HORT20019 URBAN TREE MANAGMENT
TREE REPORT
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Report on *Eucalyptus cladocalyx* , located at reserve on 570-572 Swan St Burnley VIC 3121, -37.826825, 145.016634.
Assessments carried out August through September 2015 by Patrick Honan.

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BRIEF

The topic for this assessment is an established, large, mature *Eucalyptus cladocalyx* existing in a grassed reserve in Burnley, Melbourne, Victoria. The reserve is between the corner of Madden Grove and Swan street, and the adjacent railway line.
This tree is of a significant size in the publicly accessible reserve, and so the council City of Yarra has contracted an arborist to assess the tree, fill out an ISA Basic Tree Risk Assessment form and produce this report.

This report's objective is to professionally evaluate the specified trees condition with regard to hazard potential, identifying causal issues and provide recommendations for treatment and management. In doing so, this report will allow for a formal documentation of risk and liability posed by the tree to the council, and ultimately the users of the park. This is part of the wider tree management strategy for public open spaces in City of Yarra. There were no further changes or modifications to the brief beyond this scope.

As this report is being prepared for the public open space management department of City of Yarra this report is written with some level of assumed knowledge about the topic, and uses some industry and technological terminology.

BACKGROUND

The species belongs to the botanical family Myrtaceae, and is known commonly as “Sugar Gum” (University of Melbourne 2015).
The site is a wide grassed reserve, easily accessible to the public via foot. It is bordered on one side by a footpath and a road. There are no paths in the reserve. FIGURE 1 depicts a satellite image of the site. The reserve is occasionally rented as an outdoor events space by the council, with travelling circuses as an example of a temporary tenant. These events attract a sizable amount of people on an inconsistent basis. The site is also used occasionally for general recreation by the public for activities like dog walking and ball sports.

The specimen is an open-grown park planting set into turf and mulched to the canopy line (FIGURE 2). At the edge of canopy there is a power box (approximately 1 metre high, see FIGURE 2), used when events are held in the space. The council has installed a ring of small boulders at the canopy line where the mulch begins, in an effort to deter foot & vehicle traffic (FIGURE 8). The tree is fully exposed to prevailing westerly winds and other environmental & weather conditions.

The species is not indigenous to the area of the state, originating from South Australia. It is often planted for timber purposes, and it has naturalised outside its natural range

(University of Melbourne 2015). It is highly drought tolerant, can be expected to reach a height of 35 metres at maturity.
The area experienced significant dry periods as part of Australia wide drought conditions starting in 1995 and continuing until 2009 (Sydney Morning Herald, 2008). The year 2006 was the driest on record. (Beureau of Metereology, 2006). These conditions are likely to increase the chance of limb shear in this genus (Matheny & Clark 1994).
The author of this report has not been informed of any development intentions beyond the current level of infrastructure on the site.
The need for this report has risen from the size of the tree, the nature of the public use of the site and the City of Yarra's policy of being proactive about tree management in public space.

METHODS & PROCEDURE

A ground inspection of the tree was carried out on the 22/08/2015 by the author of this report. An ISA Basic Tree Risk Assessment form was completed following this inspection. Photographic records were taken, and are used throughout this report.
For these inspections data collected included tree height, trunk diameter at breast height (1.4m, known as DBH), live crown ratio and canopy width (averaged).
Tree height was determined using a height meter and DBH using a diameter tape measure. All other measurements taken used a metric tape measure. A penetrometer was used for the assessment of soil conditions.
A second site visit was conducted by the author on 17/09/2015 to photograph the tree.

FINDINGS

See attached completed ISA Basic Tree Risk Assessment form for complete documentation of findings (APPENDIX). What follows is a broad overview to frame discussion.

