pre-development tree assessment

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PROJECT
Cronulla Town Centre Upgrade - Stage 2
Cronulla Mall & Kingsway, Cronulla, NSW 2230

CLIENT / PRINCIPAL
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i EXECUTIVE SUMMARY

In 2018 Council commissioned a Town Centre Master Plan. The master plan prepared by Gallagher Studio, and endorsed by SCC, proposed an holistic approach to the town centre and recommended numerous changes and embellishments to the Mall and the surrounding streets. The assessment of the trees forms an extension of this earlier work and is to provide further information required to help realise the potential vision of the master plan.

Cronulla Mall and the Kingsway are located adjacent to the southern end of Cronulla Beach, within a few hundred metres of the surf and ocean. The study area itself, is a typical urban environment, with fully paved footpaths adjacent to the busy Kingsway and the extensive, and essentially hard paved surfaces throughout the Mall itself. There is a prominent planting of mature Canary Island Date Palms adjacent to Kingsway and throughout the northern end of the Mall. The other trees within the Mall, are predominantly a mixture of relatively stunted *Gleditsia tricanthos* (Honey Locust) and *Platanus x acerifolius* (London Plane Tree). The street to the south of the pedestrianised Mall, Cronulla Street, is planted with a mixture of *Cupaniopsis anacardioides* (Tuckeroo) and *Livistona australis* (Cabbage Tree Palm) street trees.

The current size and condition of the majority of trees, some **35 years** after their installation, suggests that the trees were installed into **very poorly prepared** tree pits with only minimal available soil. On the whole, the tree population is not thriving. Most trees appear to be merely sustaining life, as evidenced by features such as tip dieback, epicormic growth, short internodal growth, and their generally stunted appearance and the small overall sizes observed. Both the *Gleditsia triacanthos* 'Shademaster' (Honey Locust) and *Platanus x acerifolia* (London Planes) are expected grow to be medium to large trees, even in relatively harsh growing conditions. A 30 year old London Plane Tree, would have been normally expected to reach at least 15-18m in height and spread. Most trees within the Mall have failed to achieve even a height of 8 metres, after more than 30 years growth. This is a particularly poor outcome. The ability to significantly improve the conditions of the existing trees is limited.

It should be noted that all Phoenix canariensis (Canary Island Date Palms) included in this assessment have recently been sampled and are currently being DNA tested by the Royal Botanic Gardens Sydney for the presence of *Fusarium Oxysporum f.sp. canariensis* (Foc). This is a fungal pathogen that causes vascular collapse that ultimately results in the death of the infected palm. The current retention values for the 23 *Phoenix canariensis* (Canary Island Date Palm) have been applied based on a visual assessment of their current condition, together with their cultural and visual significance within the landscape of the Mall and surrounds. If any of the palms are found to be infected with Fusarium wilt they will need to be removed.

If the Palms are found to be free of Fusarium they should be targeted for retention. Given their ability to be readily transplanted they could also be relatively easily relocated and moved to other preferred locations nearby, thereby continuing their historical association with Cronulla and the Mall.

Given our understanding of the likely scope of the proposed public domain upgrade, it is the authors opinion that consideration should definitely be given to removal of all of the current deciduous trees to allow their replacement with new and better performing trees. This would allow the new trees to be:

- in new and appropriately prepared tree pits or planting trenches that will provide better growing conditions and appropriate soil volumes for longer term growth of healthy and resilient trees;
- access to more adequate soil moisture and generally better growing conditions through the use of permeable paving and other passive irrigation techniques;
- new and more appropriate species that will provide improved aesthetic appeal that may be desired by the public, shop keepers and Council;
- a diversity of species that may be better able to tolerate the vagaries of a changing and more intense climate and also provide appropriate landmark or signature trees at important locations.

This document has been prepared by Arterra Design Pty Ltd, using the expertise of our in-house consulting arborist (AQF Level 5), Robert Smart. Rob is a member of the International Society of Arboriculture, a Registered Consulting Arborist with Arboriculture Australia and a licenced practitioner in the QTRA system.

Robert Smart AAILA , ISA, AA
Director, Registered Landscape Architect (054), Registered Consulting Arborist (1804).

1.0 INTRODUCTION

1.1 Background

On the 9 September 2019, Arterra Design was engaged by Sutherland Shire Council (SSC) to undertake an arboricultural assessment of the trees within Cronulla Mall and along the southern side of Kingsway east of the Mall. The brief was to prepare the relevant reports and plans to help inform and guide the proposed Cronulla Town Centre Public Domain Upgrade- Stage 2. On the 19 September and 14 October 2019, Arterra completed a detailed assessment of the trees, identifying the trees and assessing their structures, health and retention values.

In 2018 Council commissioned a Town Centre Master Plan. The master plan prepared by Gallagher Studio, and endorsed by SCC, proposed an holistic approach to the town centre and recommended numerous changes and embellishments to the Mall and the surrounding streets. The assessment of the trees forms an extension of this earlier work and is to provide further information required to help realise the potential vision of the master plan.

Figure 1 – Context Plan showing the general location and context of the study area. (Photo Nearmap 27.01.19)

1.2 Aims of Report

The aim of this report is to assess the existing trees within and adjacent to the site that are in the immediate vicinity of the potential and proposed works. Specifically the report aims to: -

- Assess the health and condition of the trees within the immediate vicinity of the proposed works;
- Accurately record information relevant to the existing trees;
- Assess the significance and retention values of the existing trees;
- Provide clear recommendations as to which trees should be retained and protected, if any;
- Identify the proposed Tree Protection Zones (TPZs) to guide the project's design and construction and
- Provide preliminary advice on the likely tree protection measures that will be required during both design and construction.

The following limitations apply to this report's use: -

1. It is a preliminary document: This report is a preliminary assessment document to provide guidance to the designers. The guidance is based on a brief site inspection and it may be necessary to make adjustments and further site investigations once the full nature of any proposed site works are known.

2. Plans: All plans are based on information provided to Arterra and are illustrative for planning purposes. They should only be used relating to tree issues and are not suitable for any other purpose.
3. Confidentiality: This report is confidential to the Client and should not be released to any Third Party without consultation with Arterra and consent from the Client.
4. Notification of proposed disturbance within TPZs: Arterra, or the client, should be clearly notified of any disturbance proposed within TPZs, so that we may advise on the implications before any layout or work is finalised.
5. Further consultation on tree related issues: We advise against any design based on this information being submitted for approval without the relevant tree related issues being further reviewed by Arterra.

1.3 Relevant Controls or Legislation

SSC – DCP 2015, Chapter 39, Section 4 -Natural Resource Management relates to the protection of Trees and Bushland Vegetation. A note at the bottom of the introduction to Section 4 states: Bushland and trees on land owned or in the care, control and management of Sutherland Shire Council are managed in accordance with Council's adopted policy: "Urban Tree and Bushland Policy".

Section 4.2 of the above DCP document – 'Controls for Clearing Trees and Vegetation', specifies the trees and vegetation to which the controls for the clearing of trees and vegetation contained in State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017, apply.

Section 4.4.2 of the above document states the section applies to a single or multi trunked tree with a diameter of 100mm or more measured at 500mm above ground level. Section 4.3 of the above document lists a variety of species that are specifically exempt from protection under the DCP. *Phoenix canariensis* (Canary Island Date Palms) are on this list.

The Cronulla Mall area is not with an area mapped for 'core', 'support' or 'restoration' of Greenweb vegetation.

1.4 Conduct and Author Qualifications

Given the above stated aims of this report, as author of this report, Arterra Design confirms that Robert Smart is suitably qualified to provide comment and the required arboricultural advice pertaining to these matters.

Furthermore, Mr Smart confirms that he has read and agrees to be bound by the NSW Uniform Civil Procedure Rules 2005, Part 31 Division 2 Provisions, Schedule 7 - Expert witness code of conduct.

Arterra provides specialist consulting arborist services only and does not provide any physical tree work services such as climbing, pruning, removal, root investigations or root pruning. Our advice is based on impartial professional assessment only, as we do not derive any financial benefit from specifying pruning or other physical services. We will not specify any such activities unless we determine them to be essential to the ongoing health or stability of the tree.

1.5 Documents Reviewed

Plans and documents referenced and reviewed as part of this tree assessment were:

- Sutherland Shire Council DCP 2015
- SSC- Cronulla Town Centre Public Domain Master Plan – August 2018
- GHD – Cronulla Town Centre Design Stage 2 - Geotechnical Investigation and Waste Classification Report - August 2019
- Cronulla Centre Documentation Package prepared by Philip Cox, Richardson Taylor and Partners Pty Ltd, et al – January 1988
- Geosurv – Underground services Survey – 5 May 2019

1.6 Site Location and Context

Cronulla Mall and the Kingsway are located adjacent to the southern end of Cronulla Beach, within a few hundred metres of the surf and ocean. The study area itself, is a typical urban environment, with fully paved footpaths adjacent to the busy Kingsway and the extensive, and essentially hard paved surfaces throughout the Mall itself. There is a prominent planting of mature Canary Island Date Palms adjacent to Kingsway and throughout the northern end of the Mall. The other trees within the Mall, are predominantly a mixture of relatively stunted *Gleditsia tricanthos* (Honey Locust) and *Platanus x acerifolius* (London Plane Tree). The street to the south of the pedestrianised Mall, Cronulla Street, is planted with a mixture of *Cupaniopsis anacardioides* (Tuckeroo) and *Livistona australis* (Cabbage Tree Palm) street trees.

The site is exposed to relatively constant sea breezes and some salt spray, being located close to the coast. The Kingsway is a busy arterial road rising up to the west, away from the beach. The palms along The Kingsway are particularly exposed to constant sea breezes and salt spray. Many specimens display varying degrees of wind burn and browning of the frond tips. Cronulla Mall is oriented north-south, and a little more protected from prevailing coastal conditions but represents an equally challenging environment. The trees appear to be typically growing in constrained conditions with very limited soil volumes and fully surrounded by tiled paving on thick concrete slabs. Stronger southerly oriented winds are frequently funnelled up the Mall.

Figure 2 – Cronulla Mall looking north from around the centre of the mall. (Photo: Arterra 14.10.19)

Figure 3 – Cronulla Mall where it meets Kingsway with the visually prominent cluster of Canary Island Date Palms lining the southern side of the road and defining the character of the northern portions of the Mall. View looking south-west from Kingsway. (Photo: Arterra 14.10.19)

1.7 Site Ownership and Zoning

The Mall is zoned B3 Commercial Core and is owned, managed and maintained by SSC. Kingsway is zoned SP2 Infrastructure and is an RMS controlled road. The town centre area surrounding the commercial core is zoned R4 High Density Residential.

