees.

The Australian Standard AS 4970-2009 'Protection of Trees on Development Sites' has been used as a guide in the allocation of TPZs for the assessed trees. The TPZ for individual trees is calculated based on trunk diameter (DBH measured in centimetres), measured at 1.4 metres up from ground level, unless stated otherwise. The radius of the TPZ is calculated by multiplying the trees DBH by 12.

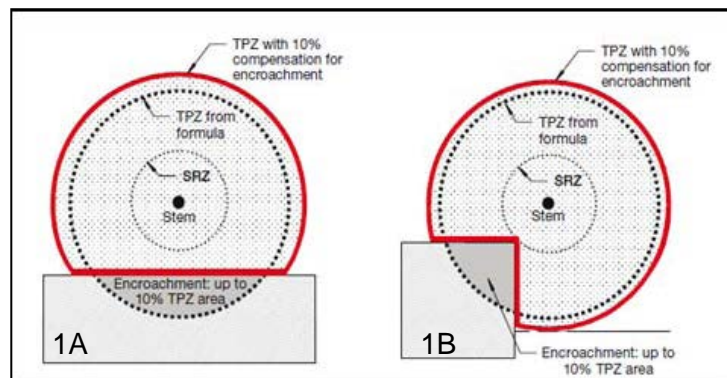
This method provides a TPZ that addresses both the stability and growing requirements of a tree. TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level. The maximum TPZ should be no more than 15m radius and the minimum TPZ should be no less than 2m radius.

Encroachment into the TPZ is permissible under certain circumstances though this is dependent on both site conditions and tree characteristics. Minor encroachment, up to 10% of the TPZ, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Encroachment must also consider the crown of the tree and ensure that excessive pruning is not required that would cause the tree to become unbalanced or disfigured.

The 10% encroachment on one side equates to approximately a  $\frac{1}{3}$  reduction of the radial distance.

Examples of minor encroachment are provided in Diagram 1A & 1B.

Encroachment greater than 10% is considered major encroachment under AS4970-2009 and is only permissible if it can be demonstrated that after such encroachment the tree would remain viable. Non-destructive root investigation (NDRI) may be required to investigate and identify the location of roots within the proposed area of encroachment.



**Diagram 1A & 1B: Examples of minor encroachment into a TPZ.**  
Extract from: AS4970-2009, Appendix D, p30 of 32

Tree root growth is opportunistic and occurs where the essentials to life (primarily air and water) are present. Heterogeneous soil conditions, existing barriers, hard surfaces and buildings may have inhibited the development of a symmetrically radiating root system. Existing infrastructure around some trees may be within the TPZ or root plate radius. Where this has occurred, the roots of some trees may have grown in response to the site conditions and if existing hard surfaces and building alignments are utilised in new designs the impacts on trees should be minimal.

All TPZ measurements are provided in the tree assessment data in Appendix 1. Appendix 4 provides tree protection guidelines that should be incorporated into design and management plans for retained trees.

The Structural Root Zone (SRZ) is the area in which the larger woody roots required for tree stability are found close to the trunk and which then generally taper rapidly. This is the minimum area recommended to maintain tree stability but does not reflect the area required to sustain tree health. The area between the reduced TPZ and the SRZ may only be encroached if root sensitive construction methods are adopted, based on results of Non-destructive root investigation and if approved by the

consulting arborist or relevant authorities. No works are permitted within the SRZ radius as tree stability maybe compromised.



## Appendix 5: Protection of retained trees

The following are guidelines that must be implemented to minimise the impact of the proposed construction works on the retained trees.

- The Tree Preservation Zone (TPZ) is fenced and clearly marked at all times. This fence should deter the placement of building materials, entry of heavy equipment and vehicles and also the entry of workers and/or the public into the TPZ. Australian Standard AS 4687 - 2007 Temporary fencing and hoardings, specifies appropriate fencing requirements. Existing perimeter fencing can be incorporated into the protective fencing. Shade cloth should be attached to reduce the movement of dust and other particulates into the TPZ. Signs identifying the TPZ are to be placed on the fencing.
- If the area within the TPZ is to be accessed during the construction phase then the area will need ground protection. Measures may include a permeable membrane, such as a geotextile, to cover the TPZ area beneath a 100 mm layer of crushed rock below rumble boards.
- Contractors and site workers should receive written and verbal instruction as to the importance of tree protection and preservation within the site. Successful tree preservation occurs when there is a commitment from all relevant parties involved in designing, constructing and managing a development project. Members of the project team need to interact with each other to minimise the impacts to the trees, either through design decisions or construction practices.
- The consultant arborist is on-site to supervise excavation works around the existing trees where the TPZ will be encroached.
- There is no immediate requirement for mulching within the TPZ. There is benefit to maintaining existing site conditions within the TPZ and is more analogous to proposed completion conditions. Monitoring of the trees in-line with prevailing weather conditions will indicate if mulching will be required. The same approach is to be used in providing supplemental irrigation.
- No persons, vehicles or machinery to enter the TPZ without the consent of the consulting arborist or site manager.
- Any underground service installations within the allocated TPZ should be bored and utility authorities should common trench where possible.
- No fuel, oil dumps or chemicals shall be allowed in or stored on the TPZ and the servicing and re-fuelling of equipment and vehicles should be carried out away from the root zones.
- No storage of material, equipment or temporary building should take place over the root zone of any tree.
- Nothing whatsoever should be attached to any tree including temporary services wires, nails, screws or any other fixing device.
- Any pruning that is required must be carried out by trained and competent arborist who has a thorough knowledge of tree physiology and pruning methods and carry out pruning to the Australian Standard AS 4373 – 2007 '*Pruning of Amenity Trees*'.
- All root excavation should be carried out by hand digging or with the use of 'Air-Excavation' techniques, and roots should be severed by saw cutting or with a sharp axe and not with a Backhoe or any machinery or blunt instrument.

## **Appendix 6: Root Investigation report: Yellow Box (Tree 4).**

See following 8 pages.

