ATTACHMENT
CONFIDENTIAL

1st Ordinary Council Meeting

13 November 2018

Item C26.1.1 - Establishing a Resilient Urban Forest for Darwin

CITY OF DARWIN
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Tree Re-establishment Advisory Committee (TRAC)

Terms of Reference

Purpose

On Saturday March 17th 2018 Tropical Cyclone Marcus struck Darwin and its environs with an enormous impact on trees and vegetation and the overhead power network caused through tree damage. City of Darwin's public open space and road reserve areas were hit particularly hard and clean-up work still continues.

At the Ordinary Council meeting on 27 March 2018, a report was tabled entitled 'Dangerous Trees in the Darwin Municipality' from which Council resolved in part that '*An investigation is undertaken to identify, in consultation with local experts, suitable species of trees mainly native to the top end areas with high rainfall and cyclonic conditions to be used in the future for landscaping.*

Whilst it is the responsibility of the Council to make the final decision, the role of this Tree Re-Establishment Advisory Committee is to provide recommendations, advice and information to the Council on those specialised matters pertaining to re-establishing resilient tree species.

Scope

This is a special project (ad hoc) group that will meet for a defined period of time and deliver a series of recommendations to City of Darwin in a written report format.

The Panel is to:

- Consider available literature relating to cyclone resilient trees including, but not limited to;
    - 'An Assessment of tree damage and resilience in Darwin Parks following Tropical Cyclone Marcus March 17th 2018' – by Mike Clark
    - 'An Assessment of tree susceptibility and resilience to cyclones – A study based on Tropical Cyclone Yasi 2nd February 2011 – Dr Greg Calvert
    - City of Darwin Tree Management Plan and A Guide To Visual Tree Risk Assessment – Bill Sullivan
    - City of Darwin current preferred Tree Species Planting List
- Recommend a list of trees not to be planted by City of Darwin in any future tree establishment programs;
- Recommend a preferred tree species planting list to City of Darwin for consideration;
- Advise City of Darwin on best practice methods of tree propagation, planting and protection across the Darwin Municipality;

Authority

The Committee will make Recommendations to City of Darwin which will be made public.

Membership

There Committee will consist of:

- An Elected Member of Council;
- A representative of the Nursery and Garden Industry Northern Territory;
- A representative of the NT Chapter - Australian Institute of Landscape Architects;
- A representative of the Northern Territory Arboreal Association;
- A representative from Greening Australia;
- A City of Darwin Parks Technical Officer;
- Two City of Darwin appointed Community Members with expertise in their field of work;
- Other experts as required

The representatives of the organisations must be members or employees of the organisations they represent. Community Members shall be chosen for their expertise, experience, dedication and commitment to the purpose of the group.

The Chairperson will be appointed by City of Darwin.

Meeting arrangements

Meeting frequency will be weekly with a timeframe of 12 weeks and a quorum of 4 is required.

Agendas and Minutes will be prepared by City of Darwin appointed staff member who will attend meetings. This staff member will also undertake to provide any Council documentation the group requests.

Between meetings communication is encouraged between members.

Reporting

The Chairperson of the group will report to the General Manager Infrastructure, City of Darwin on a weekly basis after each meeting via e-mail. There will be public distribution of the business papers.

Resources and budget

The Chairperson of the group will receive sitting fees of $719 per meeting in accordance with the C2 classification structure of Northern Territory Government bodies. The other group members shall serve without remuneration.

Council will provide secretariat functions to set and distribute Agendas and Minutes of the meetings, take minutes at meetings and provide any Council documentation the Panel requests.

The other group members shall serve without remuneration.

Deliverables

The Chairperson of the group will undertake to present a draft report to the General Manager of Infrastructure at the end of the 12 weeks period.

Review

The Terms of Reference will be reviewed after the first meeting and any findings will be reported by the Chairperson to the General Manager Infrastructure, City of Darwin.

ESTABLISHING A RESILIENT URBAN FOREST FOR DARWIN

Best Practice Guidelines

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Reference No: 3777063
Version: 29 October 2018_Rev C

Cyclone Marcus 2018

Executive Summary

Cyclone Marcus went over Darwin on 17th March 2018. For a category 2 cyclone with wind gusts up to 130 km/hour, the damage seemed disproportionately high. The visual impact of the number of very large trees uprooted and subsequent power interruptions and infrastructure damage will remain with many residents as the indelible memory of Cyclone Marcus. A review was required to understand why so many trees failed.

The review firstly established that regardless of the best efforts and following of best practice, the community must acquire an acceptance of, and an expectation that some tree failures and losses will occur during storm events. Tree risk management options are presented in the 'Whole of Life Tree Management' section. This is an area recommended for further community consultation and education.

This report presents an assessment of 219 tree species against several attributes that contribute to cyclone resilience. Appendix A is the preferred tree list for Darwin with 194 species. Whilst a heavy weighting has been placed on observed cyclone resilience, in selecting tree species for a location it is not solely about cyclone resilience. A tree species with low or medium cyclone resilience may have a particular attribute, such as form, colour, wildlife attractant etc. that is desirable in that landscape design for a location. Some low cyclone resilience species are small and unlikely to cause damage in the event of uprooting. Appendix A therefore includes a mix of species with high, medium and low cyclone resilience. The use of any of these species needs to be tempered by an understanding of their performance in storm events and the conditions of the planting site.

Appendix B contains 25 species not recommended for planting in Darwin. This includes many with a low cyclone resilience. In addition, there are species that are highly cyclone resilient but are not recommended for planting in particular locations for other reasons such as being allergenic/poisonous, are invasive, or have nuisance fruit.

Tree Selection

Darwin Urban Forest

To achieve the outcome of a stable tree that has a high resilience to cyclonic events requires attention to the entire life cycle of the tree. This starts with the selection of the most appropriate species through to the whole of life management of the mature tree. This report discusses the best practice options at each of the stages of plant selection, plant procurement and supply, tree installation, and whole of life tree management and provides many technical suggestions and recommendations to improve tree stability in storm events.

To facilitate future selection of tree species a matrix template of factors to be considered for any species has been developed as an aid to decision-making. These fields are presented in Appendix C and the matrix is available in the form of an Excel spreadsheet.

Some tree species appear to be more susceptible to failure in storms and others appear to have some inherent characteristics that make them more resistant, however, the majority of tree failures during storms across the Greater Darwin region can be attributed to lack of maintenance such as pruning, or root disturbance caused by cutting or damage. The report discusses tree protection and maintenance regimes. These are identified as the critical and predominant factors in improving tree stability with the clear message that a priority should be given to adopting mechanisms that avoids such damage to trees.

While the report has a focus on individual tree species there is also a discussion around the concept of developing an urban forest and the recognition of the numerous benefits that not only individual trees bring but also when trees form an urban forest. A range of trees of varying ages and attributes will collectively have a greater cyclone resilience. Such diversity is an important aspect of a resilient urban forest.

Recommendations

A summary of the key recommendations is presented grouped under the headings found within the report.

Plant Selection

1. *THAT* further evaluation should be done on the tree species in numerous individual planting sites in addition to the evaluation of many potentially suitable species that are not currently represented in the Darwin region.

2. *THAT* ongoing trials and research on potential new tree species for landscaping in Darwin could be supported by City of Darwin and undertaken collaboratively with various stakeholders in Darwin.

3. *THAT* most of the tree species in Appendices A and B are 'Unknown' for climate change resilience. This is an area in need of further research that could be promoted by City of Darwin.

4. *THAT* City of Darwin has the opportunity to liaise with the community and assess community attitudes about trees being replanted, what species, where they should be planted, and what their idea of a walkable liveable cool suburb is.

Tree Lists

5. *THAT* City of Darwin officers over time complete the desired attribute fields nominated in Appendix C to the tables shown in Appendix A and B.

Plant Procurement and Plant Supply

6. *THAT* City of Darwin prefer tree supply be given to Nursery Industry Accreditation Scheme Australia Accredited nurseries. The accreditation provides an audited best practice system for production nurseries that ensures high quality plant stock.

Pre-order and lead times

7. *THAT* City of Darwin continue with the contract for the supply of container grown trees.

Tree Installation

8. *THAT* City of Darwin follow the Australian Standard *AS 4419-2003 Soils for Landscaping and Garden Use* with the use of "Sandy Loam" in the tree pit.

Irrigation, water harvesting

9. *THAT* City of Darwin stipulate for all tree management that watering should deliver a suitable volume of water in such a way that it penetrates the soil profile to a depth of at least 450mm.

10. *THAT* City of Darwin stipulate in civil design projects that stormwater harvesting using storm water collection inlets should be installed wherever possible, and mandatory within the CBD.

Tree data base and data collection

11. *THAT* City of Darwin use a database to systematically inventory park and street tree assets. Goal is 100% of trees in the City of Darwin municipality be identified and plotted over a 3-year period.

12. *THAT* City of Darwin program reassessment of every tree every 3 years.

13. *THAT* City of Darwin provide appropriate Council officers and arborists with adequate resources for emergency operational data gathering to react promptly following an event.

14. *THAT* City of Darwin regularly review this report and the associated tree lists every 3 years or after a significant storm event.

Ongoing maintenance and associated funding – trees are a valuable community asset

15. *THAT* City of Darwin adopt the City of Melbourne tree valuation methodology.

16. *THAT* City of Darwin actively manage the loss of trees in the municipality to maintain and increase current canopy cover levels in public open space to a minimum of 50% by 2030.

17. *THAT* City of Darwin review the Tree Management Plan to ensure it reflects the findings of this report and any recommendations endorsed by council.

18. *THAT* City of Darwin reviews its resources to maintain the urban forest to a satisfactory level.

19. *THAT* City of Darwin updates its existing policy, procedures and processes for all tree related management to meet the organisational requirements for tree risk management, tree condition assessment, tree removal, tree retention, tree replacement and development consent.

20. *THAT* City of Darwin prepare a citywide, long-term Strategic Urban Forest Management Plan.

Pruning

21. *THAT* City of Darwin adopt *AS4373-2007 Pruning of Amenity Trees* as the standard for maintaining trees.

Monitoring/ risk management/ acceptable risk thresholds

22. *THAT* City of Darwin adopts an industry standard, peer reviewed, tree risk assessment system.

23. *THAT* City of Darwin conduct further community consultation and education to ensure the community understands the balance between an acceptable level of tree risk and the type of landscape that is envisaged for Darwin.