1.8 Key Definitions and Abbreviations

The following abbreviations are used throughout this report.

TPZ = Tree Protect Zone
This is the area as defined by AS 4970 – "Protection of trees on development sites" and means the typical minimum area above and below ground at a given distance from the trunk to provide for protection of the tree. Most importantly it represents the root zone required to be kept uninjured to maintain a healthy and viable tree. Please note, that roots will usually extend well beyond this zone, so this represents the minimum remaining root zone required, assuming all others are lost or damaged due to construction. It is typically calculated as a circle centred on the trunk unless existing site conditions can be assessed and indicate otherwise.

For palms such as *Phoenix canariensis* the TPZ is considered to be at least 1m past the projection of the canopy fronds.

SRZ = Structural Root Zone
This is the area as defined by AS 4970 – "Protection of trees on development sites" and means the area immediately around the base of the tree at a given distance from the trunk. The woody roots and soil cohesion in this area are considered vital to the structural stability of the tree. Damage or removal of soil and roots from this area will typically render the tree unstable and require its removal. It is typically calculated as a circle, centred on the trunk, unless existing site conditions can be assessed and indicate otherwise.

For palms the SRZ is not specifically addressed under the standard. For palms such as the *Phoenix canariensis* the SRZ is therefore considered to be at least 1.0m from the outer edge of the relevant trunk base and at least 1.2m deep. This is based on the typical size of root plates that are often excavated for transplanting of this species. Transplanting is often successfully carried out with this species, and other such palms, and therefore should represent an acceptable structural root zone when considering impacts from construction or transplanting feasibility.

DBH = Diameter at Breast Height
This is the diameter of the trunk measured at 1.4m above ground level.

DGL = Diameter at Ground Level
This is the diameter of the trunk measured at ground level, but just above any root flare.

Inclusion or Included Bark Branch Union
Growth of bark at the interface of two or more branches on the inner side of the branch union which is unable to be lost from the tree and accumulates, or is trapped, between the acutely divergent branches. This can form a weakened branch union in some species.

1.9 Assessment Methodology

On the 19 September and 14 October 2019, Robert Smart of Arterra, completed a detailed assessment of the trees within and immediately adjacent to the study area. The trees' health and condition were assessed via a visual inspection of the trees from the ground only. Requisite tree data, including DBH, DGL, height & canopy spread, condition & proximity to services, was recorded using an Apple iPad and Filemaker Pro database.

The basic health and condition criteria that were inspected for each tree can be summarised as follows: -

- Tree size, broad age class and general balance of the tree;
- Above ground obstructions;
- Evidence of recent site disturbance;
- Canopy foliage size, colour and density;
- Dieback and epicormic growth;
- Trunk or branch wounding, branch tear outs and pruning history;
- Structural defects such as any co-dominant stems, cracks, splits, included bark, decay; and
- Pests and disease evidence or occurrence.

All of the trees were photographed and given a unique numbered identification and plotted onto a scaled base plan for referencing and identification throughout the report and for future discussions and co-ordination. (Refer Appendix 4.2 Tree Assessment Schedule and 4.3 'Tree Retention Value Plan'). A photographic record of trees and general site context was taken using the inbuilt Apple iPad camera and a Panasonic Lumix TZ220 digital camera. Files have been resized, dated, named and filed in accordance with normal office procedures and protocols. No other image manipulation has been undertaken.

Tree trunk diameters were measured using a metric diameter tape measure. Tree heights were measured using the two-point clinometer function of a Nikon Forestry Pro laser range finder. Canopy spreads were estimated by pacing out distances along the cardinal axis of the canopy and cross referencing to survey information and aerial photos. Canopy position and extents were then altered on the plans to more accurately portray the canopy extent and position.

No specialised equipment or methods were employed to test for the extent of decay in any of the trees, apart from a nylon 'sounding' mallet. Frond samples from all of the 23 *Phoenix canariensis* have been sent for analysis and independent testing at the Royal Botanic Gardens Sydney to verify whether any of the palms have Fusarium Wilt disease (*Fusarium oxysporum f. sp canariensis*). This sampling was carried out on the 19 September 2019 and the samples submitted to the RBGS on the 20 September 2019. The results from this testing have not yet been received by Arterra and will be the subject of a separate supplementary report. No exploratory excavations were done to determine location and/or condition of roots and no detailed soil laboratory testing has been undertaken.

Desktop Review and Research
Digital AutoCAD files of the survey were imported into Arterra's standard CAD software (ArchiCAD v21). Various area calculations and measurements were made in the CAD software to depict the tree TPZs and SRZs.

Recent aerial photography was data was obtained from the Nearmap website with aerial photos of the site dating from January 2019 imported into the above software for cross checking and assessment. (http://www.nearmap.com/ accessed 04/09/2019)

Climatic data was obtained from the Bureau of Meteorology using statistics from Sydney airport which is located approximately 11.6 km north of the site. (http://www.bom.gov.au/climate/data/ accessed 25/9/2019)

1.10 Pre-Development Tree Assessment – Tree Retention Values

The information gathered in the field was tabulated and the retention value assessed using a combination of techniques commonly used and recognised in the arboricultural industry. The tree life expectancy was established using the Safe Useful Life Expectance (SULE) system. A brief summary of these systems is described below.

SULE – SAFE USEFUL LIFE EXPECTANCY
This is a system developed by Jeremy Barrell in 1993 that determines the time a tree may be expected to be retained based on its age, health, condition, safety and location. This is then moderated by the economics of maintenance or other costs of retaining the tree. A long SULE means the tree is presently expected to live longer than 40 years with minimal intervention and cost. A short SULE indicates a tree that is not expected to live longer than 5 years or may require substantial intervention or costs to retain it.

RETENTION VALUES
The proposed retention value of the trees was determined based on a considered combination of the size, age, condition and suitability of the tree.

Each tree was then ranked according to one of 4 retention categories.

1. **"High" Retention Value** – these are trees that are typically in good or very good condition, large and visually prominent, historically or environmentally important. They should represent a serious physical constraint to the development and their removal avoided where possible and feasible.
2. **"Moderate" Retention Value** – these are trees that are in good to reasonable condition and should be retained where possible and feasible to do so.
3. **"Low" Retention Value** – these are trees that are of poor condition or have structural defects, are particularly small or common place, are not historically, environmentally or socially significant and should not be considered as a constraint to the development. They could be retained only if they are not likely to be impacted by or constrain potential desirable development outcomes.
4. **"Should Remove" / No Retention Value** – these are trees that are in very poor health, or poor form, or have serious structural defects, are considered weeds or combination of all these, and therefore should be considered for removal regardless of any development.

Consideration has also been given to the relationship of the trees to one another and their proximity to the likely development areas on the site. For example, trees that are part of a closely spaced group, or are likely to be significantly misshapen or unstable with the removal of surrounding trees and structures are considered with these factors in mind.

1.11 Tree Assessment – Tree Protection Zones Generally

In order to provide for the long-term survival and growth of any trees, to be retained on the site, a suitable area is required to be protected around the tree. This area should typically be as large as possible. It should also take into consideration: -

- The size and age of the tree;
- Above and below ground properties;
- The health and condition of the tree;
- The species of tree and its tolerance to disturbance;

- Soil conditions, type, depth and site hydrology and
- Site specific conditions and any existing obstructions to root development.

The Tree Protection Zones (TPZs) have been calculated using the formula and criteria outlined in AS 4970-2009 Protection of Trees on Development Sites. In summary the standard applies the calculation for the radius of the TPZ as 12 x (the tree trunk diameter (in metres) calculated at breast height (DBH)). DBH is taken at 1.4m above ground level.

A maximum TPZ radius will be 15m (unless crown protection is required) while the minimum TPZ radius shall be 2m.

The TPZ is typically assumed to be radial and centred on the centre of the tree's trunk unless other site factors or tree canopy size and location dictate an adjustment. Encroachments of up to 10% of the area may be accepted within the TPZ as long as it is outside of the Structural Root Zone (SRZ). This is known as a "minor encroachment". Encroachments greater than this, known as "major encroachments" will only be accepted with additional specific evidence that the tree will not be unduly impacted.

Whenever an encroachment is made into a TPZ, a suitable compensation should be made elsewhere and physically contiguous to the remaining TPZ.

The Structural Root Zone (SRZ) is the area defined as the minimum area required to retain the structural stability of the tree. The formula for calculating the SRZ is outlined in AS 4970 Section 3.3.5. No encroachment into the SRZ shall typically be allowed.

2.0 KEY OBSERVATIONS & DISCUSSIONS

2.1 Existing Site Conditions & Use

Cronulla Mall and Kingsway are located on a local rise to the west of the southern end of Cronulla Beach. The study area is a typical urban public domain environment. There are fully paved footpaths on Kingsway and a pedestrianised shopping Mall bordered by low rise commercial buildings. The Cronulla Mall is oriented north-south and the Kingsway runs perpendicular east-west. The area is relatively exposed to almost constant sea breezes and occasional salt spray. At present the tree population offers little shade to the hard-paved areas. Instead, the majority of shade and shelter within the Mall is provided by way of shop awnings and occasional fabric covered shelters.

The palms adjacent to Kingsway are typically growing within small semi-circular kerbside planting pits, approximately 1.5m diameter, with less than a metre from the base of the trunk to the back of the road side kerb. These pits are typically topped with permeable resin-bonded paving. The palms do make a noticeable and significant contribution to the landscape character at this part of Cronulla. Given the limited space, harsh growing conditions and the exposed location they do provide a sizable and hardy solution to street tree planting.

The palms within the northern part of the Mall are growing in a variety of surrounds. All are relatively small growing areas for the species and size of the tree. The cluster of palms to the north-west are typically in slightly better growing conditions with a larger circular seat wall surrounding each palm. The palms located within the Mall area are in a slightly more sheltered environment, due to the protection afforded by the surrounding buildings.

Figure 4 – View east from where Cronulla Mall meets The Kingsway. (Photo: Arterra 19.9.19)

The palms within the southern part of the Mall are growing in raised timber planters, approximately 2.4m square. Roots are readily seen around the edges of the planter and are often lifting the timberwork above the pavement. This is symptomatic of the trees having limited soil volumes and indicating that the root mass has most likely now fully exhausted the available soil resources.