## Root Investigation Report

**Property Address** 35 – 37 Regent Street, Mount Waverley, Vic  
**Tree Location:** 35 – 37 Regent Street, Mount Waverely, Vic  
**Investigation Date:** Tuesday, 31st May, 2016  
**Report Date:** Monday, 27th June, 2016  
**Assessor:** David Phillips (Ass Deg Env Hort)

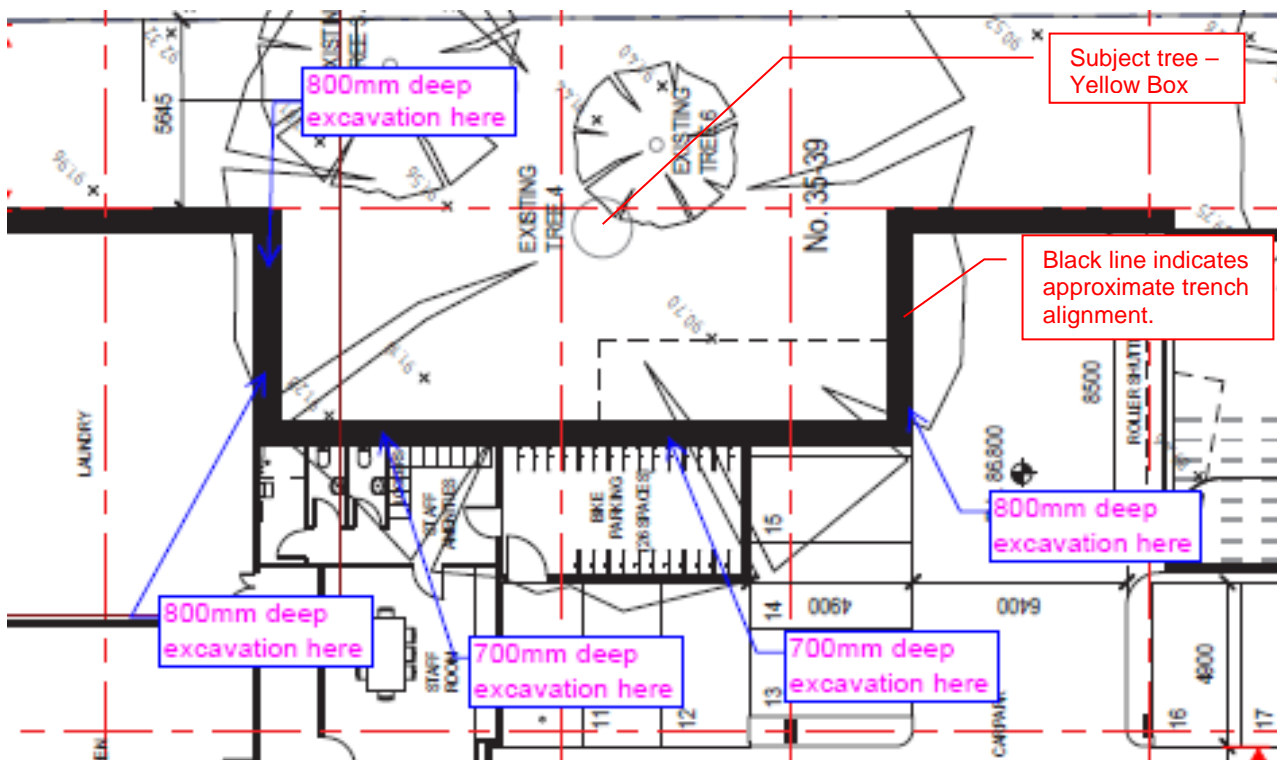
**Scope:** Undertake a root investigation to understand the extent of root growth within the subject site from a large Yellow Box (*Eucalyptus melliodora*) located in the front setback with the intent to determine the alignment of the proposed basement car park.

### Method:

Excavation was undertaken using an Airspade 2000® powered by 225 cfm air compressor, augmented by trenching shovel to extract spoil where able. A 1 tonne mini track excavator was also employed to excavate deeper into the soil profile where the air spade was unable to penetrate the hard clay soil.

The investigation trench followed a U-shaped alignment as set out in Figure 1 indicated by the solid black line. The trench alignment was 5m to the west, 8m to the south and 9m to the north of the Yellow Box. The depth of the trench was at 450mm with several explorations to 700 - 800mm in depth at intervals along the trench. These deeper excavations typically were of 1.5 to 2m in length. Part of the existing driveway was removed to investigate the heaving as a root was suspected of being the cause.

Root diameters were measured using a lineal tape measure. Exposed roots were painted for photographic purposes.



**Figure 1:** Shows the location of the subject tree and the approximate alignment of the root investigation at 35 – 37 Regent Street, Mount Waverley.



### Tree Details<sup>1</sup>:

**Botanical Name:** *Eucalyptus melliodora*

**Common Name:** Yellow Box

**Height:** 27m

**Spread:** 23m

**Trunk diameter:** 89 cm

**Age Class:** Mature

**Tree Protection Zones (TPZ<sup>2</sup>):** 10.7m

**Structural Root Zone (SRZ<sup>3</sup>):** 3.4m

**Comments:** Identified as Tree 4 in the arboricultural assessment report.

### Findings

The upper soil profile was a thin layer of imported sandy loam for establishment of the turf grass. The soil horizon between 100 to 600mm was generally a silty clay loam with a clay loam below. The soil taken from the deeper excavations was very dry and crumbly and would not form a ribbon when rubbed between the fingers.

Explorations with the excavator augmented the root investigation where the air spade was unable to penetrate deeper into the soil profile. This was reflective of root growth which was generally located in the upper 150mm soil profile. The shallow rooting depth was also reflected in the adjacent Monterey Pine which displayed several roots exposed at the soil surface indicating the difficulty for roots to penetrate the lower soil profiles.

Roots were observed in three separate sections of the trench alignments. Roots were noted to the west, north and south of the Yellow Box, however not all of the exposed roots belong to the subject tree. Some roots within the trench alignment belong to a Leighton Green Leyland Cypress (*X Cupressocyparis leylandii* 'Leighton Green') and Brush Box (*Lophostemon confertus*), both located on the western side of the subject tree immediately adjacent to the trench alignment. Other roots were observed from a Monterey Pine (*Pinus radiata*) located at the eastern end of the southern trench alignment and a Golden Elm (*Ulmus glabra* 'Lutescens') located at the eastern end of the northern trench alignment.