Tree protection

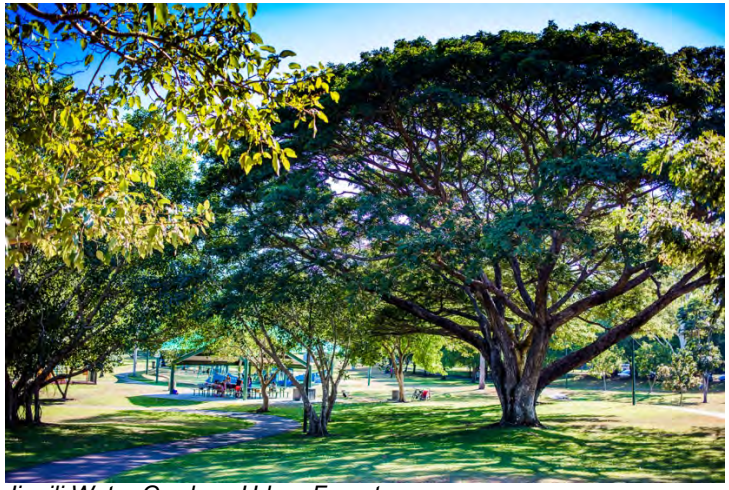
24. *THAT* City of Darwin adopt AS4970-2009 Protection of Trees on Development Sites as the standard.

25. *THAT* City of Darwin adopt mechanisms to enforce tree protection.

26. *THAT* City of Darwin review existing measures in other LGAs such as by-laws, Tree Protection Orders, Vegetation Protection overlays, tree removal/pruning permit systems, development consent requirements and the associated need for resourcing of such systems, including enforcement and surveillance.

Education

27. *THAT* City of Darwin develop and deliver tree management education programs to tree management staff, tree workers, parks crews, all contractors, (including irrigation), development assessment staff, customer service staff, high level decision makers and the wider community.



Jingili Water Gardens Urban Forest

Lake Alexander Urban Forest

Introduction

The development of an urban forest for Darwin that has improved cyclone resilience requires an explicit recognition of the numerous contributions that trees make to a city and the community. These benefits are discussed in the section on *'Why Plant Trees?'*. The Darwin community needs to recognise that there will always be risks associated with trees and storm events but a city without trees would be an unthinkable outcome. The community needs to understand the balance between an acceptable level of risk and type of landscape that is envisaged for Darwin. Tree risk management options are presented in the Whole of Life Tree Management section. This is an area recommended for further community consultation and education.

To achieve the outcome of a stable tree that has a high resilience to cyclonic events requires attention to the entire life cycle of the tree. This starts with the selection of the most appropriate species and includes the processes of procurement, propagation, tree installation and then the whole of life management of the mature tree. A tree can be compromised at any one or more of these stages resulting in an inherently less stable tree. This report discusses the best practice options at each of these stages. This in turn will also maximise the value of trees as essential urban infrastructure and a community asset.

Presented in this report is a list of 219 tree species that have been assessed primarily for their cyclone resilience (Appendices A and B).Cyclone resilience is not the only factor that should influence the selection of trees within Darwin. There is no one perfect tree for Darwin. A range of trees of varying ages and attributes are needed to create diverse plantings that, collectively, have a greater cyclone resilience. Such a diverse tree collection is an important aspect of a resilient urban forest. There are species that are highly cyclone resilient but are not recommended for planting in particular locations for other reasons such as being allergenic/poisonous, invasive, or having nuisance fruit. These species are included in Appendix B.

Yanyula Park

Conversely, a tree with low cyclone resilience may have an attribute such as form, colour or wildlife attractant that is desirable in a location. Where these trees are small, such as many Grevilleas and Acacias, and unlikely to cause damage in the event of uprooting, they have been included in Appendix A. The use of these species needs to be tempered by an understanding of their performance in storm events. Choosing the right trees for a site is also about factors such as proximity to infrastructure, space constraints, soil type and depth, watering regime and purpose of tree.

To facilitate future selection of tree species a matrix template of factors to be considered for a species has been developed as an aid to decision-making. These fields are presented in Appendix C and the matrix is available in the form of an excel spreadsheet. The fields relating to cyclone resilience, geographic origin, invasiveness and height x spread have been completed. It is recommended that this task should be completed for the remaining fields. Appendix C also presents a further list of attributes that should be considered in an expanded matrix tool.

Cyclone Marcus 2018

Trees and cyclone resilience

"Species have been reported to show differences in resistance to Tropical Cyclone force winds. But wind resistant species only buys you so much protection. I think the more important factors are:

1) soil and site conditions, and

2) tree defects in the crown and root system;

I think these outweigh the importance of species, perhaps by a lot. Lists of wind tolerant trees vary because factors 1 and 2 above over-ride species so often.

So let's dispel the myth that we can solve wind related tree failure by selecting the right species alone

…… There is much to this and simply recommending species does a great disservice to our community."1

1. *https:hort.ifas.ufl.edu/woody/wind.shtml*

Shallow Roots

Resilient Forest

While cyclones pose an enduring threat to Darwin, this does not mean yards and public spaces should be without large trees. All large trees in Darwin are sufficiently mature to have survived at least one cyclone, and many trees have endured through many severe cyclonic and storm events. The wind speed, direction, duration, and the level of soil saturation are all are involved with tree failure under high wind loads.

Many tree failures during storms can be attributed to lack of formative pruning and associated tree defects, such as bark inclusions on co-dominant stems, as well as wounds resulting in decay columns causing mechanical weakness. Soil saturation from heavy rain events leads to soil failure causing root plate destabilisation. Other factors include root disturbance, cutting or damage with associated fungal infections prior to a storm which contribute to root plate failure. By avoiding such damage to trees, cyclone resilience will clearly be improved.

Room for tree roots to anchor, through appropriate tree pit design and tree planting techniques, coupled with the selection of quality trees for planting will have a significant impact in reducing tree failure during storm events. Careless maintenance causes fungal infections of root systems which in turn lead to mechanical weaknesses. These issues can generally be rectified by appropriate design and thoughtful maintenance. Tree installations, with a focus on the most suitable tree for the location, combined with sensible and sustainable design and appropriate arboricultural maintenance will improve urban forest resilience against severe tropical storms and cyclones.

The community must acquire an acceptance of, and an expectation that some tree failures and losses will occur during storm events. It is impossible to have trees around people without any risk at all. In severe storm events, some trees will fall over, some will break apart, others will damage fences, cars, and buildings and other infrastructure. Many will also stand and continue to provide shade and environmental functions long after the storm has passed.

Physiological, sociological, economic and aesthetic benefits.

A resilient urban forest

The concept of an Urban Forest is utilised in the City of Darwin (CoD) CBD Master Plan (2015) and is a concept supported in this report. The following is a quote from the Darwin CBD Masterplan.

> *"The Urban Forest comprises the trees and vegetation throughout the Darwin City Centre, inclusive of all tree types and irrespective of whether they are on streets, in parks or on private land.*
>
> *The Urban Forest, measured as a canopy cover percentage of the total land area, is recognised as a primary component of the urban ecosystem (LGA NSW 2003). It is one component of the complex-built environment along with roads, car parks, buildings, footpaths and services. Urban forests in and around urban communities provide physiological, sociological, economic and aesthetic benefits.*
>
> *They are one of the most effective means of cooling a city and have been shown to greatly reduce urban heat island effects. Streetscapes and public realm open space will play a key role in the Urban Forest.*
>
> *It is important that adequate provision in terms of space (above ground and underground) is made for trees.*
>
> *In addition to the initial capital costs of installing trees, there should be realistic ongoing funding for tree maintenance and management to ensure the potential benefits are fully realised.*
>
> *The development of individual sites by the private sector has an impact on the potential benefits of the urban forest through tree planting, green roofs, increased reflection of heat."2*

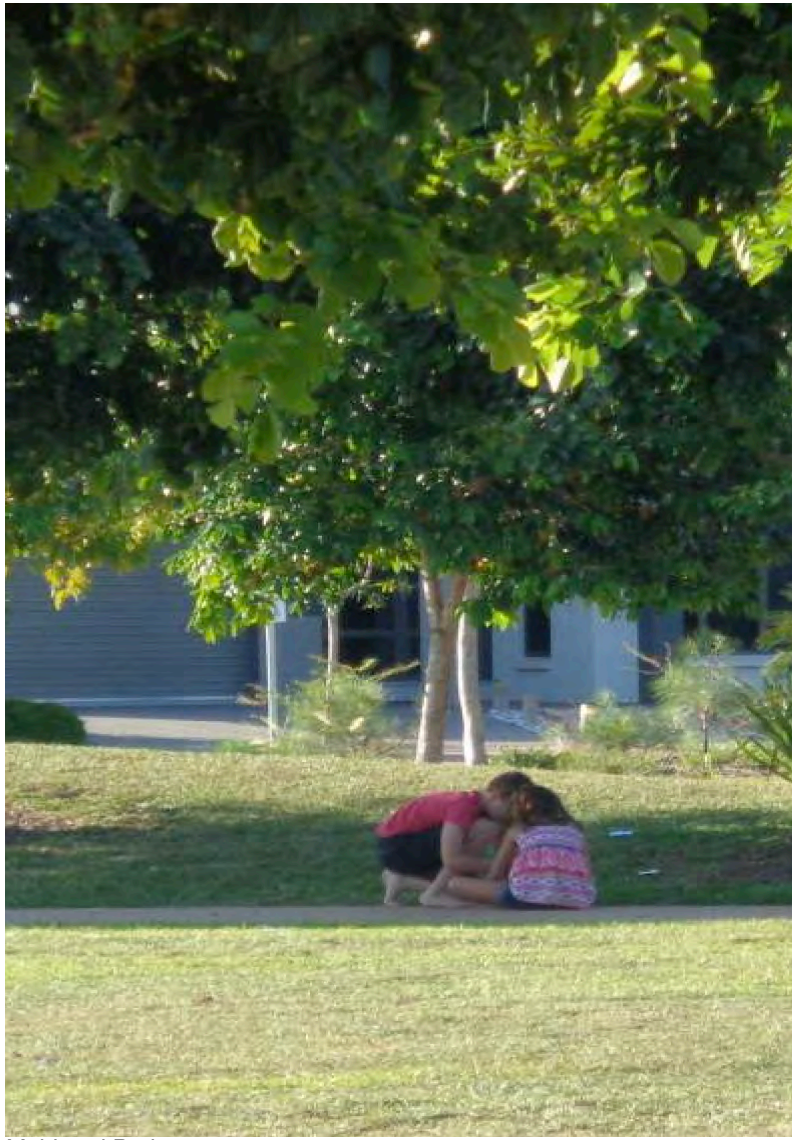
2 City of Darwin CBD Masterplan 2015

Change

Adoption of an Urban Forest concept brings with it a fundamental change to the approach in the way trees are viewed and managed. The following table summarises these changes to the approach to urban trees in Darwin:

Where we have been… Traditional Urban Tree Management	Where we need to be… Modern Urban Forestry Model
• Trees as ornaments	• Trees viewed as critical infrastructure
• Focus on individual trees	• Focus on overall canopy cover and forest
• Trees treated with low priority	• Trees have equal priority to other urban infrastructure such as roads and services
• Trees have no monetary or economic value	• Economic value of forest recognised and valued
• Focus on smaller and ornamental species	• Focus on larger longer-lived canopy trees
• Individual tree maintenance	• Overall forest management
• Aesthetic based design only	• Ecological and aesthetic based design
• Legal boundaries determine tree management	• Urban forest seen as continuous resource regardless of ownership boundaries

Table: Traditional versus modern urban forest approach (Source: North Sydney Council 2011)



Muirhead Park

WHY PLANT TREES?