All of the Phoenix palms have been sampled and tested for Fusarium. The results from this testing are not currently known. This will be presented in a separate supplementary report, once the results are received back from the Sydney Royal Botanic Gardens - Plant Diagnostic Unit. One palm (T17) did display very typical symptoms of Fusarium Wilt.

The other trees within the Mall are a mixture of *Gleditsia tricanthos* 'Shademaster' (Honey Locust) and *Platanus x acerifolius* (London Plane Tree) which have been planted in regularly spaced tree pits approximately 1.0m square. These are located in a relatively consistent line down both sides of the Mall, similar to normal roadside planting patterns. Most of the trees have been pruned to provide canopy clearance to pedestrians and nearby shop awnings and building fascades. Exposed root flares are typically visible at the tree bases and are now filling the spaces left between the trunk and the paving.

None of the palms or other trees appear to have any operational irrigation installed.

Form research, review of aerial photos and anecdotal evidence from SSC, the current tree planting appears to have been part of the previous upgrade to Cronulla Mall that was undertaken to coincide with the 1988 Bicentennial celebrations. The palms were likely to have been transplanted at mature sizes, that were similar to their current sizes and heights.

Figure 5 – View of typical palm surround along Kingsway. (Photo: Arterra 16.10.19)

Figure 6 – View of typical palm surround at the northern end of the Mall near Kingsway. (Photo: Arterra 16.10.19)

Figure 7 – View of a typical palm within a raised concrete seatwall surround at the northern end of the Mall. (Photo: Arterra 16.10.19)

Figure 8 – View of the Phoenix palms at the southern end of the Mall where they have been planted within a raised timber surround. Roots are readily seen around the edges and are lifting the timberwork above the pavement. This is symptomatic of a tree with limited soil volume and indicating that the root mass has most likely fully exhausted the available soil resources and now expanding in the only way it can. (Photo: Arterra 19.9.19)

Figure 9 – View of typical tree surround in the Mall. Note that the tree root flare has now typically fully occupied the space between the pavement and around the tree. Further root flare development is extremely limited. (Photo: Arterra 16.10.19)

2.2 Climate and Microclimate

Cronulla is located on the coast at the southern end of Bate Bay to the south of Kurnell, and shares the general climate of this coastal region with moderate temperatures, good rainfall and minimal climatic and weather extremes. It is typically described as a temperate climate with hot to warm summers and cool winters, with relatively uniform rainfalls greater than 800mm / year. There is no distinct dry season. It has an approximate average annual rainfall of 1100mm, fairly evenly spread across the year but with a slightly drier period during the late winter and early spring months. The highest rainfall period is usually June with an average of 125mm and the driest month being September with an average of less than 60mm.

Maximum average daily temperatures range from 26.7ºC in January and to 17.2ºC in July. The minimum average daily temperatures range from a high of 19.1ºC in February down to lows of 7.3ºC in July.

The primary wind direction is from the south to the north-east in the afternoons while it is predominantly from the north west to southerly in the mornings. This is common of coastal areas dominated by "sea breeze" affects. Review of climate data indicates that the primary direction for strong winds is from the south and in the afternoons. The most significant microclimatic influences to consider are exposure to salt spray and general exposure to the elements due to the relatively exposed coastal location.

2.3 Soils and Landform

The original and natural soil landscape of the site would have been relatively unusual for Sydney in that the study area is located at the confluence of underlying sandstone, coastal sand dune and shale geology. Cronulla is particularly notable for being the point at which Wianamatta Shale derived clay soils occur nearest to the coast. Although this is interesting from an historical viewpoint, today the mixture of exotic trees are believed to be growing in a highly altered and unnatural soil profile that has been completely disturbed and modified by the development of the surrounding buildings and streets, over the last 100 years or more.

Review of the recent geotechnical investigations undertaken by GHD reveal highly disturbed soil profiles dominated by very thick concrete pavements overlying them. The subsurface profiles encountered during testing generally consisted of various layers of tiled or bitumen-capped pavement slabs underlain by variable granular and probably re-worked residual subsoils. This was underlain most probably by Hawkesbury Sandstone bedrock which is suspected to be closer to the surface towards the southern end of the Mall.

Based on the above findings and the observed tree growth, it is assumed most trees are growing within relatively confined areas with limited ability to access any good soil with desirable horticultural qualities. The thick concrete pavements may assist in trapping soil moisture due to reduced surface evaporation but the pavement would also greatly restrict the infiltration of any rainwater into the soils. Given the ridge top location of the Mall, it is likely that the soils may be very prone to drying out and therefore limiting appropriate soil moisture for reliable tree growth. Much of the soil below the pavements is also likely to be heavily compacted for the construction of the previous roadways. This would in turn limit and restrict soil oxygen levels and therefore greatly limit tree root growth.

Analysis of the original 1988 construction drawings for the Mall construction would suggest that the excavations for the trees was very limited and it is highly likely the trees were planted into tree pits that were approximately only 1m square and no deeper that the containerised root balls of the trees that were being planted (600-800mm). The mature palm transplants appear to have been installed into prepared tree pits that were slightly larger being approximately 2.0m square and likely to be no deeper than 1.0m, to accommodate the immediate root ball of the palms that were delivered and transplanted.

These planting pits would have served the trees adequately for only the first few years, but after this the trees would a have needed to access greater soil volumes and moisture to sustain good growth. Some trees may have roots that have escaped the immediate confines of the prepared pits but are still likely to have suffered from the poor soil conditions experienced under the pavements. The couple of better condition trees are likely to have broken into the surrounding stormwater drainage pipes and pits and therefore accessed greater water resources which has facilitated slightly better growth.

2.4 General Tree Assessment – Species and Condition

The palms and trees occurring throughout the study area are very common and hardy species. They have been commonly used throughout the later half of the 1900s as reliable street and public domain trees. The Phoenix palms have been favoured for mature transplanting, in the past, to provide an instant and recognisable landscape statement. This species have historically been favoured for transplanting because they usually survive the transplanting process extremely well. They are also a palm that is extremely tolerant of coastal exposure and generally harsh and hot environments. This palm is now less favoured for use in Sydney landscapes due to:

- Susceptibility to the fatal Fusarium wilt disease
- Attraction of pest species such as Ibis
- Propensity to seed and spread into nearby gardens and bushland reserves

The exotic deciduous Gleditsia and London Plane Trees have historically been reliable street tree performers that are usually tolerant of constrained street environments and a wide range of soil conditions. Back in the 1980's these would have been considered very appropriate choices. Plane Trees are now becoming less favoured due to:

- Increasing susceptibility to pests and diseases such as Anthracnose, Sycamore Lace Bug and Powdery Mildew.
- Propensity to create irritant and allegen problems from microscopic material shed from young leaves and seed pods
- Propensity to shed 'mess' resulting from autumn and premature leaf drop caused by the above diseases and their fruit
- Increasing lower tolerance to extreme heatwave conditions resulting in leaf burn and other tree health problems

The current size and condition of the majority of trees, some **35 years** after their installation, suggests that the trees were installed into very poorly prepared tree pits with only minimal available soil to support early tree growth. On the whole, the tree population is not thriving. Most trees appear to be merely sustaining life, as evidenced by features such as tip dieback, epicormic growth, short internodal growth, and their generally stunted appearance and the small overall sizes observed.

Both the *Gleditsia triacanthos* 'Shademaster' (Honey Locust) and *Platanus x acerifolia* (London Planes) are expected to grow to be medium to large trees, even in relatively harsh growing conditions. A 30 year old London Plane Tree, would have normally expected to reach at least 15-18m in height and spread within this time. Most trees within the Mall have failed to achieve even a height of 8 metres, after more than 30 years growing within the Mall. This is particularly poor growth. Observations of aerial photography over the last 9 years suggest that the trees have failed to put on any significant growth within this period.

Figure 10 – Despite being one of the better trees in the Mall, this London Plane (T25) is very stunted and not really contributing to the Mall in a way that should be expected from a 3-0-40 year old tree. (Photo: Arterra 16.10.19)

Figure 11 – A typical tree within the Mall. Given the age of the tree this tree should be considered woefully inadequate as it provides little in the way of shade or amenity. Although it may survive for some years, it is our opinion that it should be removed as part of the upgrade in favour of new tree planting that is provided with significantly improved subsurface growing conditions (Photo: Arterra 16.10.19)

Although the trees may continue to 'survive' in their current situation for years to come, they are more and more likely to be susceptible to further decline, particularly during any extremes of heat or drought. By any measure, the trees are generally failing to contribute to the intended character of the Mall. They are also failing to provide the expected environmental performance for the space such as contributing to worthwhile shading, evaporative cooling and aesthetic appeal.

The exception to this is the majority of Phoenix palms. These do provide a worthwhile contribution to the character of the Mall and Kingsway due to their size and consistency. It is likely they too, however, have suffered from a lack of soil resources, with many of the specimens displaying symptoms of reduced growth rates and vigour since being transplanted (ie. thinner trunks and shorter growth increments at the top of the trunks).

A total of 45 trees were assessed for this report and most were observed to be in only fair health. All of the trees have been deliberately planted and date from the late 1980s. None of the trees on the site are listed on the Council's Register of Significant Trees. The following Tables 1 & 2 provide a brief summary of the trees within the site by species and retention value.

Table 1: Tree Population by Species

Species Name	Common Name	Number of Trees
Phoenix canariensis	Canary Island Date Palm	23
Gleditsia triacanthos 'Shademaster'	Honey Locust	13
Platanus x acerifolia	London Plane Tree	7
Cupaniopsis anacardioides	Tuckeroo	1
Livistona australis	Cabbage Palm	1
Total Trees		**45**

Table 2 : Tree Population by Species & Retention Value

Species Name	Common Name	Low Retention Value	Moderate Retention Value	High Retention Value*	Total
Phoenix canariensis	Canary Island Date Palm	1	-	22*	**23**
Gleditsia triacanthos' Shademaster'	Honey Locust	12	1	-	**13**
Platanus x acerifolia	London Plane Tree	4	3	-	**7**
Cupaniopsis anacardioides	Tuckeroo	1	-	-	**1**
Livistona australis	Cabbage Tree Palm	-	-	1	**1**
Total Trees		**18**	**4**	**23***	**45**

* Note: the retention values of the palms are dependent on them not being subsequently diagnosed with Canary Island Date Palm Fusarium Wilt Disease.