Tree data recorded from *Eucalyptus cladocalyx* 22/08/2015

Tree height	29.4 metres
Diameter at breast height (AUSTRALIAN STANDARD)	119 centimetres
Canopy width North to South	19.4 metres
Canopy width East-West	18.8 metres
Canopy averaged	19.1 metres
Live crown ratio	90.00%
Soil bulk density test	300/120= 2.5

Overview of areas of concern for tree hazard potential, with subsequent risk rating

CONDITION	DETAIL	RISK RATING
Included bark	Advanced branches of significant size showing	LOW

	decay at branch union; poorly attached with weak attachments	
Epicormic shoots	Widespread and advanced epicormic shoots with weak attachments and imbalance	LOW
Cracks and rotting	Stripped bark from limb loss & poor pruning technique is allowing decay to set in at various points in the tree. Single branch showing crack along underside of remaining branch due to snap or improper pruning	MODERATE
Open scar with decay	Significant scar and rot of heartwood at base, continuing below soil level	LOW
Rot and presence of frass on trunk	Unhealed wounds from limb removal on trunk show evidence of decay and frass, suggesting potential borer damage	MODERATE
Lean	Entire tree leans to at least a 10 degree angle	LOW
Overall risk rating of tree	MODERATE	

DISCUSSION

Included bark

Refer to FIGURE 3 for photo, depicting included bark at branch union. Such are inherently weak, as connective tissues are unable to properly form at the join (Matheny & Clark 1994). As decay increases at the site of inclusion, so does the potential for failure (Matheny & Clark 1994). This defect is rated at “low”, see APPENDIX; the target zone for this defect is rarely to occasionally occupied, the tree is exposed to windy conditions & the genus has a habit of limb shedding (University of Melbourne 2015). Though the defect is likely to fail at some point, there is no indication that this failure is imminent, with no additional swelling at the branch point. As the branch is of a significant size, failure and shear will expose a large portion of the cambium to decay.
The defect will require future monitoring. As the tree grows, the accumulation of included bark will increase stress on the union with time. The risk represented by this defect will increase as the tree ages (Matheny & Clark 1994).

Epicormic shoots

Refer to FIGURE 4 for photo, depicting a variety of epicormic branches shooting vertically from midpoints in horizontal branches. Such growth is an indicator for environmental stress . These shoots arise from latent buds or meristematic points along the lower trunk, large branches, and pruning wounds (Konijnendijk 2005). In this case we can suggest such growth is a response either to evidenced improper pruning technique, or previously detailed environmental conditions. Harris, Clark and Matheny (2004) note epicormic shoots as a symptom of tree decline.
Epicormic growth form poor tree architecture and have weak branch union, as they are not joined all the way to the centre of the stem (Albers, Pokorny & Johnson 2003). These unions have no observable indicators that suggest failure is imminent. As it is a structural fault it will require future, ongoing monitoring. However it is not significant with respect to tree hazard potential at this immediate time.

Cracks and rotting

FIGURE 5 shows how inappropriate pruning technique or storm damage has lead to stripped bark and partial limb loss. Such wounds usually damage important conducting tissues for the tree (Shigo 1985). These wounds also act as a vector to expose the inside of the tree to pathogenic organisms, primarily bacteria and fungi (Raven, Evert & Eichhorn 2005). These infections lead to decay, and shorten the life and structural integrity of the tree (Shigo 1985).

FIGURE 6 shows in one location how either inappropriate pruning or complete limb shear has lead to a failure of a healing and covering response from the tree. The result is the exposed wood has begun to decay, compromising the integrity of the trunk and acting as a vector for pathogen attack. The presence of borer holes is noted, suggesting insect damage which is discussed later.

Open scar with decay

FIGURE 7 depicts significant scar and rot of heartwood at base of tree, extending down to the root collar. This decay may extend into the root system. Tankersley (2015) notes that such decay is a major cause of tree failure due to the inflexibility of dead tissues. This is a significant problem when present in the trunk, as healthy trees are required to bend and sway (Tankersley 2015), and is particularly relevant given the exposed site for this tree. It should be noted that Tankersley (2015) states that vigorous trees have been observed to grow more sound wood around the hollow, compensating for that lost to decay. Compartmentalisation of the decay also prevents spread and size of the damage from spreading (Shigo 1985).

The placement of this scar needs to be considered, and its proximity to the root system. Raven, Evert & Eichhorn (2005) note that such wounds act for a vector for infection and decay. Tankersley (2015) notes the importance of roots in anchoring the tree, and states that any damage to the roots will come with a corresponding probability of tree failure, and that damage by decay may cause the tree to be more susceptible to wind throw. This is particularly relevant given the trees exposed position and angle of lean.
Use of ground penetrating radar is a well documented solution (Stokes et al. 2002) that is appropriate in this context to establish the extent the decay has spread into the root system.