Directly west of the subject tree, six (6) roots between 50 mm – 130 mmØ with red, flaky outer bark were exposed in the top 150 mm soil profile. These roots belong to the Leyland Cypress and Brush box trees that was located on either side of the trench alignment.

In the northern trench alignment, five (5) roots with a diameter between 20 mm – 70 mm were exposed at the eastern end. These roots were not typical of roots associated with Yellow Box trees but were suspected of belonging to the adjacent Golden Elm.

The southern trench identified two (2) roots, 30mm and 35mmØ within the top 150mm soil profile. These roots were also not typical of Yellow Box roots and likely extended from the adjacent Monterey Pine. There were no other woody roots found within this alignment of the trench.

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<sup>1</sup> Tree data from arborist report: Phillips (2016) 35 – 37 Regent Street, Mount Waverley.

<sup>2</sup> TPZ Radius = Trunk diameter measured at 1.4m (nominal) above grade (DBH) x 12. The TPZ is used to provide adequate space for the preservation of root and crown area to ensure tree viability<sup>2</sup> SRZ radius =  $(D \times 50)0.42 \times 0.64$  where D = trunk diameter, in metres. The SRZ comprises the area around the base of a tree required for the tree's stability in the ground.

<sup>2</sup> SRZ radius =  $(D \times 50)0.42 \times 0.64$  where D = trunk diameter, in metres. The SRZ comprises the area around the base of a tree required for the tree's stability in the ground.

Roots associated with the Yellow Box were located to the south west of the tree with one root extending beneath the driveway. The root under the driveway was approximately 100 mmØ that was causing heave of the underlying concrete strip and cracking in the slate driveway surface. Eight (8) roots to the south-west were exposed with diameters between 20 mm and 60 mm within the top 450mm of the soil profile. These roots were extending in a westerly direction.

### **Impact Assessment and Conclusion**

Typically root growth was within the upper soil profile, however the roots of the Yellow Box were located at deeper soil depths. The roots associated with the Yellow Box were extending into the proposed basement footprint and would be lost as part of the proposed development. Yellow Box trees have a good tolerance to root loss and based upon the diameter and number of roots in relation to the size of the tree, it is expected for the tree to tolerate the amount of root loss from the proposed basement alignment.

To ensure the tree sustains the development it must be fully protected during all stages of the site redevelopment as per AS4970 2009 *Protection of trees on development sites* and no further encroachment beyond the basement alignment is to occur.

### **Recommendations**

The following specific recommendations are provided in relation to the basement footprint and tree protection:

- a) Excavation of the 3m deep basement must not occur beyond the proposed alignment as stipulated in the ground Floor Plan, TP-04, dated 21/06/2016.
- b) All utility services, including telecommunications electricity, water, gas or the like must be located within the basement footprint. If this is unachievable within proposed design, all services are to be bored at a minimum depth of 600mm below the soil surface to the top of the bore head. Bore entry and exit pits are to be located outside the TPZ.
- c) No soil grade changes are to occur within the remaining TPZ area.
- d) All existing hard landscape features, including the driveway and masonry fence within the TPZ must be demolished using hand held tools and removed from the site by hand.
- e) TPZ fencing in the form of 1.8m x 1.8m chain wire mesh panels held in place by concrete feet is to be erected around the tree. The alignment of the fence is occur at the edge of the basement footprint, along the eastern property boundary (if masonry fence is removed) and at the edge of the TPZ to the north and south. The fencing must be kept in place for the duration of the site redevelopment, including demolition and landscaping phases. No entry into the TPZ is permitted without the permission of the project arborist. The TPZ area within the road reserve must also be protected with TPZ fencing.



Figure 2: Example of signage for TPZ and of appropriate TPZ fencing.

- f) The TPZ area outside the basement alignment is to be mulched with a coarse particle mulch to a thickness of 100mm. To maintain tree health, a drip irrigation system is to be installed that covers the entire TPZ area within the subject site. The TPZ area is to be monitored daily by the site manager from October to May to assess the requirement for watering.
- g) The existing driveway located outside of the basement footprint must be left in place where the property entrance is used for site ingress and egress. A crushed rock layer is to be utilised where the existing slate layer degrades or is removed.
- h) The TPZ area outside of the basement footprint must be protected during all phases of development in accordance with AS4970. This may include installing suitable ground protection system (GPS) engineered for the anticipated load, so as to avoid compaction of the underlying soil and allow for continued water percolation and gaseous exchange. Installation of the GPS is to comprise of rumble boards strapped or tree protection matting laid over mulch or aggregate with geo-textile fabric covering the soil surface. The GPS can be removed once encroachment of the TPZ ceases.

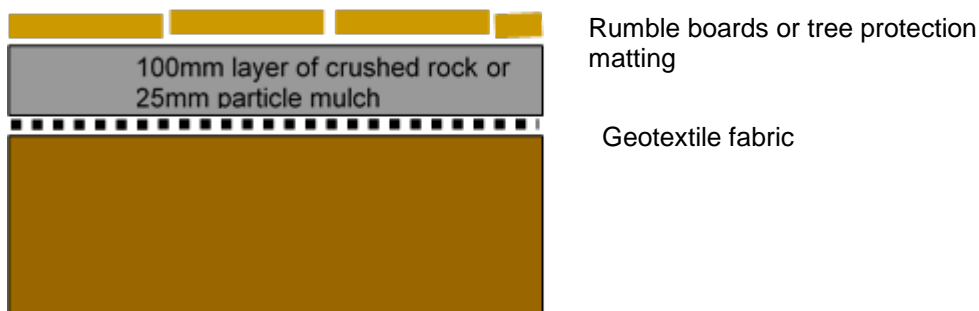


Figure 3: Indicative ground protection system - adapted from AS4970 Clause 4.5.3 Ground protection

- i) Roots greater than 20 mmØ that are to be severed must be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the trees protection zone (TPZ) to be ‘pruned’ with machinery such as backhoes or excavators.



- j) Where roots within the TPZ are exposed by excavation, temporary root protection should be installed to prevent them drying out. This may include jute mesh or hessian sheeting as multiple layers over exposed roots and excavated soil profile, extending to the full depth of the root zone. Root protection sheeting should be pegged in place and kept moist during the period that the root zone is exposed.