> *"It is a sign of a great civilisation when old men and women plant trees that they may never sit under to enjoy the shade"*
> Greek Saying

It is true, that planting a tree is an investment in the future. It is also true that trees have much greater value than just providing a shady spot to sit and socialise. In our developing cities, trees provide multiple benefits and recent studies indicate that their value to society can be significant. Preliminary research for the Darwin CBD trees undertaken in 2016 valued the trees at $2.4M.

In cities around Australia and the world, trees are increasingly being recognised as important Green Infrastructure, and the development of Urban Forests within our cities is becoming mainstream policy.

In our tropical city, trees are a key aspect of reducing temperatures. Dense shady tree canopies can reduce surface temperatures by up to 25 degrees and assist in reducing the overall ambient temperature. Studies have shown that this cooling effect can reduce air-conditioning costs for adjoining properties by thousands of dollars per year.

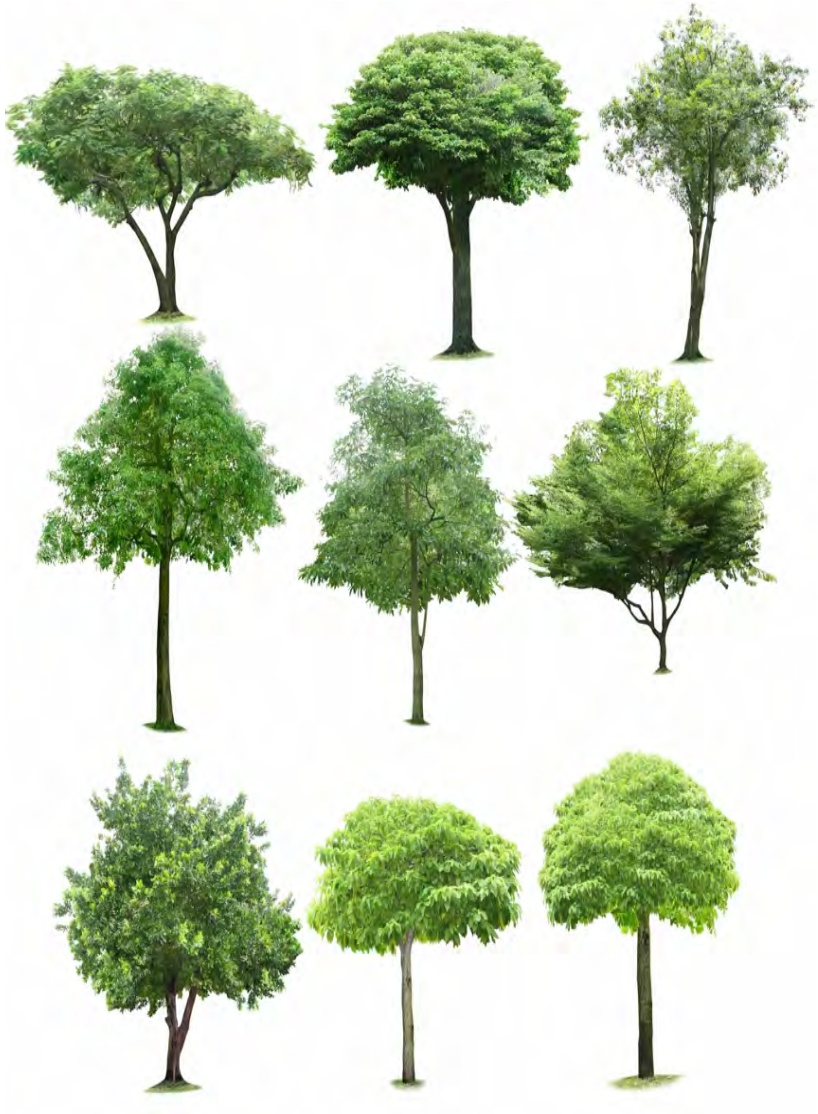
Trees are an important part of our culture, identity and character. Within Darwin, the Tree of Knowledge, the large Boab in the Post Office Carpark and numerous other Milkwoods, Banyans and Beauty Leafs are distinct and highly valued by the community. They have been meeting places providing shade and amenity for many years. They have also survived at least 4 cyclones - in 1917, 1937, 1974 (Tracy) and more recently 2018 (Marcus). Numerous surveys and public consultation undertaken by NTG and City of Darwin testify to the public's support for 'a lush, shady, tropical' city. There is widespread appreciation of tree lined shady streets and parks.

Darwin Botanical Gardens

Numerous studies within Australia and internationally demonstrate that well treed streets and suburbs are also those with higher property values. They are an investment with good returns for both private property owners and the community.

Trees provide valuable environmental benefits. Models developed and used in Australia demonstrate that the annual environmental contribution of a large, evergreen tree can be in the order of $10,000 and higher. This is in the areas of storing carbon (counteracting carbon emissions), removal of air pollutants and particles, water retention and cleansing. Trees can also contribute to infrastructure savings by reducing flooding levels and extending the life of road pavements.

Open space, parks and trees all make important contributions to the health and well-being of residents and visitors. Shady streets and parks promote physical and social activities. This translates directly to improved physical and mental health and has been shown to result in significant reductions in health costs.



Characteristics of trees

PLANT SELECTION

Plant selection is the first and most important step in the process of establishing a healthy, resilient tree. The golden rule should always be “The right tree for the right place”.

Consider the Strategic Aspects of an Urban Forest

- Life cycle (e.g. succession planting) considerations.
- Climate change considerations.
- Species diversity as part of a resilient urban forest. Many councils have a diversity plan along the lines of no more than 30% of one family, 20% of one genus and 10% of one species. This will help stagger growth rates of trees, avoid repeating past mistakes, (too many of one species of a similar age around the entire area) assist with allowing for climate change predictions and provide a more diverse selection of options.
- Maintenance and tree establishment commitment – resources and costs.

Consider the Physical Site Characteristics

Trees take time to develop and mature – they are living systems and their environment will greatly impact on how well they establish, mature and survive. Consider:

- Existing soils, natural drainage and water movements.
- Irrigation – permanent, temporary, establishment only or none.
- Shading and exposure arising from other trees, buildings and structures.
- Fast growth or long-term stability – these are often at odds.
- Available space – both above ground and below ground – refer to ‘Tree Installation’ section.
- Constraints such as underground and overhead services and the associated authority guidelines.

Raintree Park

Nature Playgrounds

Consider the Functional Requirements of Trees

- Shade to buildings, streets parks and open space.
- Creation of comfortable microclimates within outdoor spaces.
- Opportunities to educate (science studies, animal and plant interaction such as caterpillars, basis for art lessons, caring for land and Indigenous studies) and demonstrate sustainable land management practices.
- Indigenous local plantings provide habitat for native fauna and increase biodiversity values in the local area.
- Planting in the playground can inspire exploration, social interaction, learning and controlled risk taking for children.
- General; amenity and appearance.

From the above it can be seen that there are many aspects to be considered in plant selection. The Appendices to this report provide guidance on tree selection in respect of cyclone resilience, weed risk and other limiting factors, but this should only be the starting point in refining the final tree selection.

Appendices A and B are primarily a review of the list tree species that are known to be planted in and around Darwin. As such it is a limitation of the report. Further work should be done in relation to the evaluation of the myriad of individual planting sites along with the evaluation of many potentially suitable species that are not currently represented in the Darwin region. Included here would be also those species in the 'Inconclusive' category of cyclone resilience in Appendix A.

These species represent possible options to increase the diversity of species available for planting and may also represent species with favourable attributes under future climate scenarios. This is a field for ongoing trials, research and risk assessment that could be supported by City of Darwin and undertaken collaboratively with various stakeholders in Darwin.

Tree Canopy Adds to Walkable Neighbourhoods

The consideration of tree selection in future climate change scenarios is of increasing importance. Will tree species planted today cope with the temperature, rainfall and storm events predicted under future climatic conditions predicted for Darwin? Kendal *et al.* (2017) provide data on the risk of temperature rises due to climate change on trees in the Darwin CBD. Alarmingly, all of the 41 tree species assessed were flagged as at risk with temperature rises under a 'business as usual' scenario by 2070. Climate change resilience has been included in the tree selection matrix in Appendix C. However, it must be noted there is a paucity of data available for tropical trees. Most of the species in Appendices A and B are City of Darwin as 'Unknown' for climate change resilience. This is an area in need of further research that could be carried out in Darwin.

There is also the aspect of educating and responding to community aspirations for tree selection. The City of Darwin has the opportunity to liaise with the community and assess community attitudes about trees being replanted, what species, where they should be planted, and what their idea of a walkable liveable cool suburb is.

City of Darwin Nursery

Nursery Stock

PLANT PROCUREMENT AND SUPPLY

It is recommended that preference for supply be given to Nursery Industry Accreditation Scheme of Australia accredited nurseries. The accreditation provides an audited best practice system for production nurseries that ensures high quality plant stock.

Pre-order and lead times

The lead time and pre-ordering of stock is critical to ensure availability of quality stock at time of planting. As an example, 25 litre plants typically take 12-18 months to grow, larger plants require even longer lead times. Even tube stock/starter plants can require 12 months lead time due to constraints of seeding times, seed availability and species selection.

Issues around delays in construction projects provides many examples where plant stock has been held by nurseries for extended times which has led to the supply of stock that has been compromised by extended holding time. End users need to know tree stock has a use-by date and contracts for supply need to state these dates and put financial liability for unused, no longer suitable, ordered stock on the end user. Specifications around *AS 2303-2015 Tree Stock for Landscape Use*, in particular relating to container type, growing media and pruning/form need to be clear and adhered to by suppliers and enforced by end users. High tree quality according to *AS 2303-2015 Tree Stock for Landscape Use* should be the expectation of all end users. It is noted that a lack of alternative quality stock regularly forces end users to use poor quality stock.