Rot and presence of frass on trunk

Unhealed wounds from limb removal on trunk show evidence of decay and frass, suggesting potential borer damage (FIGURE 8).
The holes are also observed intermittently on the trunk, and are suggestive of *Phoracantha semipunctata* (Gerozisis & Hadlington 2004). The presence of this insect is likely secondary to an overall decline in health in the tree, as it usually effects dead or dying trees (Museum Victoria Biodiversity Snapshots 2014). The damage carries into the sapwood of the affected tree, which could act as a vector for other pests, disease and decay. Already the presence of decayed tissue is observed at the surface. It is not possible to determine if this has been directly caused by the pest insect, or the limb shear previously discussed. In great numbers the pest can completely destroy phloem-cambium region on which it feeds (Gerozisis & Hadlington 2004), and so further surveying is required to establish extent of infestation

Lean
The tree exhibits a notable lean of approximately 10 degrees (FIGURE 2). There is no mounding of soil visible. Tree lean is a common defect leading to failure that can be symptomatic or aggravated by root damage or restriction (Harris, Clark & Matheny 2004). This is particularly relevant given the decay observed at the root collar, which as discussed may extend below soil level. If these are related symptoms, then it may suggest an issue with whole tree stability. Thorough observation of the soil for cracking (the first sign of tree wind throw) (Mattheck & Breloer 1994, Matheny & Clark 1994) was not possible due to mulch layer on site. The exposed nature of the site compounds the potential for failure and wind throw.

Risk mitigation works
The impact of any of these failures is linked directly to occupancy rates. Although the reserve is open and publicly accessible, it should be noted that the council has taken steps to dissuade public use under the canopy. This is achieved through embedded rocks to prevent cars from accessing the area, and mulching around the canopy to discourage people travelling and stopping in the area. This is depicted in FIGURE 9. These steps work well to curb the potential failure and impact, as occupancy rates are discouraged and decreased. However, it should be noted the occasional tenancy of this land for events as leased by the council is a unquantified variable to occupation rates, and therefore risk and impact.

CONCLUSIONS AND RECOMMENDATIONS

Tree is severely compromised due to the following

- large number of limbs improperly pruned or dropping independently, acting as vectors for decay to set into tree and compromise stability and health
- Rot, included bark observed at branch unions, suggesting significant limb shear is likely. Consistent with observation of prior limb shear
- Large scar at trunk extends into root collar, evidences presence of decay in trunk that may extend into root zone. Threatens stability of entire tree
- Epicormic shoots and evidence of borers symptomatic of tree decline, compounding problems though poor branch unions, potential vectors for decay and pathogens.

SUGGESTED MITIGATION OPTIONS

- IMMEDIATE aerial inspection: This will quickly determine best course of action in terms of limb removal, weight reduction, whole tree removal and concern for public access. The evaluation carried out in this report is based on ground observations only and should therefore be treated as preliminary data only, due to the limitations of this observation type. Aerial inspection will allow for more through investigation of problems identified in this report.

- MID TERM Remove limbs with poor attachment & to aid weight reduction. This will reduce risk to pedestrian access and load bearing on tree
- MID TERM Use of ground penetrating radar to investigate root system architecture; extent of decay spread into root zone and instability of tree as a whole.

- LONG TERM Fence off entire area surrounding canopy to prevent pedestrian access to fall zone of limbs, whole tree
- LONG TERM Remove entire tree as it degrades further

FIGURES

Figure 1- *Location of subject tree*

Figure 2-*Subject tree and surrounding environment*

Figure 3- *Included bark at branch union*

Figure 4- *Multiple epicormic branches throughout the tree*

Figure 5- *Torn bark, cracks and decay from limb shear or improper pruning technique*

Figure 6- *Decay setting into trunk from tree being unable to properly cover wound following limb shear or improper pruning*

Figure 7-*Scar and decay on base of trunk at root collar, possibly extending below soil level. Iphone pictured for scale*