**Photographic Catalogue**



**Above left:** View to the north showing the trench on the western side of the tree. The Leyland Cypress and Brush Box trees can be seen on either side of the trench with the Yellow Box to the right of the image. The majority of Yellow Box roots were concentration in area indicated by the red rectangular box.

**Above right:** View to the north showing the trench alignment adjacent to the Leyland Cypress and Brush Box. These roots were mostly attributed to the conifer.



**Above Left:** View to the western trench showing a closing view of the roots from the Yellow box.



**Above Right:** View of the existing driveway to the west. The heave caused by the root of the Yellow Box is shown within the red rectangle.





**Above left:** View to the east showing the southern trench alignment. Two deep excavation were carried out exposing two roots extending from the Pine tree (as indicated by arrow).

**Above right:** View to the east showing the northern trench alignment. Two 800mm deep excavations were carried out within the trench.



**Above Left:** Shows one of the deep excavations carried out on site with crumbly clay soil in the bottom of the trench.

**Above Right:** View showing the roots exposed at the eastern end of the northern trench. These roots likely extended from the Golden Elm located on the eastern boundary, 5m away.

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## **Appendix 7: Root Investigation report: Lemon-scented Gum (Tree 38).**

See following 7 pages.

## Root Investigation Report

**Property Address** 39 Regent Street, Mount Waverley, Vic  
**Tree Location:** 39 Regent Street, Mount Waverley, Vic  
**Investigation Date:** Wednesday, 22nd June, 2016  
**Report Date:** Wednesday, 29th June, 2016  
**Assessor:** David Phillips (Ass Deg Env Hort)

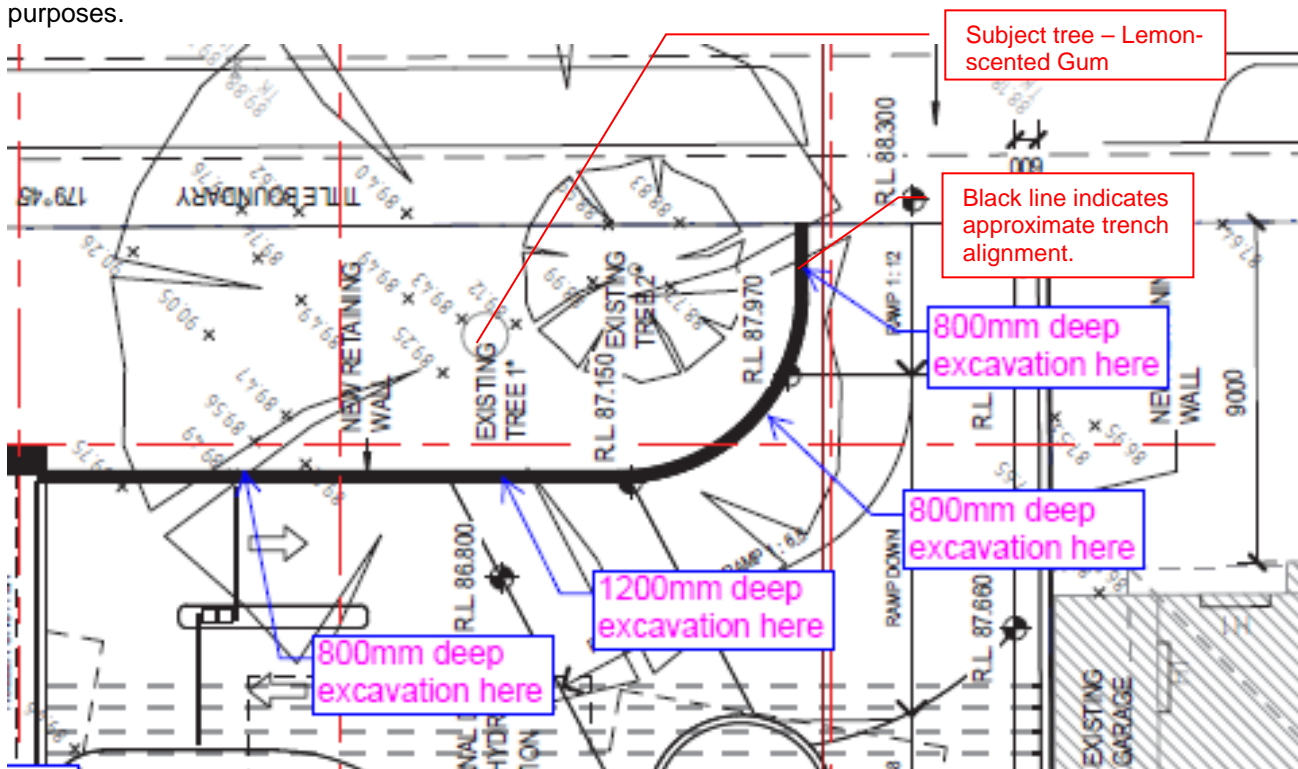
**Scope:** Undertake a root investigation to understand the extent of root growth within the subject site from a Lemon-scented Gum (*Corymbia citriodora*) located in the front setback to understand the impacts from the alignment of the proposed retaining wall.

### Method:

Excavation was undertaken using a 1 tonne mini track excavator augmented with an Airspade 2000® powered by 225 cfm air compressor and trenching shovel to extract spoil where able.

The investigation consisted of an L-shaped trench indicated by the solid black line in Figure 1. The trench extended from the edge of the existing driveway and 7.6 m to the south of the tree (a total of length of 8.5 m) and offset 3.5 m to the west. The depth of the trench was between 600 – 800 mm with a deeper exploration of 1.2m directly west of the trunk. An 800 mm deep excavation was undertaken between the driveway and northern property boundary. No excavation occurred within the existing driveway due to the concrete slab base.

Root diameters were measured using a lineal tape measure. Exposed roots were painted for photographic purposes.