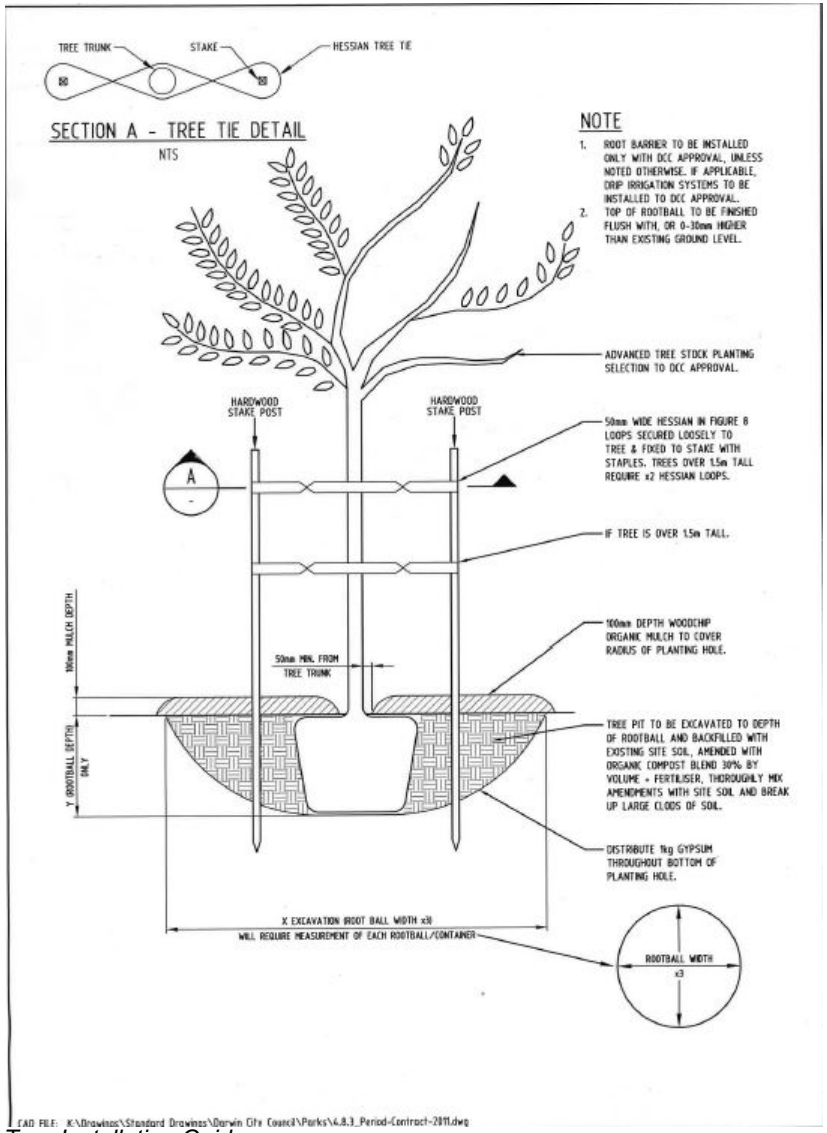
There is a need for limited quantities of high-quality stock of a pre-determined species list to be available at other times. The City of Darwin should continue with the contract for the supply of container grown trees.

Planting

Planting sizes (initial impact v long term viability)

Current research shows that smaller propagation container size produces a better outcome over larger containers. Research has also supported that air root pruning, regardless of propagation container size will produce superior quality stock.

Smaller plants are more prone to theft, vandalism, lawn mower/whipper snipper damage though it was noted that DIPL are getting good results with tube stock if in association with appropriate plant protection. City of Darwin has found that 25-50 litre propagation container size has been the most successful planting size.



Tree Installation Guide

TREE INSTALLATION

Tree planting specification – Turf/Garden areas

Tree planting in turf/Garden areas should be in accordance with the standard drawing below. Tree planting holes should be three times the diameter of the tree root ball and of the same depth. Root barrier or other impediments to lateral root growth must not be used at any time. Planting holes shall be excavated to ensure the sides of the hole are not glazed, compacted or otherwise hardened, as this has the effect of guiding the tree roots around the edge of the planting hole, causing circled and girdling roots which will have a negative effect on the trees long term resilience to high wind events.

Tree pit considerations – Size, volume, soil types, soil microbiome, drainage in urban landscapes

Ensure the maximum soil volumes possible but with minimum soil volumes specified. Industry publications and scientific findings in relation to both canopy diameters and recommended minimum soil volumes for tree rooting capacity can assist to provide specification to tree pit size and soil volume requirements for urban trees. Details are provided in Appendix E.

The Australian Standard *AS 4419-2003 Soils for Landscaping and Garden Use* should be followed with the use of “Sandy Loam” in the tree pit. The incorporation of humates and beneficial microbes prior to planting has been shown to be beneficial and can reduce the need for further fertilising.

Tree pits should be connected to stormwater or natural drainage. Woodchip mulch is preferable to paving and tree grates are preferable to permeable paving within 1500mm of tree trunks. The maximum area possible of permeable surface treatment over the structural root zone is preferred to facilitate water ingress and gas exchange.

In Ground Irrigation

Irrigation, water harvesting

In-ground irrigation is preferred over manual irrigation. Water truck irrigation is available. Drip irrigation can supply the recommended volumes. Whichever irrigation method is used watering should deliver a suitable volume of water in such a way that it penetrates the soil profile to a depth of at least 450mm.
Trees in hardscapes require watering each dry season.

The City of Darwin shall undertake a continuous 6-month watering program over the first 3 years following installation of any tree to irrigate installed trees. The works program schedule should be provided by the City of Darwin to staff and contractors engaged in watering trees. Due to varying climatic conditions, alteration of the start/finish time of the watering program and any additional watering may be advised.

Trees are to be watered via water truck or by drip line irrigation during the first three years following planting, with the following frequency:

- Three (3) times per week for the first Four (4) weeks only, after the planting date.
- Three (3) times per week for the duration of the first dry season (May 1st – October 31st)
- Two (2) times per week for the duration of the second dry season (May 1st – October 31st)
- Once (1) times per week for the duration of the third dry season (May 1st – October 31st)

At each watering event in the first-year irrigation supplied should match the volume of the container the tree was in prior to planting, for example:
25 litre tree = 25 litres per water
50 litre tree = 50 litres per water

In years 2 and 3, water volume should be a minimum of 30 litres per tree, per water event. The tree watering program should be carried out utilising qualified horticulturalists and used as an opportunity to identify issues such as pruning and pest and disease outbreak.

Trees and Services

Stormwater harvesting using storm water collection inlets should be installed wherever possible, and mandatory within the CBD. Water sensitive urban design options that relate to Darwin rainfall patterns can be considered to create a water bank, reduce runoff and optimise tree performance. Where tree pits utilise stormwater harvesting, they should also be connected to the stormwater system to ensure positive drainage is retained in tree pits to prevent waterlogging.

Working around services

It is acknowledged that trees are essential in the CBD despite potential conflict with services. A design review involving all stakeholders would facilitate infrastructure and tree coexistence. Such a review would be particularly relevant to nature strip situations and should maximise and optimise uninterrupted soil volumes and crown space for tree establishment.

Conflict with services could be reduced by:

- Locating CBD trees in the road pavements where space in verges is restricted due to underground services or other constraints.
- Referring to the relevant service authority requirements for clearances.
- Consolidating services on one side of the street. In many suburban streets overhead lines are down one side of the road, water and sewer down the other making conflict with trees inevitable.
- Mapping high priority power/water infrastructure and ensure plantings will not interfere with main delivery lines under any circumstances.
- Defining an acceptable level of risk to infrastructure.
- Using a tree valuation method to realistically compare values with infrastructure costs.

Maintaining the Urban Forest

Establishment (Year 3) including fertilising program and formative pruning

- A fertiliser program for new plantings should be developed that provides 2 applications annually of a suitable fertiliser and 2 applications during the dry season of an appropriate soil wetting agent.
- Where possible, it is preferable to provide fertiliser and wetting agents by means of liquid application, via a water truck. Granular products may be used where necessary.
- Each tree should be mulched as per the planting specification at least once annually or as required using high quality, aged woodchip mulch with a maximum of 10% fine particles (10mm in diameter)
- Formative pruning shall be undertaken annually, and pruning must be in accordance with *AS 4373-2007 – Pruning of amenity trees*.
- Pests and diseases will be treated as required to ensure trees remain healthy and establish to their full potential.

Location of trees affected by Cyclone Marcus 2018

WHOLE OF LIFE TREE MANAGEMENT

Tree data base and data collection

The use of a data base to systematically inventory park and street tree assets is recommended and it is noted that City of Darwin has made progress in this aspect. There needs to be a systematic approach to ensure all Council areas are covered. It is recommended that 100% of trees in the municipality be identified and plotted over a 3 year period. There should be a programmed reassessment of every tree every 3 years. The management of the tree inventory data requires dedicated software that provides the required functionality and that can interface with other IT platforms used by City of Darwin. The committee notes that *Treeplotter* software is one option that meets City of Darwin requirements.

Such an approach will assist City of Darwin with their tree management plans. Knowing what you have, and its location is a prerequisite to manage assets in a cost effective and proactive manner. TC Marcus has provided a unique opportunity for City of Darwin to conduct an inventory as there are now many thousands less trees. The inventory data is a foundation to build operational plans and will assist City of Darwin with future planning and planting plans.

Council should also use the report on TC Marcus and its data format as a basis for gathering data following future storm/cyclone events. An additional data field that should be included in future reports is to record observations on why an individual tree has failed e.g. root damage, poor pruning, disease etc. Several Council officers and arborists should be trained and allocated for emergency operational data gathering with adequate resources to react promptly following an event. Accumulating information in such a way and conducting regular reviews of this report and the associated tree lists every 3 years or after a significant storm event will continue to improve the cyclone resilience of tree plantings in Darwin.

Increasing Canopy Cover

The tree inventory, data base and resultant improved planning will facilitate a shift from reactive tree management to a proactive modern urban forest model which will result in fewer customer requests, better tree health and structure and more cost-effective operations.

Ongoing maintenance and associated funding – trees are a valuable community asset

If mature trees are properly valued, then the decision making for works in proximity to trees becomes a straight forward cost benefit analysis. The cost of activities such as realigning irrigation trenches or design and placement of footpaths can then be compared with the properly assessed value of a mature tree which may be in the tens of thousands of dollars. Added to that value can be the assessment of damage to infrastructure should the works compromise the tree stability in a future storm event.

There are tools for valuing trees in an urban setting and a good example that is relatively simple to use is the system developed by the City of Melbourne.
https://www.melbourne.vic.gov.au/SiteCollectionDocuments/Tree-valuations.DOC

The committee recommends that City of Darwin should review the current resource allocation concerning tree management and its ability to provide a satisfactory level of service to the Councils tree assets, and community's tree population.