2.5 Tree Biology and Tree Care Basics

Trees are dynamic living organisms. Trees can be very susceptible to damage, stress and declining rapidly if overly impacted by construction. Trees take decades to grow but can be injured and killed in a very short time frame. This is particularly due to the irreparable damage to the often shallow, extensive and unseen root systems. It is rarely possible to repair a stressed or damaged tree, after the damage has occurred. Proper protection is the key. Severing of roots within the Structural Root Zone (SRZ) can also lead to potentially unsafe instability of the tree as a structure.

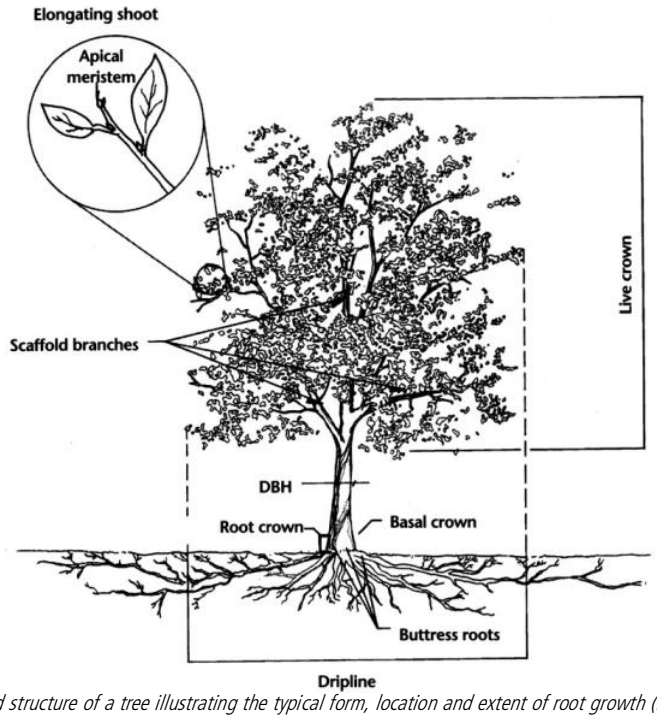

Figure 12 – Typical form and structure of a tree illustrating the typical form, location and extent of root growth (Source: Matheny and Clark, 1998)

Basic Tree Needs

As a living organism a tree remains alive by completing the following chemical reaction -
Carbon Dioxide and water in combination with chlorophyll and light is converted to Glucose and Oxygen [CO_2 + H_2O + light = sugar (CH_2O [Glucose]) + O_2]

The process ultimately leads to the plant cells 'respiring' and producing energy for survival, a natural requirement for all cells livings. Anything that affects a plants photosynthesis and then cellular respiration will affect the overall plant health. The limiting factors of photosynthesis and respiration will typically be the availability of oxygen, water and nutrients which make up the important chemical molecules and reactions.

Trees therefore have five basic requirements to survive and successfully grow:-

1. Oxygen (and particularly oxygen within the soil);
2. Water (a cellular necessity and primarily taken up by the tree roots);
3. Light & Sufficient Foliage (in order to photosynthesise and create the resources needed for cellular survival);
4. Soil (for physical anchorage and critical chemical nutrients) and
5. Physical Space (both above and below ground to grow).

Importantly, a minimum of 15% soil oxygen is required for active root growth and nutrient uptake. Less than 10% available soil oxygen starts to restrict root extension and growth and a minimum of 3% soil oxygen is required to just maintain root existence. Less than this will result in root death (Harris 1999).

One of the most insidious effects of construction on trees is often that of soil compaction or covering of root zones with impervious surfaces, as it:-

- Reduces infiltration rates of surface water;
- Reduces the availability of water to the roots as they can't naturally extract remaining moisture when soil becomes too dry;
- Reduces air to roots (roots cease to function properly and die without oxygen);
- Increased soil strength caused by compaction mean that roots need more energy to growth through it or can't even physically penetrate the soil;
- Roots are physically broken or crushed and there is increased potential for fungal and pathogen attack. (Harris 1999).

Tree Tolerance

Typically, older and larger trees are less tolerant of construction impacts. Different species also have different tolerance of injury and disturbance. Importantly it needs to be stressed, that a tree does not "heal" from injury as animals do. Typically, any injury made to a tree results in the tree expending considerable energy reserves to create new growth that "seals" and surrounds a wound and then attempt to compensate structurally and

physically for any losses. Impacts to trees are therefore cumulative and a series of otherwise small and unrelated impacts can easily result in the death of a tree.

A tree that is already compromised or showing signs of stress is far less likely to tolerate construction impacts due to its lower levels of energy reserves and already weakened state. Therefore, a tree that is only in a fair condition or poor condition is less likely to tolerate construction impacts than a young tree in good or excellent condition. Weakened or stressed trees are also far less able to combat the myriad of normal environmental stresses and pathogens that are naturally imposed against them such as drought, decay, fungi, bacteria and insect pests.

2.6 Potential Tree Related Impacts to be Managed During Construction

The main potential impacts from potential construction activity can be summarised as tree damage and 'reduced life expectancy' caused by:

- Root loss and disturbance due to excavations, footings and service trenching;
- Compaction of the root zone from trafficking, storage and stockpiling of materials;
- Contamination of the soil from the preparation of chemicals, wash down/ cleaning of equipment, refuelling of vehicles and dumping of waste;
- Root disturbance from cut and fill and soil level changes;
- Physical damage to the tree trunks and branches from passing machinery;
- Damage to the tree roots from landscaping and pedestrian pathway construction or modification.

The following section provides some preliminary recommendations with regard to tree retention and the proposed measures that will aim to minimise and avoid these impacts as much as realistically possible, if the trees are to be successfully retained.

3.0 TREE MANAGEMENT RECOMMENDATIONS

3.1 Tree Assessment and Retention Values

It should be noted that all *Phoenix canariensis* (Canary Island Date Palms) included in this assessment have recently been sampled and are currently being DNA tested by the Royal Botanic Gardens Sydney for the presence of *Fusarium oxysporum f.sp. canariensis* (FOC). This is a fungal pathogen that affects a few species within the palm genera *Phoenix* and *Washingtonia*. It causes vascular collapse that ultimately results in the death of the infected palm. The current retention values for the 23 *Phoenix canariensis* (Canary Island Date Palm) have been applied based on a visual assessment of their current condition, together with their cultural and visual significance within the landscape of the Mall and surrounds. If any of the palms are found to be infected with Fusarium wilt they will need to be removed.

Summarising the retention values for all trees assessed:

- **23 have been rated as High** retention value: 22 x *Phoenix canariensis* (Canary Island Date Palm) and 1 x Livistona australis (Cabbage Palm);
- **4 have been rated as Moderate** retention value: 1 x *Gleditsia triacanthos* (Honey Locust) and 3 x *Platanus x acerifolia* (London Plane Tree);
- **18 have been rated as Low** retention value (12 x *Gleditsia triacanthos* (Honey Locust) 4 x *Platanus x acerifolia* (London Plane Tree), 1 x *Cupaniopsis anacardioides* (Tuckeroo) and 1 x *Phoenix canariensis* (Canary Island Date Palm).

All 23 High retention value trees should be considered appropriate for inclusion into the proposed public domain upgrade for the Mall. They may be retained in their current locations, however if desired, the Palms could be carefully and professionally transplanted into new locations. This provides the opportunity to provide more appropriate and expanded soil volumes around the trees, access to better water and growing conditions that will generally help these palms thrive into the future. It also keeps a significant natural resource within the Mall, rather than seeing them needlessly removed or impacted by development.

As noted above, the High retention value attributed to the 22 x *Phoenix canariensis* (Canary Island Date Palm) is based on a visual assessment of their current condition, together with their contribution to the cultural and visual significance within the landscape of the Mall. Should the results of the DNA testing confirm the presence of the Fusarium in any of the *Phoenix canariensis* (Canary Island Date Palm), the infected palms' retention value will subsequently be adjusted to Very Low, and their removal recommended, to minimise the likelihood of further spread of the pathogen throughout the remaining, and potentially unaffected population.

Figure 13 – Cronulla Mall, southern end, view southeast, three of the better-looking Phoenix canariensis (Canary Island Date Palm). These could be transplanted to a new location within or near the Mall to facilitate the proposed upgrades and provide better and longer term health and vigour for these palms into the future. (Photo: Arterra 19.09.19)

Trees rated with Moderate retention values 'may' be retained, should Council wish to do so. If the existing trees are to be retained, efforts should be focussed on these moderate or high value trees, ahead of lesser quality trees. Even the largest London Plane Tree (T45) located in the Mall, at only 8.2m tall with a maximum canopy spread of around 6m, is noted as being 'stunted' for its age. It is worthy to note that it is extremely difficult to improve the existing growing conditions of existing trees in such an environment. This would typically entail removing pavement from around the tree and attempting to ameliorate the soils via the introduction of organic matter, fertilisers, water and provision of generally more horticulturally focussed space around the tree. This would impact and influence the design of the future Mall and may prohibit the desired urban design outcomes. It is also not guaranteed that improved growth would result from this intervention and it will not rectify any inherent flaws in the trees root system or branch structure.

Given our understanding of the likely scope of the proposed public domain upgrade, it is the authors opinion that consideration should definitely be given to removal of all of the current deciduous trees to allow their replacement with new and better performing trees. This would allow the new trees to be:

- in new and appropriately prepared tree pits or planting trenches that will provide better growing conditions and appropriate soil volumes for longer term growth of healthy and resilient trees,
- access to more adequate soil moisture and generally better growing conditions through the use of permeable paving and other passive irrigation techniques;
- new and more appropriate species that will provide improved aesthetic appeal that may be desired by the public, shop keepers and Council;
- a diversity of species that may be better able to tolerate the vagaries of a changing and more intense climate and also provide appropriate landmark or signature trees at important locations.

Achieving these important outcomes, while trying to work around existing trees and their root systems, is generally impractical and may lead to increased development costs, compromises in the desired outcome and function of the Mall and unintentional impacts to the existing trees trying to be worked around.

3.2 Nominal Tree Protection Zones

The tree protection zones have been calculated for all trees on the site. These zones have been calculated based on the Australian Standard 4970 – Protection of Trees on Development Sites and then adjusted in line with the standard as needed for onsite conditions and protection of the canopy. They have also been adjusted to account for the reduced and special requirements of the palms.

Where trees are located adjacent to or near elements such as road kerbs, buildings or retaining walls the TPZs and SRZs may need to be adjusted to compensate for the likelihood of there being little root development into these areas. The adjusted TPZ for each tree will be offset from the element to an approximately equal area to more accurately represent the likely extent of tree roots.