Figure 8-*Evidence of frass in wound suggesting presence of borers*

Figure 9-*Risk mitigation (mulch and rocks) installed by council to deter both vehicle and foot traffic from canopy line of tree*

APPENDIX- *ISA Basic Tree Risk Assessment Form*

Basic Tree Risk Assessment Form

Client City of Yarra Date 22/08/2015 Time 0900

Address/Tree location Reserve between the corner of Madden Grove and the rail line, Burnley Tree no. 25 white Sheet 1 of 2

Tree species Eucalyptus cladocalyx dbh 119cm Height 29.4m Crown spread dia. 1925cm (averaged)

Assessor(s) Patrick Honan Time frame 1 hour Tools used Diameter tape, height meter, tangent gauge, tape measure, DSLR, penetrometer

Target Assessment

Target number	Target description	Target zone: Target within drip line	Target zone: Target within 1 x Ht.	Target zone: Target within 1.5 x Ht.	Occupancy rate (1 – rare, 2 – occasional, 3 – frequent, 4 – constant)	Practical to move target?	Restriction practical?
1	Power box	x			4	no	no
2	Public park, occasionally used as event space	x			2	no	yes
3							
4							

Site Factors

History of failures _____ **Topography** Flat ☒ Slope ☐ _____% **Aspect** _____

Site changes None ☒ Grade change ☐ Site clearing ☐ Changed soil hydrology ☐ Root cuts ☐ Describe _____

Soil conditions Limited volume ☐ Saturated ☐ Shallow ☐ Compacted ☐ Pavement over roots ☐ _____% Describe 2.5 penetrometer reading

Prevailing wind direction WEST **Common weather** Strong winds ☐ Ice ☐ Snow ☐ Heavy rain ☐ Describe _____

Tree Health and Species Profile

Vigor Low ☐ Normal ☐ High ☐ **Foliage** None (seasonal) ☐ None (dead) ☐ Normal 100 % Chlorotic _____% Necrotic _____%

Pests Borer **Abiotic** _____

Species failure profile Branches ☒ Trunk ☐ Roots ☐ Describe Genus is generally susceptible to limb shear

Load Factors

Wind exposure Protected ☐ Partial ☐ Full ☒ Wind funneling ☐ _____ **Relative crown size** Small ☐ Medium ☒ Large ☐

Crown density Sparse ☐ Normal ☐ Dense ☐ **Interior branches** Few ☐ Normal ☒ Dense ☐ **Vines/Mistletoe/Moss** ☐ _____

Recent or planned change in load factors _____

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

Unbalanced crown ☒ LCR 90 %

Dead twigs/branches ☐ ____% overall Max. dia. _____

Broken/Hangers Number 5 Max. dia. _____

Over-extended branches ☐

Pruning history

Crown cleaned ☐ Thinned ☐ Raised ☐

Reduced ☒ Topped ☒ Lion-tailed ☐

Flush cuts ☐ Other _____

Cracks ☒ Single branch showing crack along remaining length where it has snapped in wind or been improperly pruned Lightning damage ☐

Codominant ☐ _____ Included bark ☒

Weak attachments ☒ Epicormic branches, multiple Cavity/Nest hole ____% circ.

Previous branch failures ☒ see cracks Similar branches present ☐

Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐

Conks ☐ Heartwood decay ☐ _____

Response growth _____

Main concern(s) Innapropriate pruning or limb shear has lead to a number of poorly attached and unbalanced branches, as well as multiple epicormic shoots. Stripped bark from limb loss is allowing decay to set in. Decay evidenced at branch union on some branches, included bark

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☒ Advanced trees branches of significant size poorly attached and decaying

Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☒

— Trunk —

Dead/Missing bark ☒ Abnormal bark texture/color ☐

Codominant stems ☐ Included bark ☐ Cracks ☐

Sapwood damage/decay ☒ Cankers/Galls/Burls ☐ Sap ooze ☒

Lightning damage ☐ Heartwood decay ☒ Conks/Mushrooms ☐

Cavity/Nest hole _____ % circ. Depth _____ Poor taper ☐

Lean 10 ° Corrected? _____

Response growth _____

Main concern(s) Significant scar and rot of heartwood at base. Additional decay evidenced at site of limb shear/removal close to base. Frass and evidence of borers in trunk

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☒

Likelihood of failure

Improbable ☐ Possible ☐ Probable ☒ Imminent ☐

— Roots and Root Collar —

Collar buried/Not visible ☐ Depth _____ Stem girdling ☐

Dead ☐ Decay ☒ Conks/Mushrooms ☐

Ooze ☐ Cavity ☐ _____% circ.