City of Darwin should actively manage the loss of trees in the municipality to maintain and increase current canopy cover levels in public open space to a minimum of 50% by 2030.

Tree Management

The committee recommends that City of Darwin should review all tree related policy and process and assess for their ability to meet the organisational requirements for tree risk management, tree condition assessment, tree removal, tree retention, tree replacement and development consent, and for their performance against contemporary best practice urban forest management models and existing/future strategic outcomes. A citywide, long-term Strategic Urban Forest Management Plan is required.

Following the endorsement of this report and any recommendations that are accepted by council the *Tree Management Plan* should be reviewed to ensure that the *Tree Management Plan* accurately reflects the findings of this report and any recommendations endorsed by council.

Irrigation/ supplementary watering

Watering regimes for the first 3 years are discussed under the Tree Establishment section. After 3 years most, trees should be sufficiently established to survive without additional watering. There may be locations where additional watering is needed but this should be assessed on a case by case basis.

City of Darwin in conjunction with other stake holders should investigate the use and installation of storm water collection inlets for storm water harvesting and watering of street trees.

Pruning

For long term management of trees *AS4373 Pruning of Amenity Trees* is recommended.

Monitoring/ risk management/ acceptable risk thresholds

The community needs to understand and have an expectation and acceptance of tree failure(s) during cyclonic and major storm events; it is inevitable.

Tree Management

Therefore, a tree risk threshold needs to be defined and understood by the community and this may require some effort in community education. What level of tree risk is acceptable and what level is not, and what level of risk requires intervention. In the development of risk thresholds there must be a consideration of cyclonic strength wind events. This should be balanced by the demonstrable benefits that trees provide during cyclonic events. A tree risk inspection program that identifies and consequently mitigates tree risk to avoid or reduce exposure to legal liability claims is integral to such a risk management strategy.

It is recommended City of Darwin adopts an industry standard, peer reviewed, tree risk assessment system. The International Society of Arboriculture Tree Risk Assessment Qualification (TRAQ) method (Dunster 2017) and the Quantified Tree Risk Assessment system (QTRA 2018) are two methods worth considering. A tree risk assessment system would be used to develop risk thresholds and points where intervention is required and lead to a balanced and proportionate tree risk management approach.

Tree protection

The management and care of the below ground portion of a tree is as important as the management of the above ground portion. If tree roots are not protected, then it is irrelevant what species are planted. Damage to large portions of any tree root system will compromise the tree and contribute significantly to instability and uprooting in a storm event.

There is an Australian Standard - *AS4970-2009 on Protection of Trees on Development Sites*. This should be followed but more importantly Council should consider mechanisms to enforce tree protection. One effective means to protect public trees could be achieved by integrating the requirements *of AS4970-2009 Protection of Trees on Development Sites* into council development processes.

Tree Management

AS4970-2009 should be incorporated into City of Darwin council's works permit system. Works within 3 meters of any tree less than 5 meters in height, or within the Tree protection zone of any tree greater than 5 meters in height must have a works permit issued, with conditions in place to ensure the protection of the tree as per the standard in place. City of Darwin should encourage all other NT government departments to follow suit.

The committee recommends that Council should review existing measures in other LGA's such as by-laws, Tree Protection Orders, Vegetation Protection overlays, tree removal/pruning permit systems, development consent requirements and the associated need for resourcing of such systems, including enforcement and surveillance. The establishment of a bond on tree assets for protection has been used by City of Darwin during construction of the Raintree Park upgrade. The implementation and success of this should be reviewed by Council as a possible option for all construction activities in proximity of trees on Council land.

Education

It is recommended that City of Darwin develop and deliver tree management education programs to tree management staff, tree workers, parks crews, all contractors, (including irrigation), development assessment staff, customer service staff, high level decision makers and the wider community. This would include educating all stake holders on the importance of the recommendations in this document and the repercussions if these guidelines are not adhered to.

Gardens Road

Conclusion

Darwin needs its urban forest as the effects of climate change, the need to attract and retain population and tourism continue to grow. Adoption by City of Darwin of the full cycle of tree management recommended in this report, assists City of Darwin to retain and increase its urban forest well into the future, even in the event of cyclones such as Marcus 2018.

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AS 4970-2009 Protection of trees on development sites. https://www.standards.org.au/standards-catalogue/sa-snz/agriculture/ev-018/as--4970-2009

APPENDICES

APPENDIX A

PREFERRED TREES FOR DARWIN

A tree with low cyclone resilience may have an attribute such as form, colour, wildlife attractant that is desirable in a specific location. Where these trees are small, such as many Grevilleas and Acacias, and unlikely to cause damage in the event of uprooting, they have been included in Appendix A.

Similarly, trees that have been recognised as having a medium cyclone resilience because of issues with branch drop or trunk splitting are included here. The use of these species needs to be tempered by an understanding of their performance in storm events and careful consideration of the planting location.

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Acacia	dunnii	Elephant Ear Wattle	NT Native	Low
Acacia	torulosa		NT Native	Low
Acacia	latescens		NT Native	Medium
Adansonia	gregorii	Boab	NT Native	High
Adansonia	digitata	African Boab	Exotic	Medium
Adenanthera	pavonina	Red Bead Tree	NT Native	Medium
Aidia	racemosa	Archer Cherry	NT Native	High
Albizia	lebbeck	White Siris	NT Native	Medium
Albizia	saman	Rain Tree	Exotic	Medium
Allosyncarpia	ternata	Allosyncarpia	NT Native	Medium
Alphitonia	excelsa	Red Ash	NT Native	Medium
Alstonia	actinophylla	Northern Milkwood	NT Native	High
Antidesma	ghaesembilla		NT Native	High
Araucaria	cunninghamii subsp. cunninghamii	Hoop pine	Australian Native	Medium
Archontophoenix	alexandrea	Alexandra Palm	Australian Native	High

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Arfeuillea	arborescens	Hop Tree	Exotic	High
Asteromyrtus	magnifica		NT Native	High
Asteromyrtus	symphyocarpa	Liniment Tree	NT Native	High
Banksia	dentata		NT Native	High
Barringtonia	asiatica	Poison tree	Exotic	High
Barringtonia	acutangula	Freshwater Mangrove	NT Native	Medium
Bauhinia	variegata	Purple Bauhinia	Exotic	Low
Berrya	cordifolia	Trincomalee	Exotic	Inconclusive
Bismarkia	nobilis	Bismark Palm	Exotic	Medium
Bombax	ceiba	Kapok Tree	NT Native	High
Brachychiton	diversifolius	Kurrajong	NT Native	High
Brachychiton	rupestris		Australian Native	Inconclusive
Brownea	spp.		Exotic	Medium
Browneopsis	ucayalina		Exotic	High
Buchanania	arborescens	Little Gooseberry Tree	NT Native	High
Buchanania	obovata	Green Plum	NT Native	High
Caesalpinia	ferrea	Leopard Tree	Exotic	Medium
Callistemon	viminalis	Weeping Bottlebrush	Australian Native	High
Callitris	intratropica	Northern Cypress Pine	NT Native	High
Calophyllum	inophyllum	Beauty Leaf	NT Native	High
Calophyllum	sil		NT Native	High
Canarium	australianum	Melville Island White Beech	NT Native	High
Carallia	brachiata	Bush Current	NT Native	High
Cassia	nodosa	Rainbow Shower	Exotic	High
Castanospermum	australe	Black Bean	Australian Native	High
Casuarina	equisetifolia	Coastal She-Oak	NT Native	Medium
Casuarina	papuana		Exotic	Medium

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Casuarina	cunninghamiana	Riverine Casuarina	NT Native	Inconclusive
Celtis	philippensis		NT Native	High
Citharexylum	spinosum	Fiddlewood	Exotic	Medium
Citrus	latifolia	Lime	Exotic	High
Clerodendrum	floribundum	Clerodendrum	NT Native	Medium
Coelospermum	reticulatum		NT Native	Low
Cordia	subcordata	Kerosene Wood	NT Native	Medium
Corymbia	ptychocarpa	Swamp Bloodwood	Australian Native	Medium
Corymbia	polycarpa	Long-Fruited Bloodwood	Australian Native	Medium
Corymbia	bleeseri	Smooth stemmed bloodwood	NT Native	Medium
Corymbia	jacobsiana	String Barked Bloodwood	NT Native	Medium
Corymbia	arnhemensis	Katherine Gorge Bloodwood	NT Native	Medium
Corymbia	papuana	Ghost Gum	Australian Native	Medium
Corymbia	polysciada	Apple Gum	NT Native	Medium
Corymbia	bella	Ghost Gum/White Gum	NT Native	Medium
Cupaniopsis	anacardioides	Tuckeroo	NT Native	High
Cyclophyllum	schultzii	Canthium	NT Native	High
Denhamia	obscura	Denhamia	NT Native	High
Dillenia	alata	Red Beech	NT Native	Medium
Dillenia	indica	Elephant Apple	Australian Native	Medium
Diospyros	compacta	Australian Ebony	NT Native	High
Diospyros	maritima	Broad Leaved Ebony	NT Native	High
Diospyros	nigra	Black Sapote	Exotic	Medium
Dodonea	platyptera	Hop Bush	NT Native	Low
Dypsis	lutescens	Golden Cane	Exotic	High
Dypsis	madagascariensis	Malagasy Palm	Exotic	High

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Elaeis	guineensis	African Oil Palm	Exotic	High
Erythrina	variegata	Coral tree	NT Native	Medium
Erythrophleum	chlorostachys	Ironwood	NT Native	High
Eucalyptus	apodophylla	White bark	NT Native	High
Eucalyptus	alba	White Gum/Salmon Gum	NT Native	Medium
Eucalyptus	herbertiana	Herbert's Gum	NT Native	High
Eucalyptus	nesophila	Melville Island Bloodwood	NT Native	High
Eucalyptus	bigalerita	Northern Salmon Gum	NT Native	Medium
Eucalyptus	miniata	Darwin Woollybutt	NT Native	Medium
Eucalyptus	oligantha	Broad-leaved Box	NT Native	Medium
Eucalyptus	phoenicea	Scarlet Gum	NT Native	Medium
Eucalyptus	tectifica	Darwin box	NT Native	Medium
Eucalyptus	tetrodonta	Northern Stringybark	NT Native	Medium
Eucalyptus	tintinnans	Hills Salmon Gum	NT Native	Medium
Fagraea	racemosa	Fagraea	NT Native	Inconclusive
Ficus	scobina	Sandpaper Fig	NT Native	High
Ficus	virens	Banyan	NT Native	High
Ficus	coronulata	Peach-Leaf Fig	NT Native	High
Ficus	opposita	Sandpaper Fig	NT Native	High
Ficus	racemosa	Cluster Fig	NT Native	High
Ficus	rubignosa	Port Jackson Fig	Australian Native	Medium
Ficus	longifolia	Narrow Leaf Fig	Exotic	Medium
Ficus	brachypoda	Rock fig	NT Native	Inconclusive
Ganophyllum	falcatum	Scaly Ash	NT Native	Medium
Gardenia	megasperma		NT Native	High
Gardenia	fucata		NT Native	Medium
Grevillea	angulata	Holly Leaf Grevillea	NT Native	High