Encroachments and deviations within the tree protection zones may be considered. It should be noted however that:

- Minor encroachments should typically involve compensatory areas elsewhere within the TPZ;
- Major encroachments may necessitate the need for non-destructive investigations of root extents to justify the incursion;
- Above ground encroachments also need to consider impact and loss of any branches and foliage;
- Incursions into the Structural Root Zone will typically not be allowed and would be difficult to justify without extraordinary building techniques being employed and rigorous investigation of the actual tree root zone.

3.3 Key Recommendations to Reduce Tree Impacts

The actual tree protection measures likely to be imposed on the site cannot be fully explored until the full nature and extent of any proposed development is resolved and known. The following broad guidelines can be given as an indication of the likely measures that will be required.

Design and Realistic Expectations

The best tree protection measure is to consider the retention and physical requirements of the trees to be retained during the design period for the project. Most importantly a tree to be retained should be given the appropriate space to grow and continue to develop and prosper for many years to come. As much as possible, all work, including trenching, general construction and excessive landscaping should be avoided within the identified TPZs. Where an incursion is required, this should be limited and appropriate compensatory areas applied elsewhere, contiguous to the remaining TPZ.

Where adequate protection is not possible, or is unlikely to be rigorously defended by the client and contractors, then serious thought should be given to removing the tree and ultimately replacing it with new tree planting at the completion of the development. This is preferable to wasting a lot of time, resources and development energy on retaining a tree that will almost inevitably decline and die.

Bonding of Trees and Penalties for Tree Related Damage
Consideration should be given to appropriate contractual monetary bonds being placed on the retained trees. This should be structured to place a monetary price on the tree as a whole in case of serious damage or death of the tree, and also pro-rata "damage" penalties for any damage caused to the tree. This should typically be based on the size of the component damaged (ie. root or branch) using a predefined formula.

Communication - Tool Box Meetings and Construction Inductions
All contractors and subcontractors should be inducted prior to working on the site. All inductions shall include description and identification of the TPZs and the restriction on work and activities with regard to trees. The site foreman shall ensure that all new staff and contractors are appropriately inducted and that brief "tool box" meetings are conducted regularly to ensure Tree Protection is maintained at the forefront of workers' minds.

Tree Protection Fencing
Prior to any works, including demolition, a rigid temporary 1.8m high metal "Tree Protection Fence" with adequate lateral bracing and signage shall typically be installed to demarcate and restrict access to all tree protections zones. No unauthorised access should be permitted within this zone once the fence is erected. No stockpiling, excavation, trenching or material storage should be allowed in this area.

If work is required with in a TPZ, this work should be done with small tracked equipment or by hand, with care to limit damage and disturbance of the root zone. All work within a TPZ should be supervised and overseen by a qualified consulting arborist.

Controlled Construction Access & Ground Protection
Construction access points and stockpiling and storage areas shall be clearly identified and fenced where appropriate. Uncontrolled access points and parking of vehicles on site is to be avoided. If access is required through a tree protection zone, the access way shall be mulched with 100mm of hardwood woodchip with rumble boards or other suitable rigid plating laid down over the mulch to limit soil compaction and root disturbance.

Clearing and Removal of Trees to be Removed
Removal and clearing of existing trees should be done by a suitably qualified and experience arborist. Care should be taken to avoid impact or damage to other surrounding trees throughout the process. Existing stumps should be grubbed out or ground in a controlled fashion to remove wood that may decay and promote unwanted pathogens.

3.4 References

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4.0 APPENDICES

4.1 Explanation of Safe Useful Life Expectancy (SULE) Assessment

The following explanation and description of SULE comes primarily from a conference paper "SULE: Its use and status into the New Millennium" presented to the NAAA by the author of the SULE system, Jeremy Barrel, in Sydney in April 2001.

Scope and limitations of SULE

SULE is a method of assessing the relative importance of individual trees within an identified group (normally a development site with finite boundaries). It is based on subjective assessment and cannot be considered an absolute judgement. Realistically, the best that can be achieved is a broad categorisation of good, medium and bad. Identifying the extremes of good and bad is not usually contentious; the medium category is normally the most difficult. SULE helps the making of informed judgements on which trees are the most important in planning decisions. The nature of trees and opinions on trees is extremely variable; this means that there are always exceptions to the rules and common sense is an important aspect of applying the method. Only a person experienced and knowledgeable in the management of trees can carry out a competent SULE assessment. SULE is a means of presenting complex tree information in a simplified form that professionals with no tree expertise can understand and use to make judgements in the wider context. These professionals are normally layout designers who have to decide which trees to keep and lose in planning new developments close to trees.

"Life Expectancy"

Tree life expectancy is an estimate of the number of years a tree is expected to stay alive. It is the basic starting point in all SULE assessments and is estimated based on the conditions that prevail at the time of assessment. To arrive at a figure, it is necessary to consider the present age of the tree, the average life span of the species and any local environmental modifying factors that may influence that potential. Life expectancy is this modified life span minus the age of the tree. These figures are arrived at by either experience or reference, but more usually by a combination of both.

Steps followed:-

1. Estimate the age of the tree
2. Establish the average lifespan of the species
3. Establish if the lifespan needs to be modified due to local factors (eg. Soil conditions, exposure, climate
4. Estimate life expectancy of tree (ie. Modified life span – age of tree)

"Safe"

Where trees and people come into contact, safety becomes the priority consideration. At these interfaces, the length of time that a tree can be expected to live with an acceptable level of safety is of far greater relevance than its simple life expectancy. Tree health, structure and location are the three main elements affecting safety that may modify simple life expectancy to safe life expectancy. These elements should be considered separately in turn, and their cumulative effect will produce a final safe life expectancy figure.

Steps followed:-

5. Consider the health of the tree and if this affects the safety and risk of failure (trees in poor health are typically more prone to failing)
6. Consider the size and structure of the tree (large trees typically have more stresses applied to them and will have a far greater impact)
7. Consider the location (the targets)
8. Estimate Safe Life Expectancy (ie, Life Expectancy modified by health structure and location)

"Useful"

The final consideration in assessing SULE relates to the usefulness of the tree and should take into account the future management of not only the tree in question but also others close to it. There are three measures of usefulness that should be systematically considered; the economics of management; any adverse effects on better trees; and the principle of sustaining amenity. If a tree stands alone, then the considerations of adverse effects on better trees and sustaining amenity do not apply. If the tree is part of a group, no adjustments to safe life expectancy can be made if all the trees are mutually dependent and cannot realistically be retained without each other. However, if a tree is suppressed and could be removed without prejudicing the retention of the others, then there may be a benefit in terms of reduced interference or increased planting space.

Steps followed:-

9. Consider the economics of management of the tree
10. Consider the disruptive interference with better trees
11. Consider sustaining amenity
12. Consider final Safe Useful Life Expectancy (ie. Safe Life Expectancy modified by costs, surrounding trees and amenity)

Category Allocation

Once the SULE in years has been assessed, it is a simple matter to place the tree into the appropriate SULE category and record it on the tree schedule. Each SULE category has a number of sub-divisions, which help to clarify the reasoning behind that particular assessment. It is important to record the relevant sub-division to aid future interpretation of the information. The categories as they currently stand are illustrated in the following table.

Safe Useful Life Expectancy Categories

(Updated 01/04/2001)

SULE RATING and SUB CATEGORY	EXPLANATORY DESCRIPTIONS
1: Long SULE:	**Trees that appeared to be retainable at the time of assessment for more than 40 years with an acceptable level of risk.**
(a)	Structurally sound trees located in positions that can accommodate future growth.
(b)	Trees that could be made suitable for retention in the long term by remedial tree care.
(c)	Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention.
2: Medium SULE:	**Trees that appeared to be retainable at the time of assessment for 15–40 years with an acceptable level of risk.**
(a)	Trees that may only live between 15 and 40 more years.
(b)	Trees that could live for more than 40 years but may be removed for safety or nuisance reasons.
(c)	Trees that could live for more than 40 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
(d)	Trees that could be made suitable for retention in the medium term by remedial tree care.
3: Short SULE:	**Trees that appeared to be retainable at the time of assessment for 5–15 years with an acceptable level of risk.**
(a)	Trees that may only live between 5 and 15 more years.
(b)	Trees that could live for more than 15 years but may be removed for safety or nuisance reasons.
(c)	Trees that could live for more than 15 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
(d)	Trees that require substantial remedial tree care and are only suitable for retention in the short term.
4: Remove:	**Trees that should be removed within the next 5 years.**
(a)	Dead, dying, suppressed or declining trees because of disease or inhospitable conditions.
(b)	Dangerous trees because of instability or recent loss of adjacent trees.
(c)	Dangerous trees because of structural defects including cavities, decay, included bark, wounds or poor form.
(d)	Damaged trees that are clearly not safe to retain.
(e)	Trees that could live for more than 5 years but may be removed to prevent interference with more suitable individuals or to provide space for new planting.
(f)	Trees that are damaging or may cause damage to existing structures within 5 years.
(g)	Trees that will become dangerous after removal of other trees for the reasons given in (a) to (f).
(h)	Trees in categories (a) to (g) that have a high wildlife habitat value and, with appropriate treatment, could be retained subject to regular review.
5:	**Small, young or regularly pruned: Trees that can be reliably moved or replaced.**
(a)	Small trees less than 5m in height.
(b)	Young trees less than 15 years old but over 5m in height.
(c)	Formal hedges and trees intended for regular pruning to artificially control growth.