**Figure 1:** Shows the location of the subject tree and the approximate alignment of the root investigation at 39 Regent Street, Mount Waverley

### Tree Details<sup>1</sup>:

**Botanical Name:** *Corymbia citriodora*                      **Common Name:** Lemon-scented Gum

**Height:** 20m              **Spread:** 17m              **Trunk diameter:** 61 cm

**Age Class:** Mature

**Tree Protection Zones (TPZ<sup>2</sup>):** 7.3m                      **Structural Root Zone (SRZ<sup>3</sup>):** 2.9m

**Comments:** Identified as tree 1 in the arboricultural assessment report (Phillips, 2016).

### Findings

The upper soil profile consisted of a layer of imported sandy loam used to build up the garden beds and provide a suitable growing medium for turf grass. The lower horizons consisted of a silty clay loam with a clay loam generally below 600mm. The soil of the lower profiles was crumbly in the hand with slight moisture content.

The trench was an L-shaped trench extending from the south of the tree to the edge of the existing driveway with an additional excavation between the northern side of the driveway and property boundary. Woody root growth belonging to the Lemon-scented Gum was generally found within the top 650 mm of the soil profile to the south-west of tree. Roots were also observed that belong to a Golden Ash (*Fraxinus excelsior* 'Áurea') and Monterey Pine (*Pinus radiata*) located at 35 – 37 Regent Street.

Two (2) roots less than 25 mmØ were exposed at the western end of the southern trench along with a copper water or gas pipe. These two roots were extending from the adjacent Golden Ash, approximately 2 m to the south west.

The 800 mm deep excavation was carried out between the existing driveway and northern property boundary. One (1) root 50 mmØ and numerous roots less than 15 mmØ were observed in the top 400 mm soil profile. These roots had a red, flakey appearance that are typical of a Monterey Pine which was growing close by in the adjacent northern property. Smaller woody and fibrous roots were also noted belonging to garden shrubs growing within the bed.

The trench on the western side of the tree was 8.5m in total length and 300mm wide with the depth varying between 600 mm and 1.2 m. The 1.2 m deep excavation was carried out directly west of the subject tree as was 2m in length. Surprisingly no roots belonging to the subject tree were observed within this section of trench. A cluster of six (6) roots associated with the Lemon-scented Gum were observed further to the south within the trench alignment. Two (2) higher order roots 110 mm and 130 mmØ were noted at 400 mm soil depth. Both of these roots had branched, and included sinker roots that were extending vertically into the soil. One (1) root 95 mmØ and two (2) roots of 60 mmØ were also noted between 540 mm and 650 mm soil depth. One low order root of 45 mmØ was also noted at 450mm soil depth.

### Impact Assessment and Conclusion

The root investigation alignment identified higher order roots extending to the south-west of the subject tree that had developed with sinker roots as well as a number of smaller diameter roots. The sinker roots are important to stabilise the tree and aid water and nutrient uptake, particularly during extended dry periods. These sinker roots

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<sup>1</sup> Tree data from arborist report: Phillips (2016) 39 Regent Street, Mount Waverley.

<sup>2</sup> TPZ Radius = Trunk diameter measured at 1.4m (nominal) above grade (DBH) x 12. The TPZ is used to provide adequate space for the preservation of root and crown area to ensure tree viability

<sup>3</sup> SRZ radius = (D x 50)0.42 x 0.64 where D = trunk diameter, in metres. The SRZ comprises the area around the base of a tree required for the tree's stability in the ground.

would be lost In relation to the proposed retaining wall alignment that could impact upon the health and stability of the tree. It is recommended for the alignment of the retaining wall be offset further from the tree to the west to avoid the loss of the sinker roots and maintain an area sufficient in size for ongoing tree health and development of new roots on the western side. No roots were observed within the southern trench and the proposed retaining wall alignment of 7.3 m would not impact upon the tree.

### Recommendations

The following specific recommendations are provided in relation to the construction footprint and tree protection:

- a) Modify the design, so the retaining wall alignment, including drainage is no closer than 5m on the western side from the tree trunk. The 7.3m retaining wall alignment to the south of the tree can be maintained.
- b) No further encroachment into the reduced TPZ area is to occur.
- c) All utility services, including telecommunications electricity, water, gas or the like must be located outside the TPZ. If this is unachievable within proposed designs all services are to be bored at a minimum depth of 600 mm below the soil surface to the top of the bore head. Bore entry and exit pits are to be located outside the TPZ.
- d) No soil grade changes are to occur within the reduced TPZ area.
- e) All existing hard landscape features, including the driveway and masonry fence within the TPZ must be demolished using hand held tools and removed from the site by hand.
- f) TPZ fencing in the form of 1.8m x 1.8m chain wire mesh panels held in place by concrete feet is to be erected around the tree. The fence is to be erected along the alignment of the retaining wall and eastern property boundary (if masonry fence is removed). The fencing must be kept in place for the duration of the site redevelopment, including demolition and landscaping phases. No entry into the TPZ is permitted without the permission of the project arborist. The TPZ area occupying the road reserve must also be protected during the entire site redevelopment.



*Figure 2: Example of signage for TPZ and of appropriate TPZ fencing.*

- g) The TPZ area is to be mulched with a coarse particle mulch, 100 mm in thickness. Supplementary watering maybe required in line with prevailing soil conditions. A drip irrigation system should be installed to provide supplementary water during dry soil conditions. The irrigation system must cover the TPZ area within the



subject site and the rooting environment should be monitored daily by the site manager from October to May to assess the requirement for watering. .

- h) The existing driveway within the TPZ must be left in place if the property entrance is used for site ingress and egress. This is to protect any roots that may be under the driveway and the growing environment from the movement of plant and equipment.
- i) When the driveway is demolished, a soil that is coarser than the underlying soil is to be placed within the driveway alignment to allow for the continued movement of water and oxygen to the soil below.
- j) The TPZ area must be protected during all phases of development in accordance with AS4970. This may include; installing suitable ground protection engineered for the anticipated load so as to avoid compaction of the underlying soil and allow for continued water percolation and gaseous exchange. An example of a ground protection system would be rumble boards strapped or tree protection matting laid over mulch or aggregate with geo-textile fabric covering the soil surface.