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Grevillea	heliosperma	Rock Grevillea	NT Native	High
Grevillea	parallela	Silver Oak	NT Native	Low
Grevillea	pteridifolia	Fern-Leaved Grevillea	NT Native	Low
Grevillea	refracta	Silver-Leaf Grevillea	NT Native	Medium
Grevillea	decurrens	Clothes-peg Tree	NT Native	Medium
Helicia	australasica	Helicia	NT Native	Inconclusive
Hibicus	tiliaceous	Beach Hibiscus	NT Native	Medium
Hibicus	tiliaceous var. rubra	Red Beach Hibiscus	NT Native	Medium
Horsefieldia	australiana	Nut Horsfieldia	NT Native	High
Hydriastele	wendlandiana	Florence Falls Palm	NT Native	High
Hyophorbe	verschaffeltii	Spindle palm	Exotic	High
Jacksonia	dilatata	Jacksonia	NT Native	High
Kigelia	pinnata	Sausage Tree	Exotic	High
Lagerstroemia	indica	Crepe Myrtle	Exotic	High
Lagerstroemia	speciosa	Pride Of India	Exotic	Medium
Latania	loddigesii	Blue Latan Palm	Exotic	High
Leptospermum	madidum	Weeping Tea Tree	NT Native	High
Licuala	ramsayii	Queensland Fan palm	Australian Native	High
Livistona	benthamii	Benthams Fan Palm	NT Native	High
Livistona	humilis	Sand Palm	NT Native	High
Livistona	inermis	Whispy Fan Palm	NT Native	High
Livistona	mariae subsp. rigida	Mataranka Fan Palm	NT Native	High
Livistona	muelleri	Northern Cabbage Palm	Australian Native	High
Lophostemon	grandiflorus subsp. riparius	Northern Swamp Box	NT Native	High
Lophostemon	lactifluus	Swamp box	NT Native	High
Lyrata	pandurata	Fiddleleaf fig	Exotic	Inconclusive
Mangifera	indica	Mango	Exotic	Medium

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Maniltoa	lenticellata	Silk handkerchief tree	Australian Native	High
Maranthes	corymbosa	White Cloud Tree	NT Native	High
Melaleuca	leucadendra	Weeping Paperbark	NT Native	High
Melaleuca	argentea	Silver-Leaved Paperbark	NT Native	High
Melaleuca	bracteata	Black tea tree	NT Native	High
Melaleuca	cajuputi	Paperbark	NT Native	High
Melaleuca	dealbata	Paperbark	NT Native	High
Melaleuca	minutifolia	Paperbark	NT Native	High
Melaleuca	nervosa	Fibrebark	NT Native	High
Melicope	elleryana	Euodia	NT Native	Low
Micromelum	minutum		NT Native	High
Miliusa	brahei	Miliusa	NT Native	High
Millettia	pinnata	Indian Beech	NT Native	Medium
Mimusops	elengi (cultivated)	Mimusops Red Condoo	Exotic	High
Mimusops	elengi (NT natve)	Mimusops	NT Native	High
Mimusops	elengi cv. Street Elegance	Mimusops "Street elegance"	Exotic	High
Monoon	australe	Northern Territory Polyalthia	NT Native	Medium
Morinda	citrifolia	Rotten Cheesefruit	NT Native	High
Myoporum	acuminatum	Boobialla	Australian Native	Inconclusive
Myristica	insipida	Wild Nutmeg	NT Native	High
Nauclea	orientalis	Leichardt Tree	NT Native	High
Peltophorum	pterocarpum	Yellow Flame Tree	NT Native	Medium
Persoonia	falcata	Milky plum	NT Native	High
Petalostigma	pubescens	Quinine Tree	NT Native	High
Phaleria	clerodendrum	Butterfly Tree/Scented Daphne	Australian Native	High

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Pittosporum	moluccanum		NT Native	Medium
Pittosporum	angustifolium	Native Apricot	NT Native	Inconclusive
Planchonia	careya	Cocky Apple	NT Native	High
Pleiogynium	timoriense	Burdekin plum	Australian Native	High
Plumeria	obtusa	Singapore Frangipani	Exotic	High
Plumeria	rubra	Frangipani	Exotic	High
Polyalthia	longifolia	Polyalthia	Exotic	Medium
Polyalthia	longifolia subsp. pendula	Indian Mast Tree	Exotic	Medium
Pterocarpus	indicus	PNG Rosewood	Exotic	Medium
Ptychosperma	macarthurii	Macarthur palm	NT Native	High
Roystonea	regia	Cuban Royal Palm	Exotic	Medium
Saraca	spp.		Exotic	Medium
Schefflera	actinophylla	Umbrella Tree	NT Native	Medium
Schleichera	oleosa	Ceylon Oak	Exotic	High
Staphylea	pinnata	European Bladdernut	Exotic	Medium
Sterculia	quadrifida	Peanut Tree	NT Native	High
Sterculia	holtzei		NT Native	Inconclusive
Syzygium	forte	White Bush Apple	NT Native	High
Syzygium	nervosum	Daly River Satinash	NT Native	High
Syzygium	suborbiculare	Red Bush Apple	NT Native	High
Syzygium	minutuliflorum	Gove Satinash	NT Native	Medium
Syzygium	armstrongii	Bush Apple	NT Native	High
Syzygium	fibrosum	Small Red Bush Apple	NT Native	High
Syzygium	cumini	Java Plum	Australian Native	Low
Syzygium	angophoroides	Satinash	NT Native	Medium
Syzygium	jambos	Rose Apple	Exotic	Inconclusive
Syzygium	eucalyptoides subsp. eucalyptoides		NT Native	High

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Tabebuia	aurea	Silver Trumpet Tree	Exotic	Medium
Tabebuia	rosea	Rosy Trumpet Tree	Exotic	Medium
Tabebuia	pallida	Pink Trumpet Tree	Exotic	Medium
Tabebuia	palmerii		Exotic	Medium
Tabernaemontana	orientalis	Iodine bush	NT Native	High
Tamarindus	indica	Tamarind	Exotic	High
Tectona	grandis	Teak	Exotic	Medium
Terminalia	ferdinandiana	Billy Goat Plum	NT Native	High
Terminalia	microcarpa	Damson Plum	NT Native	High
Terminalia	catappa	Indian Almond	NT Native	High
Terminalia	platyphylla	Wild Plum	NT Native	Medium
Terminalia	arostrata	Nutwood	NT Native	Inconclusive
Terminalia	belliricia	Bahera	Exotic	Inconclusive
Terminalia	melanocarpa		Australian Native	Inconclusive
Timonius	timon	Tim-Tim	NT Native	High
Veitchia	merillii	Manilla palm	Exotic	High
Vitex	glabrata		NT Native	Inconclusive
Wrightia	pubescens	Wrightia	NT Native	Low
Xanthostemon	paradoxus	Bridal Tree	NT Native	High
Xanthostemon	chrysanthus	Golden Penda	Australian Native	High

APPENDIX B

TREES RECOMMENDED NOT TO BE PLANTED

Most of the species with a low cyclone resilience have been recommended to be avoided in plantings in Darwin. In addition, there are species that are highly cyclone resilient but are not recommended for planting in particular locations for other reasons such as being allergenic/poisonous, are invasive, or have nuisance fruit. These species are also included here in Appendix B.

Genus Name	Species Name	Sub species	Common Name	Notes
Acacia	auriculiformis		Black Wattle	Low cyclone resilience and high risk to property and life
Alstonia	scholaris		White Cheesewood	Highly allergenic
Artocarpus	altilis		Breadfruit	Large dangerous fruit
Artocarpus	heterophyllus		Jackfruit	Large dangerous fruit
Averrhoa	carambola		Star Fruit	Environmental weed
Azadirachta	indica		Neem	Declared weed
Carpentaria	acuminata		Carpentaria Palm	Caustic fruits
Caryota	spp.		Fishtail Palm	Low cyclone resilience and environmental weed
Cascabela	thevetia		Yellow Oleander	Low cyclone resilience and environmental weed
Cassia	fistula		Golden Shower	Environmental weed
Cassia	siamea		Siamese cassia	Environmental weed
Cocos	nucifera		Coconut Palm	Large dangerous fruit
Delonix	regia		Poinciana	Environmental weed
Eucalyptus	camaldulensis		River Red Gum	Low cyclone resilience and high risk to property and life

Genus Name	Species Name	Common Name	Origin	Cyclone resilience
Ficus	benjamina		Weeping Fig	Low cyclone resilience and high risk to property and life
Ficus	microcarpa	hillii	Hill's Weeping Fig	Low cyclone resilience and high risk to property and life
Gauzuma	ulmifolia		West Indian Elm	Environmental weed
Gmelina	arborea		Gmelina	Environmental weed
Khaya	senegalensis		African Mahogany	Low cyclone resilience and high risk to property and life
Khaya	grandifoliola		Big Leaf Mahogany	Low cyclone resilience and high risk to property and life
Khaya	nyasica		African Mahogany	Low cyclone resilience and high risk to property and life
Psidium	guajava		Guava	Environmental weed
Pterocarpus	indicus	pendula	Weeping Rosewood	Low cyclone resilience and disease prone
Spathodea	campanulata		African Tulip	Low cyclone resilience and environmental weed
Wodyetia	bifurcata		Fox Tail Palm	Low cyclone resilience and high risk to property and life

APPENDIX C
TREE SELECTION MATRIX (TEMPLATE)

Family Name

Genus Name

Species Name

Sub species Name

Common Name

Overall Species rating – select from ‘Preferred’, ‘Not to be planted’

Origin – select from ‘NT Native’, ‘Australian Native’, ‘Exotic’

Cyclone resilience – select from ‘High’, ‘Medium’, ‘Low’, ‘Unknown’

Cyclone Resilience source – select from ‘Marcus report’, ‘Yasi Report’, ‘Tracy report’, ‘Committee consensus’, ‘Personal observation’

Climate change resilience – select from ‘High’, Medium’, ‘Low’, ‘Unknown’

Species Leaf Type – select from ‘Evergreen’, ‘Deciduous’