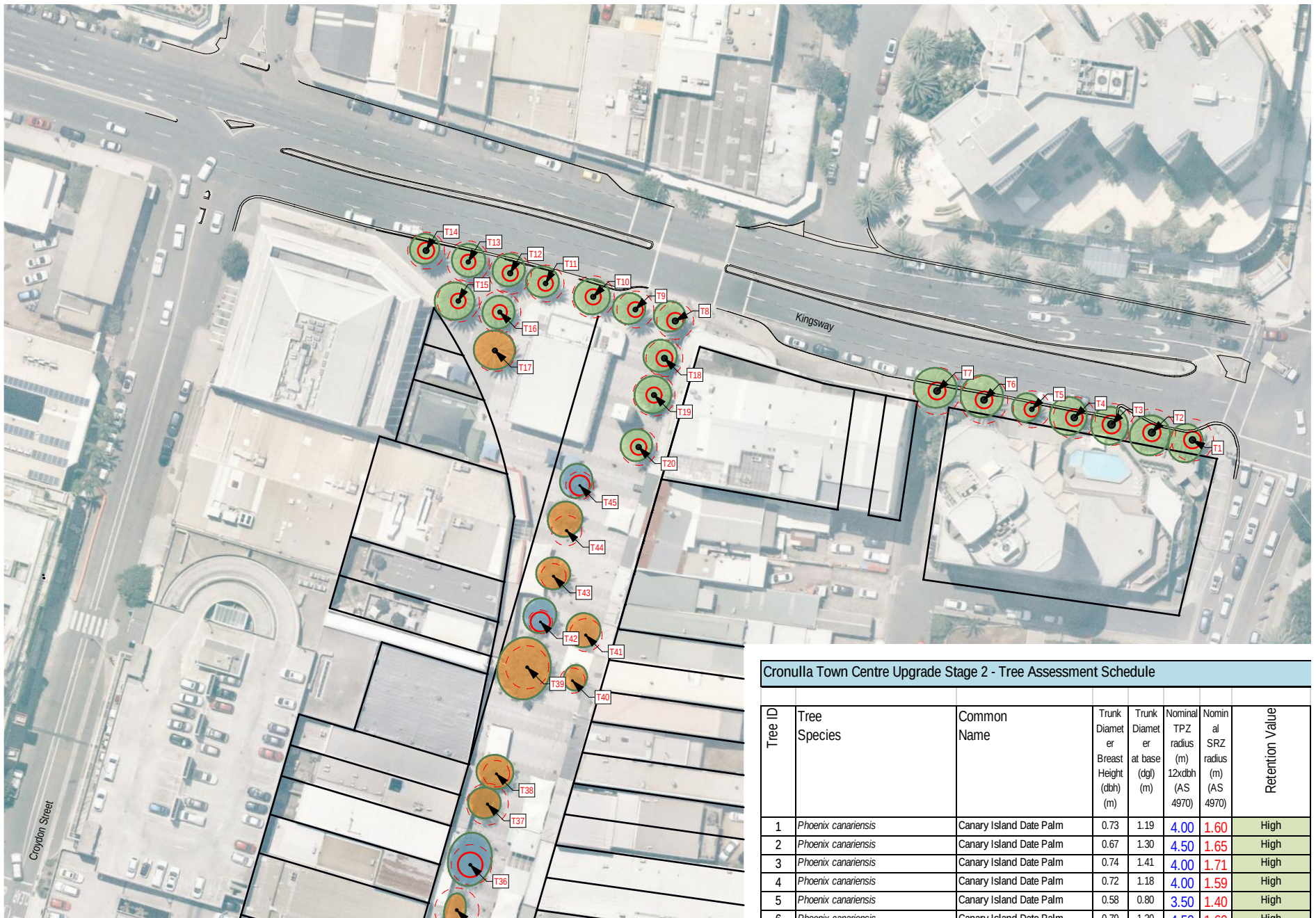
4.2 Existing Trees - Assessment Schedule

Cronulla Town Centre Upgrade Stage 2 - Tree Assessment Schedule

Tree ID	Tree Species	Common Name	Height (m)	Spread North (m)	Spread West (m)	Spread South (m)	Spread East (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970) (except palms-refer report)	Nominal SRZ radius (m) (AS 4970) (except palms-refer report)	Age Class	Current Vigour	Current Form	Noted Defects	SULE Rating	Retention Value	General Comments and Notes
1	*Phoenix canariensis*	Canary Island Date Palm	6.8	3.0	3.0	3.0	3.0	0.73	1.19	4.00	1.60	Mature	Fair	Good		Long (>40 years)	High	Generally good health and vigour. Only minor symptoms but on several fronds. Very exposed to ocean winds.
2	*Phoenix canariensis*	Canary Island Date Palm	6.6	3.5	3.5	3.5	3.5	0.67	1.30	4.50	1.65	Mature	Fair	Good		Long (>40 years)	High	No significant fusarium symptoms, except for one frond which was sampled. Very exposed to ocean winds.
3	*Phoenix canariensis*	Canary Island Date Palm	5.4	3.0	3.0	3.0	3.0	0.74	1.41	4.00	1.71	Mature	Fair	Good		Long (>40 years)	High	Minimal symptoms of fusarium noted. No particularly oneside dieback noted on fronds. Worst looking lowest living frond taken as sample.
4	*Phoenix canariensis*	Canary Island Date Palm	5.4	3.0	3.0	3.0	3.0	0.72	1.18	4.00	1.59	Mature	Fair	Good		Long (>40 years)	High	No significant onesided frond dieback noted on the tree, but many fronds suffering tip burn. Very exposed to ocean winds.
5	*Phoenix canariensis*	Canary Island Date Palm	5.2	2.5	2.5	2.5	2.5	0.58	0.80	3.50	1.40	Mature	Fair	Good		Long (>40 years)	High	Only minimal signs of any fusarium related symptoms. Similar to nearby palms with general tip burning to leaf edges. Very exposed to ocean winds.
6	*Phoenix canariensis*	Canary Island Date Palm	5.8	3.5	3.5	3.5	3.5	0.79	1.20	4.50	1.60	Mature	Fair	Good		Long (>40 years)	High	No notable onesided dieback of fronds but canopy appears sparse and general frond decline is occurring well into mid-to-upper canopy. Generally worst looking living lower frond sampled. Bitou bush growing in crown.
7	*Phoenix canariensis*	Canary Island Date Palm	5.8	3.5	3.5	3.5	3.5	0.66	1.23	4.50	1.62	Mature	Fair	Good		Long (>40 years)	High	Minimal symptoms if any. Mostly healthy looking fronds even in lower canopy. Worst looking lower living frond sampled.
8	*Phoenix canariensis*	Canary Island Date Palm	8.6	2.5	2.5	2.5	2.5	0.67	1.10	3.50	1.55	Mature	Fair	Good		Long (>40 years)	High	No definitive symptoms of fusarium. One of the tallest palms on ridge top. Very exposed to ocean winds. Some signs of bark dysfunction just below fronds for 1.5m.
9	*Phoenix canariensis*	Canary Island Date Palm	7.2	2.5	2.5	2.5	2.5	0.59	0.83	3.50	1.42	Mature	Fair	Good		Long (>40 years)	High	No significant symptoms of fusarium noted. Outer bark casing up the top of the trunk gone for approx 2-3m below fronds.
10	*Phoenix canariensis*	Canary Island Date Palm	6.6	3.0	3.0	3.0	3.0	0.64	0.92	4.00	1.46	Mature	Fair	Good		Long (>40 years)	High	Worst frond mid canopy taken. Some other dead fronds noted in mid canopy. No definitive symptoms of fusarium noted.
11	*Phoenix canariensis*	Canary Island Date Palm	8.2	2.5	2.5	2.5	2.5	0.65	0.80	3.50	1.40	Mature	Fair	Good		Long (>40 years)	High	No significant symptoms. Some minor unidentified plumed scale activity noted in sampled frond. Worst looking live frond sampled.
12	*Phoenix canariensis*	Canary Island Date Palm	7.0	3.0	3.0	3.0	3.0	0.70	0.93	4.00	1.47	Mature	Fair	Good		Long (>40 years)	High	Some symptoms of one side frond dieback. Minor unidentified plumed scale activity on sampled frond. Trunk noted with several holes and leaf scars missing in outer bark. Palm appears relatively healthy.
13	*Phoenix canariensis*	Canary Island Date Palm	6.6	3.0	3.0	3.0	3.0	0.65	0.75	4.00	1.38	Mature	Fair	Good		Long (>40 years)	High	Definite symptoms of one sided dieback on a few fronds. Appears relatively good vigour otherwise.
14	*Phoenix canariensis*	Canary Island Date Palm	6.8	2.5	2.5	2.5	2.5	0.57	1.07	3.50	1.54	Mature	Fair	Good		Long (>40 years)	High	No clear symptoms of fusarium noted. Many lower fronds dead but no obvious signs of disease. Typically decline appears bilateral on fronds and simply senescence of lower fronds.
15	*Phoenix canariensis*	Canary Island Date Palm	6.0	3.0	3.0	3.0	3.0	0.64	0.79	4.00	1.40	Mature	Fair	Good		Long (>40 years)	High	Some minor symptoms of fusarium-like dieback but on only a few fronds. Minor unidentified plume scale activity noted.
16	*Phoenix canariensis*	Canary Island Date Palm	4.8	3.0	3.0	3.0	3.0	0.62	0.71	4.00	1.36	Mature	Fair	Good		Long (>40 years)	High	No fusarium symptoms noted. Worst looking living lower frond sampled.
17	*Phoenix canariensis*	Canary Island Date Palm	5.4	3.0	3.0	3.0	3.0	0.52	0.87	4.00	1.44	Mature	Poor	Good	Pest/Disease	Remove (<5 years)	Low	Definite symptoms of fusarium wilt. Numerous lower fronds dead and collapsing. Definite single sided staining to rachis. Fronds were pruned back by second inspection on 16/10/19.
18	*Phoenix canariensis*	Canary Island Date Palm	7.8	2.5	2.5	2.5	2.5	0.68	1.06	3.50	1.53	Mature	Fair	Good		Long (>40 years)	High	Significant dieback of lower fronds to about mid canopy, but very few showing signs of one sided dieback. One noted and sampled.
19	*Phoenix canariensis*	Canary Island Date Palm	6.6	3.0	3.0	3.0	3.0	0.65	0.89	4.00	1.45	Mature	Fair	Good		Long (>40 years)	High	No significant symptoms of fusarium, generally most fronds looking relatively healthy and green. Quite sheltered position. Significant unidentified plumed scale activity noted on frond.
20	*Phoenix canariensis*	Canary Island Date Palm	7.7	2.5	2.5	2.5	2.5	0.62	0.96	3.50	1.48	Mature	Fair	Good		Long (>40 years)	High	No significant symptoms of fusarium. Most fronds looking relatively healthy. Worst looking living lower frond sampled. Relatively sheltered position.
21	*Phoenix canariensis*	Canary Island Date Palm	5.8	3.0	3.0	3.0	3.0	0.65	0.81	4.00	1.41	Mature	Fair	Good		Long (>40 years)	High	No obvious symptoms of fusarium noted. Worst looking lower living frond sampled. Self sown fig noted in canopy. Some mid canopy frond dieback and general tip burn to majority of fronds.
22	*Phoenix canariensis*	Canary Island Date Palm	6.2	3.0	3.0	3.0	3.0	0.58	0.75	4.00	1.38	Mature	Fair	Good		Long (>40 years)	High	Some symptoms minor symptoms but no notable one sided dieback noted. Some mid canopy frond death noted. Worst looking living lower frond sampled. Bitou bush seedling self sown in canopy.
23	*Phoenix canariensis*	Canary Island Date Palm	6.6	3.0	3.0	3.0	3.0	0.66	0.97	4.00	1.49	Mature	Fair	Good		Long (>40 years)	High	Some minor symptoms but no notable one sided dieback noted. Some mid canopy frond death noted. Numerous lower dead fronds. Worst looking living lower frond sampled. Bitou bush seedling self sown in canopy.
24	*Gleditsia triacanthos 'Shademaster'*	Honey Locust	6.0	2.0	3.0	1.5	1.5	0.19	0.28	2.28	1.94	Mature	Fair	Poor	Deadwood-Minor, Branch Tearouts, Root Impacts	Long (>40 years)	Low	Generally poor form. Very close to light pole. Pruned for clearances. Small tear out to south. Various small broken and contorted branches.
25	*Platanus x acerifolia*	London Plane	7.0	5.0	5.0	5.0	6.0	0.35	0.50	4.20	2.47	Mature	Fair	Average	Root Impacts, Congested Branches, Deadwood-Minor	Long (>40 years)	Moderate	Very constrained tree surround. Girdling roots. Somewhat congested branching and stunted form.