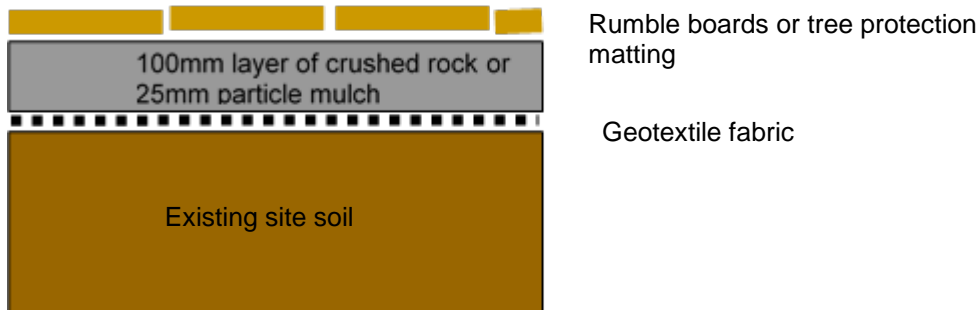


Figure 2: Indicative ground protection system - adapted from AS4970 Clause 4.5.3 Ground protection

- k) Roots greater than 20mm Ø that are required to be to be severed must be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the trees protection zone (TPZ) to be 'pruned' with machinery such as backhoes or excavators.
- l) Where roots within the TPZ are exposed by excavation, temporary root protection should be installed to prevent them from drying out. This may include jute mesh or hessian sheeting as multiple layers over exposed roots and excavated soil profile, extending to the full depth of the root zone. Root protection sheeting should be pegged in place and kept moist during the period that the root zone is exposed.

**Photographic Catalogue**



**Above left:** View to the north showing the western trench alignment in relation to the subject tree.

**Above right:** View to the north showing the western trench alignment. Exposed woody roots have been painted in pink for photographic purposes.



**Above Left:** View to the south showing the exposed root mass within the western trench alignment.

**Above Right:** View of a 130mm root with two sinker roots extending deeper into the soil profile.





**Above left:** Showing an exposed root of 110 mmØ within the western trench.

**Above right:** View to the east showing the southern trench alignment. No roots from the Lemon-scented Gum were noted within the trench alignment. Pink line indicates copper water or gas pipe.



**Above Left:** Shows the excavation between the driveway and northern property boundary.

**Above Right:** Shows the exposed root mass from the adjacent Monterey Pine within the top 400mm soil profile.

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## **Appendix 8: Root Investigation report: Brush Box (Tree 27).**

See following 5 pages.

## Root Investigation Report

**Property Address** 35 – 37 Regent Street, Mount Waverley, Vic  
**Tree Location:** 33 Regent Street, Mount Waverley, Vic  
**Investigation Date:** Tuesday, 31st May, 2016  
**Report Date:** Monday, 27th June, 2016  
**Assessor:** David Phillips Ass Deg Env Hort

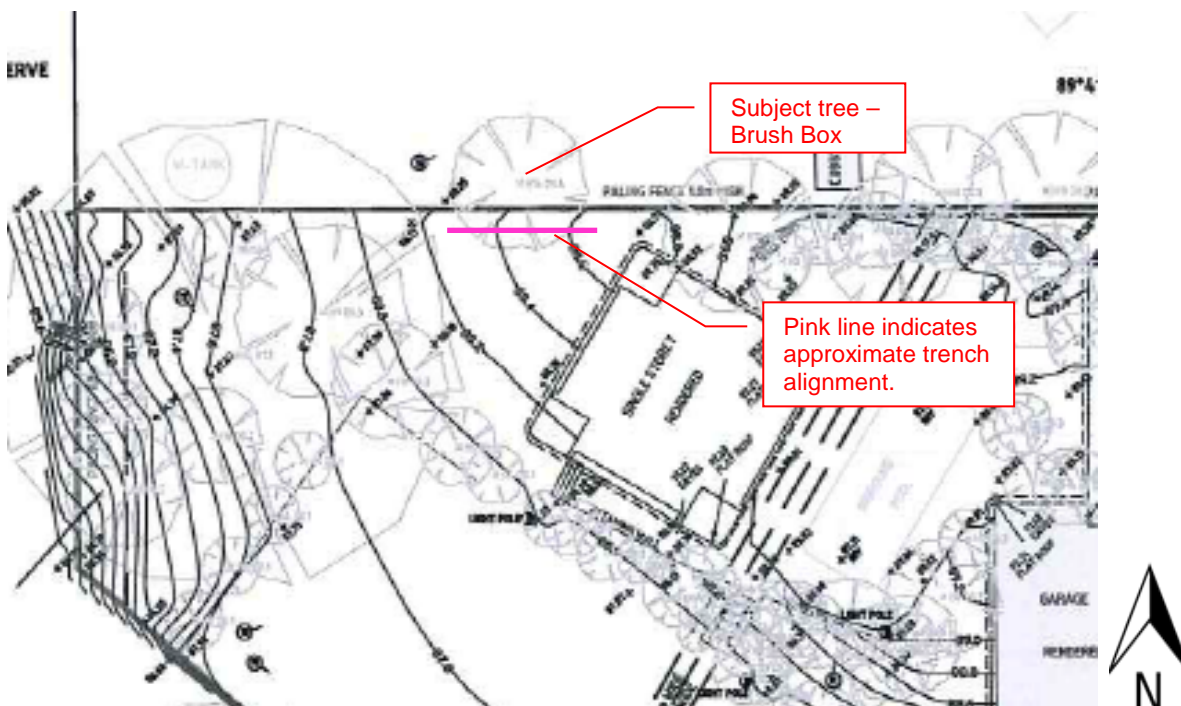
**Scope:** Undertake a root investigation to understand the extent of root growth within the subject site from the Brush Box (*Lophostemon confertus*) located in the adjoining northern property, with the intent to recommend a suitable alignment for the proposed redevelopment.

### Method:

Excavation was undertaken using an Airspade 2000® powered by 225 cfm air compressor, augmented by trenching shovel to extract spoil where able.

The investigation trench followed an east/west alignment offset approximately 500mm from the common property boundary. The trench was 250 - 300mm wide x 500mm deep x 4800mm in length.

Root diameters were measured using a lineal tape measure. Exposed roots were painted for photographic purposes.



**Figure 1:** Shows the location of the subject tree and the approximate alignment of the root investigation at 35 – 37 Regent Street, Mount Waverley.