Form – select from ‘Large tree (excurrent)’, ‘Large tree (decurrent)’, ‘Medium tree (excurrent)’, ‘Medium tree (decurrent)’, ‘Small tree (excurrent)’, ‘Small tree (decurrent)’, ‘Shrub’

Growth Rate – select from ‘Fast’, ‘Moderate’, ‘Slow’, ‘Unknown’

Longevity – select from ‘>50 years’, ‘20 - 49 years’, ‘10 - 19 years’, ‘<10 years’, ‘Unknown’

Height - meters

Spread - meters

References

Habitat – select from ‘Wet rainforest’, ‘Dry Rainforest’, ‘Eucalypt woodlands’, ‘Savannah’, ‘Coastal Wetlands’, ‘Riparian forest’

Succession category – select from ‘Pioneer’, ‘Intermediate’, ‘Climax’, ‘Unknown’

Suitable for large parks – select from ‘Suitable’, ‘Unsuitable’

Suitable for small parks – select from ‘Suitable’, ‘Unsuitable’

Suitable for road reserves – select from ‘Suitable’, ‘Unsuitable’

Suitable for Urban landscapes – select from ‘Suitable’, ‘Unsuitable’

Suitable for drainage swales – select from ‘Suitable’, ‘Unsuitable’

Irrigation requirement – select from ‘Dryland’, ‘Turf Irrigation’, ‘Deep watering’

Weed Status – select from ‘Non-invasive’, ‘Invasive – Undeclared’, ‘Declared Class A+C’, ‘Declared Class B+C’, ‘Unknown’

Notes

A further series of attributes are potentially useful and could be added to the selection matrix to aid in species selection. The following Table lists those attributes for consideration. However, for many of these attributes there are no or little data available particularly for native Top End trees. These attributes are listed primarily as an indication for future research.

Tree Species Additional Selection Criteria

- Water requirement (Drought tolerance)
- Water requirement (Waterlogging tolerance)
- Soil compaction tolerance
- Soil Ph. requirement
- Soil Volume requirement
- Soil Elements requirement
- Heat tolerance (temperature)
- Wind tolerance
- Pollution tolerance
- Light requirement (Shade tolerance)
- Mature Crown Size (Canopy cover potential)
- Paved Area tolerance
- Past Urban Performance (Adaptability)
- Shade Density
- Mature Crown Form
- Maintenance requirements
- Tree litter production
- Pathogen and pest susceptibility
- Allergen potential
- Power line (overhead) proximity suitability
- Stock quality
- Stock availability
- Aesthetic/Flowering attributes

APPENDIX D

PLANT PROCUREMENT CONTRACT TEMPLATE

CITY OF DARWIN – TREE PROCUREMENT SPECIFICATIONS
SINGLE PROJECT – SUPPLY OF PLANTS/TREES

Trees are generally the most visible element in the landscape. They are both living organisms and potentially very large structures that may live for many decades or even centuries.

It makes sense that trees that are ordered from growers should be of the best possible quality to ensure that they establish and succeed in the landscape. Money well spent at the early stages of a landscape project assists in more rapid returns on investment.

One of the most common reasons for the failure of newly planted trees to grow and establish in the landscape is poor quality stock, especially below ground. Girdled and kinked root systems limit the ability of the tree to take up water and nutrients and may provide inadequate support. Stems with inadequate taper cannot support themselves and encourage the use artificial supports such as stakes and ties. Tall plants in undersized containers generally have insufficient root volume to support them both biologically and physically.

Growing quality trees takes skill and care. Trees are living organisms that respond uniquely to their growing environment, including that of the nursery. Plants grown in containers can quickly reach their ‘use by date’ and must be sold, planted or potted-on to remain viable. Unlike manufactured items, they cannot be stored indefinitely and there will always be a degree of variability between even the most closely specified trees.

It is important to note that well-grown trees in themselves are not a guarantee of success in the landscape. The quality of trees is only one part of the process and must be combined with good planning and design, appropriate species selection, correct planting and establishment techniques and ongoing maintenance.

The majority of this Tree Procurement Contract’s Specifications are derived from *Specifying Trees: a guide to assessment of tree quality* by Ross Clark, published in 2003 by NATSPEC/Construction Information, Milsons Point. It is based on extensive measurement and assessment of nursery-grown trees.

CONDITIONS OF CONTRACT

CONTAINER TYPE AND PRODUCTION SPECIFICATION

All trees included in this growing contract are to be grown throughout all stages in 3 dimensional air root pruning containers. Standard smooth walled pots are not acceptable for this contract. Exact pots to be used are to be agreed to by City of Darwin prior to contract commencement.

Propagation from seed/cutting in seed trays is permissible, but production methods must have strict quality control mechanisms when pricking out to ensure no J-rooting or other root defects occur.

Potting-on of trees throughout various pot sizes throughout the production phase must be conducted during optimal root colonisation periods. Where possible, pot directly into the largest pot practical for plant growth and uninterrupted root development. Girdling roots or unconsolidated rootballs will not meet the required quality standard, and will be rejected.

Potting media is to conform with AS 3743-2003.

ABOVE GROUND STANDARD

The above ground qualities of a landscape tree are what is seen by the client, and generally what the trees will be judged on by the public. Maintaining an aesthetically pleasing crown, branches, and stem provides a desirable outcome. Correct nursery production of crown, branch and stem can also provide improved health, improved safety, and longer life expectancy to landscape trees.

The above-ground quality shall comply with the following requirements:

True to type

Individual trees and batches shall be clearly labelled. Correct botanical nomenclature is preferred.

Health and vigour

(a) *Health*—Foliage size, texture and colour at time of delivery shall be consistent with the size, texture and colour shown in healthy specimens of the nominated species.

(b) *Vigour*—Extension growth shall be consistent with that exhibited in healthy specimens of the species nominated.

Pest and disease

In general, trees shall show no evidence of pests or disease. However, a small amount of insect attack is common for native species (as they grow with their native pests).

Injury

Trees shall be free from injury, such as: damage caused by ties, stakes and labels, sunburn, rough handling or storms.

Self-supporting

Trees shall be self-supporting without the mechanical support of stakes/ties.

Stem taper

The stem diameter at any given point on the stem shall be greater than the stem diameter at any higher point on the stem.

Pruning

Pruning practices in the nursery impact on the aesthetics, the structural integrity or the health of the tree. It is important that pruning practices benefit the tree's development.

(c) All pruning shall be clean-cut at the branch collar.

(d) Any pruning has been carried out in such a way as to allow the tree to quickly seal the pruning wound, without long-term damage to the tree. Pruning should be in compliance with 'natural target' pruning undertaken as given in AS 4373.

(e) Pruning trees just before shipment should be minimized. Tree's shall been grown to conform with a specified clear stem height requirement throughout it's production, rather than having the lower branches removed just before shipment.

(f) Stress on the trunk is reduced, healthy growth rates are maintained and adequate stem taper is maintained by not lifting the crown of the tree too high.

Apical dominance

For trees with an excurrent form, trees supplied shall have a defined central leader with the apical bud intact.

Crown symmetry

Difference in crown distribution on opposite sides of the stem axis shall not exceed 20%.

Stem structure

For trees with excurrent form, there shall be a single stem in the centre of the crown.

For trees with decurrent form, the central stem shall not be divided at any point lower than the clean stem height specified and the stem junction at the point of division must be sound.

For all trees, branch diameter should be less than or equal to one-half of the stem diameter immediately above the branch junction.

Included bark

Included bark in crotches is a common cause of structural weakness in the branch or stem junction and can result in breakages during storms. Many failures in mature trees occur as a result of increased leverage on weakly attached stems or branches.

The branch/stem bark ridges at junctions between stems and branches and between City of Darwinominant stems shall be convex.

Trunk position

To allow the development of the root system symmetrically about the trunk it is important that the trunk of the tree is in the middle of the rootball.

The distance from the centre of the trunk to the extremity of the rootball shall not vary by more than 10%. The smallest dimension must not be less than 90% of the largest dimension.

Indication of North

The correct orientation of a tree can be important to the success of that tree in its new location (i.e. ensuring that the cambium sheltered from the sun in the nursery is not exposed on planting). This is particularly important in large trees. For trees in containers larger than 100 L, the northerly aspect in the nursery must be clearly indicated in such a way as to not be erased or misplaced in transit.

BELOW GROUND STANDARD

The tree below ground (the root system) is what we do not see and specifications generally do not deal with it well, if at all. The root system, however, is just as important as the tree above ground and, as such, should receive the same amount of attention. The root system of a landscape tree must have enough overall surface area, and be sufficient to take up water and nutrients. Importantly, it must also be well structured so it can grow-on and support the tree indefinitely.
The below-ground quality shall comply with the following requirements:

Root division

Two important aspects of root division are:

Total division.

Pattern of division.

The ability of a root system to take up moisture and nutrients is directly related to the surface area of the root system, which, in turn, is directly related to root division. Roots must divide and divide again (total division). Root systems with inadequate division not only suffer from a reduced surface area but also offer too few points for new roots to develop.

Not only should roots divide repeatedly but the pattern of this division is also important. Division should be outwardly progressive (primary division) to ensure a strong structural base for any later root development. Trees held too long in containers (above ground or in-ground) may exhibit excessive non-directed division. While this may provide root surface area, it adversely impacts on root structure and makes the rootball hydrophobic.

For small trees, the entire rootball must be occupied by fibrous roots. However, for large trees it is possible to use a range of techniques in the early and intermediate stages of growth, providing that there is enough division within the rootball to support the tree adequately at the time of sale.

For trees in containers less than 45 L, roots must have undergone primary division at not more than 100 mm intervals.

For trees in containers greater than or equal to 45 L, roots within the outer 50% of the rootball must also have undergone primary division at not more than 150 mm intervals.

Root direction

Roots, from the point of initiation, should generally grow in an outwards (radial) or downwards direction. Any deviation from the established direction must not exceed 45o.

During below-ground inspection, no evidence of kinked taproots or of circling roots shall be found within the rootball.

Rootball occupancy

On shaking or handling the unsupported rootball at least 90% of the soil volume must remain intact.

Rootball depth

For trees in containers over 45 L, rootballs shall have a diameter greater than or equal to their depth.

Height of root crown

The root crown is the junction between the belowground parts and aboveground parts of the tree. Regardless of the size of the tree the root crown belongs at the surface of the rootball. Burying the root crown can lead to fungal infections, serious disruptions of the root system’s structure and function or to the death of the tree.

The root crown shall be at the surface of the rootball, and not below.

Rootball protection in transit
The combination of container and handling system shall deliver the rootball intact.

INSPECTION AND SAMPLING

All trees included in this growing contract will be subject to inspection and/or sampling.

The grower is to complete inspections at 3 monthly intervals and report to City of Darwin using the tree inspection form (see Appendix).