Cracks ☐ Cut/Damaged roots ☐ Distance from trunk _____

Root plate lifting ☐ Soil weakness ☐

Response growth _____

Main concern(s) Significant scar on trunk extends down to root collar. Decay may extend into roots, lean of trunk may be symptomatic of root decay

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐

Likelihood of failure

Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Risk Categorization

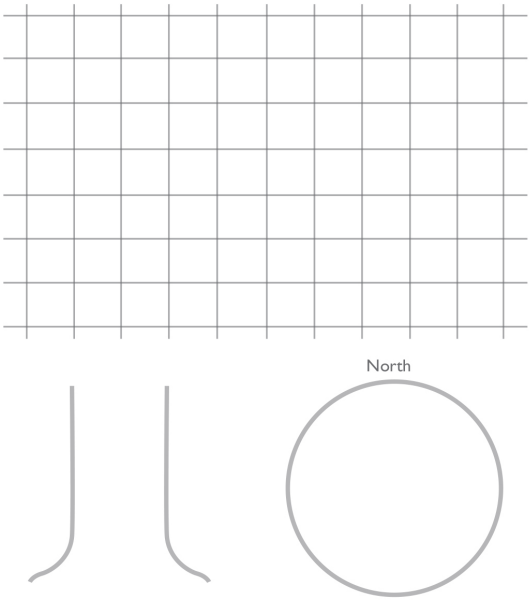
Condition number	Tree part	Conditions of concern	Part size	Fall distance	Target number	Target protection	Likelihood: Failure: Improbable	Likelihood: Failure: Possible	Likelihood: Failure: Probable	Likelihood: Failure: Imminent	Likelihood: Impact: Very low	Likelihood: Impact: Low	Likelihood: Impact: Medium	Likelihood: Impact: High	Likelihood: Failure & Impact (from Matrix 1): Unlikely	Likelihood: Failure & Impact (from Matrix 1): Somewhat	Likelihood: Failure & Impact (from Matrix 1): Likely	Likelihood: Failure & Impact (from Matrix 1): Very likely	Consequences: Negligible	Consequences: Minor	Consequences: Significant	Consequences: Severe	Risk rating of part (from Matrix 2)
1	Branch	Included bark	20m	20m	2				x			x			x							x	low
2	Branch	Epicormic shoots	5m	5m	2				x			x			x							x	low
3	Branch	Torn bark, cracked and rotting, borers	15m	15m	2					x		x				x						x	moderate
4	Root collar	Open scar with decay and rot	1m	30m	1&2				x			x			x							x	low
	Trunk	Lean, instability	30m	30m	1&2				x			x			x							x	low

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impacting Target			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low



Notes, explanations, descriptions _____

Mitigation options Remove limbs with poor attachment & decay — **Residual risk** Moderate

Fence off and completely prevent access to entire canopy area and drop zone — **Residual risk** Low

Remove entire tree — **Residual risk** Low

Residual risk _____

Overall tree risk rating Low ☐ Moderate ☐x High ☐ Extreme ☐

Overall residual risk Low ☐ Moderate ☒ High ☐ Extreme ☐

Work priority 1 ☒x 2 ☐ 3 ☐ 4 ☐

Recommended inspection interval ASAP

Data ☐Final ☐Preliminary **Advanced assessment needed** ☐No ☐Yes-Type/Reason Aerial assessment recommended to establish action required for branch removal, weight reduction, tree removal, public access risk

Inspection limitations ☐None ☒xVisibility ☒xAccess ☐Vines ☐Root collar buried Describe Tree is of significant size and inspection carried out at ground level, however major faults obvious from this level

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