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### Tree Details<sup>1</sup>:

**Botanical Name:** *Lophostemon confertus*                      **Common Name:** Brush Box  
**Height:** 14m                      **Spread:** 7m                      **Trunk diameter:** 35 cm  
**Age Class:** Semi mature  
**Tree Protection Zones (TPZ<sup>2</sup>):** 4.2m                      **Structural Root Zone (SRZ<sup>3</sup>):** 2.4m  
**Comments:** Identified as tree 27 in the arboricultural assessment report.

### Findings

The trench alignment was offset 500mm from the common boundary which is inside the 2.4m SRZ allocated to the tree.

The upper soil profile was a sandy loam with a relatively dry clay loam subsoil. The dryness of the soil could be attributed to the large Monterey Pine (*Pinus radiata*) located to the south west and dry autumn conditions.

Tree roots varying in diameter was observed throughout the trench alignment at different soil depths from 90mm to 500mm deep. The majority of roots were located at the western and eastern ends of the trench and within the top 200mm of the soil profile. Within the top 200mm soil profile, one root 80mm Ø (considered to be a higher order root), two roots, 40 mm and 50 mmØ and eight roots less than 30 mmØ were observed. Six (6) lower order roots (less than 30 mmØ) were observed below 200 mm of the soil profile.

A few smaller woody roots less than 10mm Ø were noted, spread throughout the length of the trench and there was little evidence of fibrous roots growing in the trench.

### Impact Assessment and Conclusion

The root investigation noted a moderate amount of roots developing into the subject site with the majority being lower order roots (less than 30 mmØ). The subject tree was semi-mature in age displaying fair health and expected to increase in size into the future. Vigorous, semi-mature trees are able to well adapt to root loss as they have readily available reserves to compartmentalise pruning cuts and develop new roots. Brush Box trees have a good tolerance to root loss and disturbance which is a reason why they are widely planted in the urban environment, particularly as street trees. Even though the tree is showing good vigour, some initial impact to tree health may occur with the loss of the exposed roots. However, the ongoing condition of the tree is expected to be maintained where the growing environment is protected during construction. New root development would also be expected to the east and west of the subject tree within the adjoining property as the area was open with no discernible barriers to continued root development. To minimise the impact upon tree health, the construction footprint should be no closer than 2.4m SRZ attributed to the tree.

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<sup>1</sup> Tree data from arborist report: Phillips (2016) 35 – 37 Regent Street, Mount Waverley.

<sup>2</sup> TPZ Radius = Trunk diameter measured at 1.4m (nominal) above grade (DBH) x 12. The TPZ is used to provide adequate space for the preservation of root and crown area to ensure tree viability<sup>2</sup>

SRZ radius = (D x 50)0.42 x 0.64 where D = trunk diameter, in metres. The SRZ comprises the area around the base of a tree required for the tree's stability in the ground.

## Recommendations

The following specific recommendations are provided in relation to the construction footprint and tree protection:

- a) The construction footprint is to be no closer than 2.4m from the subject tree, which includes excavation for footings or trenching for the installation of utility services.
- b) All utility services, including telecommunications electricity, water, gas or the like must be located within the construction footprint to avoid further encroachment. If this is unachievable within proposed designs all services are to be bored at a minimum depth of 600mm below the soil surface to the top of the bore head. Bore entry and exit pits are to be located outside the TPZ.
- c) Within proposed designs, the existing site conditions between the common boundary and construction footprint, and for the diameter of the 4.2m TPZ must be maintained. No soil grade changes are to occur within this area.
- d) If a path is proposed within the TPZ, all of the profiles, including the capping layer are to be permeable in design and construction and built above the existing soil grade.
- e) The remaining TPZ area must be protected during all phases of development in accordance with AS4970. This may include; installing suitable ground protection engineered for the anticipated load so as to avoid compaction of the underlying soil and allow for continued water percolation and gaseous exchange. A ground protection system in the form of rumble boards strapped or tree protection matting laid over mulch or aggregate with geo-textile fabric over the soil surface would be appropriate to protect the growing environment.

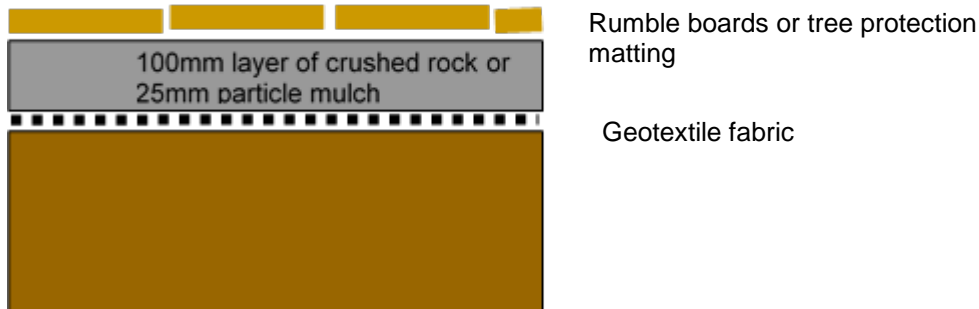


Figure 2: Indicative ground protection system - adapted from AS4970 Clause 4.5.3 Ground protection

- f) Roots greater than 20mm  $\varnothing$  that are to be severed must be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the trees protection zone (TPZ) to be 'pruned' with machinery such as backhoes or excavators.
- g) Where roots within the TPZ are exposed by excavation, temporary root protection should be installed to prevent them drying out. This may include jute mesh or hessian sheeting as multiple layers over exposed roots and excavated soil profile, extending to the full depth of the root zone. Root protection sheeting should be pegged in place and kept moist during the period that the root zone is exposed.
- h) The remaining TPZ area must be mulched with a mixed particle mulch to a depth of 100mm. Supplementary watering maybe required in line with prevailing soil conditions. The rooting environment should be monitored weekly or daily during dry conditions to assess the need for watering.



**Photographic Catalogue**



**Above left:** Showing the relative size, condition and location of the subject tree, a semi –mature Brush Box (*Lophostemon confertus*) in fair condition.

**Above right:** View to the east showing the trench alignment and proximity to the common boundary. All exposed roots were located within the top 500mm soil profile.



**Above Left:** Shows the root mass at the western end of the trench.

**Above Right:** Shows the root mass to the eastern end of the trench.

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## **Appendix 9: Root Investigation report: Conifer group & Hakea (Tree 33 & tree group 4).**

See following 5 pages.