Tree ID	Tree Species	Common Name	Height (m)	Spread North (m)	Spread West (m)	Spread South (m)	Spread East (m)	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970) (except palms-refer report)	Nominal SRZ radius (m) (AS 4970) (except palms-refer report)	Age Class	Current Vigour	Current Form	Noted Defects	SULE Rating	Retention Value	General Comments and Notes
26	*Livistona australis*	Cabbage Palm	5.8	2.0	2.0	2.0	2.0	0.22	0.46	3.00	1.23	Mature	Fair	Good		Long (>40 years)	High	
27	*Cupaniopsis anacardioides*	Tuckeroo	6.2	2.5	2.5	3.0	3.5	0.22	0.31	2.64	2.02	Mature	Poor	Average	Tip Dieback, Deadwood-Minor, Inclusions, Root Impacts	Short (5-15 years)	Low	Sparse and chlorotic foliage. Small cavity at primary junction from old pruning wound. Inclusion in a main branch to north. Poor soil and growing conditions suspected for poor condition.
28	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	7.1	6.0	4.5	3.5	2.5	0.25	0.37	3.00	2.18	Mature	Fair	Average	Tip Dieback, Asymmetric Canopy, Root Impacts, Lean-Minor	Medium (15-40 years)	Low	Minor tip dieback.
29	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	6.8	4.0	3.0	3.0	3.0	0.25	0.38	3.00	2.20	Mature	Fair	Good	Root Impacts, Tip Dieback, Deadwood-Minor	Medium (15-40 years)	Low	Minor tip dieback.
30	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	5.8	3.5	3.0	3.0	2.5	0.23	0.31	2.76	2.02	Mature	Good	Good	Root Impacts, Deadwood-Minor	Medium (15-40 years)	Low	Constrained root area otherwise reasonable tree. Some minor deadwood.
31	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	5.2	3.0	2.5	3.0	2.5	0.22	0.30	2.64	2.00	Mature	Fair	Good	Decay-Minor, Deadwood-Minor, Epicormic Growth	Medium (15-40 years)	Low	
32	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	5.9	3.0	3.5	3.0	3.5	0.28	0.38	3.36	2.20	Mature	Fair	Poor	Root Impacts, Epicormic Growth	Short (5-15 years)	Low	Very large branch pruned to west at 2.0m. Significantly constrained root environment. Very little wound closure.
33	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	5.7	3.0	2.5	2.0	3.0	0.21	0.31	2.52	2.02	Mature	Fair	Average	Lean-Minor, Epicormic Growth	Medium (15-40 years)	Low	Very congested branching form. Numerous crossing and rubbing branches,
34	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	5.5	3.0	2.0	2.5	3.5	0.22	0.30	2.64	2.00	Mature	Fair	Average	Epicormic Growth, Root Impacts, Tip Dieback, Deadwood-Minor	Medium (15-40 years)	Low	
35	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	6.0	5.0	4.0	3.0	2.0	0.35	0.45	4.20	2.37	Mature	Fair	Average	Root Impacts, Tip Dieback, Epicormic Growth, Asymmetric Canopy, Deadwood-Major	Short (5-15 years)	Low	Large crossing branches. Asymmetric canopy to north.
36	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	6.2	5.5	5.0	4.0	3.5	0.32	0.44	3.84	2.34	Mature	Fair	Good	Root Impacts, Epicormic Growth, Tip Dieback	Medium (15-40 years)	Moderate	Appears to have escaped its rooting environment. Minor tip dieback otherwise reasonable but stunted tree for its age. Good foliage growth. But a lot of epicormic growth. Good wound occlusion.
37	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	5.9	3.0	3.0	3.0	2.0	0.33	0.35	3.96	2.13	Mature	Fair	Average	Root Impacts, Tip Dieback, Epicormic Growth, Deadwood-Minor	Short (5-15 years)	Low	Very stunted form.
38	*Platanus x acerifolia*	London Plane	6.5	3.5	3.5	3.0	3.0	0.21	0.29	2.52	1.97	Mature	Fair	Good	Root Impacts	Medium (15-40 years)	Low	Very stunted for age. Relatively sparse canopy.
39	*Platanus x acerifolia*	London Plane	8.0	5.5	5.0	6.0	4.0	0.34	0.43	4.08	2.32	Mature	Fair	Average	Inclusions, Epicormic Growth	Medium (15-40 years)	Low	One of the better trees in the mall. Inclusion in main scaffold branch. Numerous epicormic shoots.
40	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	4.8	3.0	2.0	2.0	3.0	0.20	0.28	2.40	1.94	Mature	Poor	Average	Root Impacts, Tip Dieback, Deadwood-Minor, Epicormic Growth, Branch Tearouts	Short (5-15 years)	Low	Poor wound occlusion. Extensive epicormic shoots.
41	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	6.1	4.0	3.5	3.0	3.5	0.26	0.34	3.12	2.10	Mature	Fair	Average	Root Impacts, Epicormic Growth	Medium (15-40 years)	Low	Very constrained root environment.
42	*Platanus x acerifolia*	London Plane	7.8	4.0	3.5	2.0	2.5	0.19	0.25	2.28	1.85	Mature	Good	Average	Asymmetric Canopy, Root Impacts, Epicormic Growth	Medium (15-40 years)	Moderate	Slightly asymmetric. Good small tree but very stunted for age.
43	*Platanus x acerifolia*	London Plane	7.6	2.5	2.5	2.5	2.0	0.20	0.32	2.40	2.05	Mature	Fair	Average	Pest/Disease, Root Impacts, Epicormic Growth	Medium (15-40 years)	Low	Trunk cankers. Very constrained root environment.
44	*Platanus x acerifolia*	London Plane	7.2	5.0	4.0	1.0	2.0	0.24	0.36	2.88	2.15	Mature	Fair	Poor	Lean-Major, Tip Dieback, Deadwood-Minor, Asymmetric Canopy, Epicormic Growth	Short (5-15 years)	Low	Very stunted and poor form. Major lean to north.
45	*Platanus x acerifolia*	London Plane	8.2	3.0	3.0	2.0	1.0	0.22	0.27	2.64	1.91	Mature	Fair	Good	Root Impacts, Epicormic Growth, Pest/Disease, Lean-Minor	Medium (15-40 years)	Moderate	Very stunted specimen for age. Minor lean to north.

4.3 Tree Retention Value Plan



Cronulla Town Centre Upgrade Stage 2 - Tree Assessment Schedule

Tree ID	Tree Species	Common Name	Trunk Diameter Breast Height (dbh) (m)	Trunk Diameter at base (dgl) (m)	Nominal TPZ radius (m) 12xdbh (AS 4970)	Nominal SRZ radius (m) (AS 4970)	Retention Value
1	*Phoenix canariensis*	Canary Island Date Palm	0.73	1.19	4.00	1.60	High
2	*Phoenix canariensis*	Canary Island Date Palm	0.67	1.30	4.50	1.65	High
3	*Phoenix canariensis*	Canary Island Date Palm	0.74	1.41	4.00	1.71	High
4	*Phoenix canariensis*	Canary Island Date Palm	0.72	1.18	4.00	1.59	High
5	*Phoenix canariensis*	Canary Island Date Palm	0.58	0.80	3.50	1.40	High
6	*Phoenix canariensis*	Canary Island Date Palm	0.79	1.20	4.50	1.60	High
7	*Phoenix canariensis*	Canary Island Date Palm	0.66	1.23	4.50	1.62	High
8	*Phoenix canariensis*	Canary Island Date Palm	0.67	1.10	3.50	1.55	High
9	*Phoenix canariensis*	Canary Island Date Palm	0.59	0.83	3.50	1.42	High
10	*Phoenix canariensis*	Canary Island Date Palm	0.64	0.92	4.00	1.46	High
11	*Phoenix canariensis*	Canary Island Date Palm	0.65	0.80	3.50	1.40	High
12	*Phoenix canariensis*	Canary Island Date Palm	0.70	0.93	4.00	1.47	High
13	*Phoenix canariensis*	Canary Island Date Palm	0.65	0.75	4.00	1.38	High
14	*Phoenix canariensis*	Canary Island Date Palm	0.57	1.07	3.50	1.54	High
15	*Phoenix canariensis*	Canary Island Date Palm	0.64	0.79	4.00	1.40	High
16	*Phoenix canariensis*	Canary Island Date Palm	0.62	0.71	4.00	1.36	High
17	*Phoenix canariensis*	Canary Island Date Palm	0.52	0.87	4.00	1.44	Low
18	*Phoenix canariensis*	Canary Island Date Palm	0.68	1.06	3.50	1.53	High
19	*Phoenix canariensis*	Canary Island Date Palm	0.65	0.89	4.00	1.45	High
20	*Phoenix canariensis*	Canary Island Date Palm	0.62	0.96	3.50	1.48	High
21	*Phoenix canariensis*	Canary Island Date Palm	0.65	0.81	4.00	1.41	High
22	*Phoenix canariensis*	Canary Island Date Palm	0.58	0.75	4.00	1.38	High
23	*Phoenix canariensis*	Canary Island Date Palm	0.66	0.97	4.00	1.49	High
24	*Gleditsia triacanthos 'Shademaster'*	Honey Locust	0.19	0.28	2.28	1.94	Low
25	*Platanus x acerifolia*	London Plane	0.35	0.50	4.20	2.47	Moderate
26	*Livistona australis*	Cabbage Palm	0.22	0.46	3.00	1.23	High
27	*Cupaniopsis anacardioides*	Tuckeroo	0.22	0.31	2.64	2.02	Low
28	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.25	0.37	3.00	2.18	Low
29	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.25	0.38	3.00	2.20	Low
30	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.23	0.31	2.76	2.02	Low
31	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.22	0.30	2.64	2.00	Low
32	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.28	0.38	3.36	2.20	Low
33	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.21	0.31	2.52	2.02	Low
34	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.22	0.30	2.64	2.00	Low
35	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.35	0.45	4.20	2.37	Low
36	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.32	0.44	3.84	2.34	Moderate
37	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.33	0.35	3.96	2.13	Low
38	*Platanus x acerifolia*	London Plane	0.21	0.29	2.52	1.97	Low
39	*Platanus x acerifolia*	London Plane	0.34	0.43	4.08	2.32	Low
40	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.20	0.28	2.40	1.94	Low
41	*Gleditsia triacanthos 'Shademaster'*	Honey Locust Cultivar	0.26	0.34	3.12	2.10	Low
42	*Platanus x acerifolia*	London Plane	0.19	0.25	2.28	1.85	Moderate
43	*Platanus x acerifolia*	London Plane	0.20	0.32	2.40	2.05	Low
44	*Platanus x acerifolia*	London Plane	0.24	0.36	2.88	2.15	Low
45	*Platanus x acerifolia*	London Plane	0.22	0.27	2.64	1.91	Moderate