## Root Investigation Report

**Property Address** 35 – 37 Regent Street, Mount Waverley, Vic  
**Tree Location:** 33 Regent Street, Mount Waverley, Vic  
**Investigation Date:** Tuesday, 31st May, 2016  
**Report Date:** Monday, 27th June, 2016  
**Assessor:** David Phillips (Ass Deg Env Hort)

**Scope:** Undertake a root investigation to understand the extent of root growth within the subject site from the group of trees located within the adjacent northern property.

### Method:

The excavation was undertaken using an Airspade 2000® powered by 225 cfm air compressor, augmented by trenching shovel to extract spoil where able.

The trench investigation was undertaken between a narrow gap between the base of the existing rock retaining wall and paved section extending out from the existing residence. Further investigation continued in an easterly direction past the water tank and hot water service. The trench was 200mm wide x 200mm deep x 8000mm in length.

Root diameters were measured using a lineal tape measure. Exposed roots were painted for photographic purposes.



**Figure 1:** Shows the trench alignment adjacent to the group of conifers located in the adjoining northern property at 35 – 37 Regent Street, Mount Waverley. Exposed roots are highlighted in pink.



#### Tree Details<sup>1</sup>:

**Botanical Name:** *X Cupressocyparis Leylandii* **Common Name:** Leighton Green Leyland Cypress  
'Leighton Green'

**Height:** 14m **Spread:** 87m **Largest trunk diameter:** 37 cm

**Age Class:** Maturing

**Tree Protection Zones (TPZ<sup>2</sup>):** 4.4m

**Structural Root Zone (SRZ<sup>3</sup>):** N/A

**Comments:** Identified as tree group 4 in arboricultural assessment report.

#### Tree Details<sup>4</sup>:

**Botanical Name:** *Hakea salicifolia*'

**Common Name:** Willow-leaved Hakea

**Height:** 6m **Spread:** 4m **Largest trunk diameter:** Obstructed by fence

**Age Class:** Maturing

**Tree Protection Zones (TPZ<sup>5</sup>):** N/A

**Structural Root Zone (SRZ<sup>6</sup>):** N/A

**Comments:** Identified as Tree 33 in the arboricultural assessment report.

#### Findings

The soil consisted of a layer of imported loam placed on top of the existing clay soil.

Tree root growth was observed within the top 200mm soil profile and deflected along the edge of the paving. The roots did not appear to extend beneath the concrete base course of the paving. Three (3) roots: 20 mm, 30 mm and 60 mmØ were observed adjacent to the Willow leaved Hakea, located within the top 80mm of the soil profile. Four (4) roots: 20 mm, 30 mm, 40 mm and 60mmØ were noted adjacent to the group of conifers growing within the top 100 mm soil profile. The 30 mmØ root was extending below the wooden structure erected around the water tank. Two woody roots less than 20 mmØ were noted at a soil depth of 50mm.

A few smaller woody (less than 10 mmØ) and fibrous roots were encountered throughout the length of the trench.

A 25mm PVC conduit used for irrigation was noted along the length of the trench.

#### Impact Assessment and Conclusion

The majority of root development from the Hakea and Conifers would be expected within the adjacent property due to the 600mm grade difference between the sites. A minimal amount of tree roots have developed within the

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<sup>1</sup> Tree data from arborist report: Phillips (2016) 35 – 37 Regent Street, Mount Waverley.

<sup>2</sup> TPZ Radius = Trunk diameter measured at 1.4m (nominal) above grade (DBH) x 12. The TPZ is used to provide adequate space for the preservation of root and crown area to ensure tree viability

<sup>3</sup> SRZ radius =  $(D \times 50)0.42 \times 0.64$  where D = trunk diameter, in metres. The SRZ comprises the area around the base of a tree required for the tree's stability in the ground.

subject site that have mostly deflected along the edge of paving. The loss of these roots is expected to have a negligible impact upon tree health and the ongoing condition of the trees is expected to be maintained.

Proposed design plans should aim to locate the construction footprint, including excavation, the installation of utility services or construction of a retaining wall a minimum of 800 mm from the northern property boundary.

### **Recommendations**

The following specific recommendations are provided in relation to the construction footprint and tree protection:

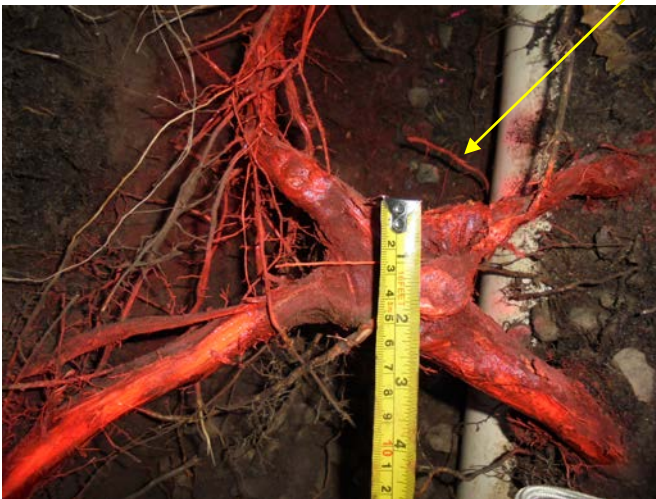
- a) Roots greater than 20 mmØ that are to be severed must be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots within the trees protection zone (TPZ) to be 'pruned' with machinery such as backhoes or excavators.
- b) Where roots within the TPZ are exposed by excavation, temporary root protection should be installed to prevent them drying out. This may include jute mesh or hessian sheeting as multiple layers over exposed roots and excavated soil profile, extending to the full depth of the root zone. Root protection sheeting should be pegged in place and kept moist during the period that the root zone is exposed.

**Photographic Catalogue**



**Above left:** Shows the eastern end of the trench adjacent to the hot water service.

**Above right:** Shows the exposed roots adjacent to the wooden structure surrounding the water tank. The white line shows the PVC irrigation pipeline.



**Above Left:** Shows a branching root of 60 mmØ located adjacent to the group of conifers.

**Above Right:** Shows a branching root of 30 mmØ with two roots of 10mmØ extending from a root of 60 mmØ.

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