Legend

- Cadastre
- High Retention value
- Moderate Retention value
- Low Retention value (Note: no SRZ's shown for these trees)
- Very Low Retention value (should remove) (Note : no TPZ's shown for these trees)
- Existing Tree Retained — Extent of canopy as verified by site measure and aerial
- Nominal Tree Protection Zone (TPZ)
- Nominal Structural Root Zone (SRZ)
- T26 — Tree Identification Number

NOTE
Refer to the accompanying Pre-Development Arboricultural Report for full description of trees, measurements and methods used to assess the trees, and potential tree protection measures.

TREE RETENTION VALUE NOTES

The proposed retention value of the trees was determined based on a considered combination of the size, age, condition and suitability of the tree. Each tree was then ranked according to one of 4 retention categories;

1. **"High" Retention Value** — these are trees that are typically in good or very good condition, large and visually prominent, historically or environmentally important. They should represent a serious physical constraint to development and their removal avoided where possible and feasible.
2. **"Moderate" Retention Value** — these are trees that are in good to reasonable condition, with no major structural defects and could be retained where possible and feasible to do so.
3. **"Low" Retention Value** — these are trees that are of poor condition or have structural defects, are particularly small or common place, are not historically, environmentally or socially significant and should not be considered as a constraint to development. They could be retained only if they are not likely to be impacted by or constrain potentially desirable development outcomes.
4. **"Very Low" Retention Value** — these are trees that are in very poor health, or poor form, or have serious structural defects, are considered weeds or combination of all these, and therefore should be considered for removal regardless of any development.

Consideration has also been given to the relationship of the trees to one another and their proximity to the likely development areas on the site. For example, trees that are part of a closely spaced group, or are likely to be significantly misshapen or unstable with the removal of surrounding trees and structures are considered with these factors in mind.

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0 10 20 50m

REVISION	DESCRIPTION	CHKD	DATE
A	For Review / Information	RWS	30/10/19

PROJECT & CLIENT
Cronulla Town Centre Trees
Sutherland Shire Council

Project No : 19.12
Designed : RWS
Drawn : SK
Scale : 1:500@A1/1:1000@A3

DRAWING TITLE: Tree Retention Value Plan
DRAWING NUMBER: T-02
REVISION: A

Plotted at : 1:18 pm 30/10/19

4.4 Tree Data Summary Sheets

ID # 01
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.8
DBH (m): 0.73 DGL (m): 1.19
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 05
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 5.2
DBH (m): 0.58 DGL (m): 0.80
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 02
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.6
DBH (m): 0.67 DGL (m): 1.30
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 06
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 5.8
DBH (m): 0.79 DGL (m): 1.20
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 03
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 5.4
DBH (m): 0.74 DGL (m): 1.41
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 07
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 5.8
DBH (m): 0.66 DGL (m): 1.23
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 04
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 5.4
DBH (m): 0.72 DGL (m): 1.18
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 08
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 8.6
DBH (m): 0.67 DGL (m): 1.10
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 09
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 7.2
DBH (m): 0.59 DGL (m): 0.83
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 13
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.6
DBH (m): 0.65 DGL (m): 0.75
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 10
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.6
DBH (m): 0.64 DGL (m): 0.92
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 14
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.8
DBH (m): 0.57 DGL (m): 1.07
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 11
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 8.2
DBH (m): 0.65 DGL (m): 0.80
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 15
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.0
DBH (m): 0.64 DGL (m): 0.79
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 12
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 7.0
DBH (m): 0.70 DGL (m): 0.93
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 16
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 4.8
DBH (m): 0.62 DGL (m): 0.71
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 17
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 5.4
DBH (m): 0.52 DGL (m): 0.87
Current Form: Good
Current Vigour: Poor
Age Class: Mature
SULE: Remove (<5 years)
Retention Value: Low

ID # 21
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 5.8
DBH (m): 0.65 DGL (m): 0.81
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 18
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 7.8
DBH (m): 0.68 DGL (m): 1.06
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 22
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.2
DBH (m): 0.58 DGL (m): 0.75
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 19
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.6
DBH (m): 0.65 DGL (m): 0.89
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 23
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 6.6
DBH (m): 0.66 DGL (m): 0.97
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 20
Species: *Phoenix canariensis*
Common: Canary Island Date Palm
Height (m): 7.7
DBH (m): 0.62 DGL (m): 0.96
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 24
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 6.0
DBH (m): 0.19 DGL (m): 0.28
Current Form: Poor
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: Low

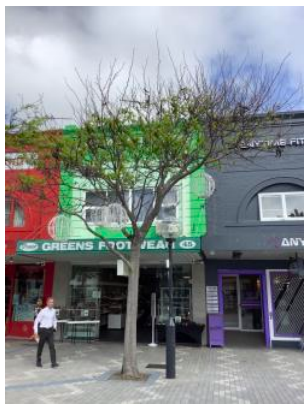
ID # 25
Species: *Platanus x acerifolia*
Common: London Plane
Height (m): 7.0
DBH (m): 0.35 DGL (m): 0.50
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: Moderate

ID # 26
Species: *Livistona australis*
Common: Cabbage Palm
Height (m): 5.8
DBH (m): 0.22 DGL (m): 0.46
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 27
Species: *Cupaniopsis anacardioides*
Common: Tuckeroo
Height (m): 6.2
DBH (m): 0.22 DGL (m): 0.31
Current Form: Average
Current Vigour: Poor
Age Class: Mature
SULE: Short (5-15 years)
Retention Value: Low

ID # 28
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 7.1
DBH (m): 0.25 DGL (m): 0.37
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 29
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 6.8
DBH (m): 0.25 DGL (m): 0.38
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low



ID # 30
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 5.8
DBH (m): 0.23 DGL (m): 0.31
Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 31
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 5.2
DBH (m): 0.22 DGL (m): 0.30
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 32
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 5.9
DBH (m): 0.28 DGL (m): 0.38
Current Form: Poor
Current Vigour: Fair
Age Class: Mature
SULE: Short (5-15 years)
Retention Value: Low

ID # 33
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 5.7
DBH (m): 0.21 DGL (m): 0.31
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 34
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 5.5
DBH (m): 0.22 DGL (m): 0.30
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 35
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 6.0
DBH (m): 0.35 DGL (m): 0.45
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Short (5-15 years)
Retention Value: Low

ID # 36
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 6.2
DBH (m): 0.32 DGL (m): 0.44
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Moderate

ID # 37
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 5.9
DBH (m): 0.33 DGL (m): 0.35
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Short (5-15 years)
Retention Value: Low

ID # 38
Species: *Platanus x acerifolia*
Common: London Plane
Height (m): 6.5
DBH (m): 0.21 DGL (m): 0.29
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 39
Species: *Platanus x acerifolia*
Common: London Plane
Height (m): 8.0
DBH (m): 0.34 DGL (m): 0.43
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 40
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 4.8
DBH (m): 0.20 DGL (m): 0.28
Current Form: Average
Current Vigour: Poor
Age Class: Mature
SULE: Short (5-15 years)
Retention Value: Low

ID # 41
Species: *Gleditsia triacanthos 'Shademaster'*
Common: Honey Locust
Height (m): 6.1
DBH (m): 0.26 DGL (m): 0.34
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 42
Species: *Platanus x acerifolia*
Common: London Plane
Height (m): 7.8
DBH (m): 0.19 DGL (m): 0.25
Current Form: Average
Current Vigour: Good
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Moderate

ID # 43
Species: *Platanus x acerifolia*
Common: London Plane
Height (m): 7.6
DBH (m): 0.20 DGL (m): 0.32
Current Form: Average
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Low

ID # 44
Species: *Platanus x acerifolia*
Common: London Plane
Height (m): 7.2
DBH (m): 0.24 DGL (m): 0.36
Current Form: Poor
Current Vigour: Fair
Age Class: Mature
SULE: Short (5-15 years)
Retention Value: Low

ID # 45
Species: *Platanus x acerifolia*
Common: London Plane
Height (m): 8.2
DBH (m): 0.22 DGL (m): 0.27
Current Form: Good
Current Vigour: Fair
Age Class: Mature
SULE: Medium (15-40 years)
Retention Value: Moderate

ID # 46
Species: *Ficus microcarpa var. hillii*
Common: Hills Weeping Fig
Height (m): 15.8
DBH (m): 1.55 DGL (m): 1.55
Current Form: Good
Current Vigour: Excellent
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 47
Species: *Ficus microcarpa var. hillii*
Common: Hills Weeping Fig
Height (m): 16.5
DBH (m): 1.72 DGL (m): 1.72
Current Form: Good
Current Vigour: Excellent
Age Class: Mature
SULE: Long (>40 years)
Retention Value: High

ID # 48
Species: *Cinnamomum burmannii?*
Common: Padang Cassia
Height (m): 6.4
DBH (m): 0.28 DGL (m): 0.31
Current Form: Good
Current Vigour: Good
Age Class: Mature
SULE: Long (>40 years)
Retention Value: Moderate