Prior to dispatch/shipment from grower, City of Darwin Arborist/Project Manager shall conduct an inspection using the tree inspection form (see Appendix).

Non-compliance may lead to rejection of the entire batch, and/or payment withheld for all/non-compliant individual trees from batch.

INSPECTION SAMPLING TABLE

Number of trees per batch	Number of trees to sample
0–20	1
21–50	2
51–100	4
101–500	4 for the first 100 + 2% of balance of order
501–2000	12 for first 500 + 1% of balance of order
2001+	27 for the first 2000 + 0.5% of balance of order

Inspection shall include visual assessment based on the tree inspection form criteria, and the following steps:

Step 1 Remove any stakes. If the tree is then not self-supporting, reject the tree. If the tree is self-supporting and less than 45 L, proceed to step 2. If the tree is self-supporting and greater than or equal to 45 L, proceed to step 3.

Step 2 Place the tree on a level surface ensuring that the root ball is well watered. Hold the stem at 80% of the total stem height. Bend the stem

making sure that the pressure is always at right angles to the position of the stem. The stem should be able to be bent 30° side to side without the root ball lifting off the ground (see Figure B1). If the root ball rocks such that it lifts off the ground then the root ball is too small to be able to support the tree without stakes.

Step 3 Holding the stem at 25% height above the rootball surface, rock the stem vigorously from side to side. There must be no evidence of movement of the stem within the rootball and there must be no evidence of cracks in the rootball at the edge of previous container(s). These indicate previous pottings, which were not correctly rootpruned, or a lack of root division at that point.

Step 4 Remove the tree from the container or remove the hessian or in-ground container or otherwise peel back any wrapping to expose the exterior of the rootball.1 Check that any confused or circling roots at the outside of the rootball have diameter of less than 25% of the stem diameter at ground level for trees of less than 40 mm and less than 10 mm in diameter for trees with a stem diameter at ground level of 40 mm or more. Investigative inspection usually takes two basic forms: destructive (complete) or partial.

Destructive and partial rootball inspections

With destructive rootball inspection, all of the soil from the rootball is washed away (using water or compressed air) to give a clear picture of how the root system has developed. However, as this destroys the tree destructive inspection will generally be carried out infrequently.

Where destructive inspection is deemed necessary, trees will be sacrificed. (The trees sacrificed will be in addition to the number of trees required.) The cost of these plants can either be built into the supplier's price when quoting for supply or itemised as an additional cost.

Where sacrifice of plants is a nominated expense they should be paid for:

1. By the purchaser, if the batch is found to conform.
2. By the supplier, if the batch fails to conform.

With partial rootball inspection, a section of the rootball, sufficient to enable inspection of the root development from the stem to the outer extremity of the rootball (generally a wedge-shaped section), is washed away (using water or compressed air).

Removal of a wedge-shaped section of the rootball of trees in 5-100 L sizes is generally practical. In such cases, ensure that sufficient media is removed to inspect the root development in the upper 150-200 mm of the rootball, from the stem to the extremity, and the outer section of the rootball – top to bottom.

Balance Inspection for Small trees

Balance (small trees) assessment requirements:

(a) Tubes or plant cells: height above rootball surface must be between 1.5 and 2.5 times the height of the tube or plant cell.

(b) Trees in containers < 45 L (other than tubes or plant cells) or ex-ground trees of Size Index < 57 (e.g. 1.9 m high × 30 mm calliper); height must fall within the range indicated for the container size in **Small container-grown trees table**.

(c) Containers/rootballs (other than tubes or plant cells) must remain flat on the ground when the stem, held at 80% of height above the rootball surface, is deflected 30º from the vertical, side to side.

Exempt: Species that naturally produce hard inflexible wood in the early stages of their development.

SMALL CONTAINER-GROWN TREES TABLE

Container size (or minimum rootball diameter)	Height range (m)	
	Thin stemmed species	Thick-stemmed species
Tubes or plant cells	Tree height between 1.5 and 2.5 × container height	
150 mm (1.8L)	0.4 – 0.6	0.3 – 0.5
180 mm (2.6L)	0.5 – 0.7	0.4 – 0.6
200 mm pot (4L)	0.7 – 0.9	0.6 – 0.8
200 mm bag (5L)	0.8 – 1.0	0.7 – 0.9
240 mm (8L)	1.0 – 1.2	0.8 – 1.0
300 mm (15L)	1.2 – 1.5	1.0 – 1.2
330 mm (25L)	1.5—1.9	1.2—1.6
400 mm (35L)	1.8—2.2	1.4—1.9

Balance inspection for Large trees

Balance (large trees) assessment requirements:

(g) For trees grown in containers ≥ 45 L, the Size Index must lie within the range for the nominal container size shown in the **Common container volumes – Size index range table**.

COMMON CONTAINER VOLUMES – SIZE INDEX RANGE

Size index	Nominal container volume (L)	Size index	Nominal container volume (L)
57–74	45	453–587	550
77–99	60	495–640	600
83–107	75	533–716	700
111–143	100	632–818	800
154–200	150	711–921	900
194–251	200	791–1023	1000
227–314	250	842–1089	1100
273–353	300	918–1188	1200
289–373	350	1148–1485	1500
330–427	400	1530–1980	2000
371–480	450	1913–2475	2500
412–518	500		

Size Index is an indicator of the tree's size above ground expressed as a simple number. Size Index is calculated by multiplying the height (m) by the calliper (mm, measured at 300 mm above ground), as follows:

Size Index = height (m) × calliper (mm)

APPENDIX 1. OF PLANT PROCUREMENT CONTRACT
TREE INSPECTION FORM

General	
Date	Reference/Purchase Order No.
Purchaser	
Supplier	Inspected by (supplier/purchaser/agent)
Species	Batch identification
Number of trees in batch	Container/rootball size
Height range	Calliper range
Special requirements	
Above ground	
Labelling	☐
Health and vigour	☐
Freedom from pests and disease	☐
Freedom from injury	☐
Self-supporting	☐
Stem taper	☐
Pruning	☐
Apical dominance	☐
Crown symmetry	☐
Stem structure	☐

Included bark	☐	
Trunk position	☐	
Compatibility of graft unions	☐	
Indication of north	☐	
Below ground	☐	
Inspection method used	☐	External only
	☐	External plus investigative
	☐	destructive ☐ Partial
Number of trees in sample	☐	
Root division	☐	
Root direction	☐	
Diameter nonconforming roots at rootball extremity	☐	
Rootball occupancy	☐	
Rootball depth	☐	
Height of root crown	☐	
Non-suckering rootstock	☐	
Balance		
Balance	☐	

Conformance with specification				
Conforming	☐	Yes	☐	No
Comments				

Name and signature (inspector)

Plant Schedule

Genus	Species	Quantity	Container volume (L)	Height (M)	Calliper (mm)	Supply Date	Unit Price (inc.GST)	Species Total Price (inc.GST)

APPENDIX 2. OF PLANT PROCUREMENT CONTRACT
SUPPLY OF TREES/PLANTS FOR CITY OF DARWIN PROJECT

(Standing Offer)
The Chief Executive Officer
City of Darwin
I/We the undersigned hereby offer to supply the goods as described in the attached document for the period stated and subject to the conditions/specifications prescribed herein. I/We agree to supply the goods within the delivery time and in accordance with the delivery terms stated.

Signed	
Print Name	
Date	
On Behalf of	
ABN	
Postal Address	

Telephone		**Facsimile**	

Signature of Witness	

Print Name	

Date	

APPENDIX E
TREE PLANTING SPECIFICATIONS - TREE PIT SOIL VOLUMES

Tree pit volumes should be calculated using the formula from the NATSPEC Specification for landscape trees (www.natspec.com.au) Required soil volume (m^3) = (Height (m) X DBH (mm) divided by 100.

e.g. the required soil volume for a *Mimusops elengi* would be 10(m) X 450(mm) divided by 100 = $45m^3$
In locations with constraints where the NATSPEC specified volumes cannot be met, tree pit volumes must be at least 60% of the calculated volume, or a smaller tree species should be selected.

Trees planted in turf or garden areas without physical restrictions on the growth of tree roots are exempt from this calculation.

Tree Reestablishment Advisory Committee (TRAC)

Consultation Report

Prepared by: City of Darwin Community Engagement Team

Northern Suburbs Darwin after Cyclone Marcus

Executive Summary

The loss of trees in Darwin during Cyclone Marcus was significant. Over 10,000 trees fell on Council land.

After Cyclone Marcus Council conducted a tree survey (of 2857 trees across 40 parks) and set up the Tree Re-establishment Advisory Committee (TRAC) to make recommendations to Council for a comprehensive plan for replanting (and to avoid the mistakes of the past.)

The Committee researched, discussed and compiled a draft list of over 200 trees on Council land in terms of their cyclone resilience.

The draft list was released for community consultation. There was media coverage with a good response across several platforms – notably through the survey (23 responses) on Engage Darwin and on City of Darwin Facebook (approx. 50 comments) and through email etc (7 responses).

There were extensive comments on the ratings of many species across all the categories and suggestions for other species to add to the lists. (Over 60 species were mentioned in the feedback.) There was also comment on other issues such as best practice for replanting and suggestions on what species people would like to see more replanting of.

A summary of comments and themes on species and on methods of replanting is included in this consultation report, but there is a lot of additional detail in the appendix which contains the full feedback across all platforms.

This material was considered by the Tree Reestablishment Advisory Committee to finalise their reports and recommendations for Council. The Committee has provided responses to tree species identified in the consultation, which is provided in the appendix.

Community Consultation

The TRAC had approximately 12 weeks to assess species and put together ‘best practice’ recommendations for replanting based on cyclone resilience. This limited the time available for community consultation to 2 weeks and 3 days – from Friday 28 September to Sunday 14 October 2018. The aim of this consultation was to provide TRAC with feedback on the draft list of over 200 trees they had assessed.

The Committee wanted to hear from any interested or expert members of the community on areas including:

- Tree species that may be missing from the list,
- The categorization of the cyclone resilience as either high, medium or low
- Information on tree species in the ‘Inconclusive’ category.

A City of Darwin Engage Darwin project page was set up with: downloadable fact sheet, tree lists, photos of some species and a short survey. A media event was held and a media release put out. Emails with fact sheets and tree lists were sent to: key stakeholders including all Committee members' contacts, NT Government reps and NT MLAs, City of Darwin Elected Members and Staff and all Engage Darwin participants. Social media was also used with extensive reach.

Feedback included 23 surveys completed, approximately 50 comments on the facebook post, 7 Written/Other submissions (via email, Elected Members and Council's Customer Service). Respondents included residents with no specialist knowledge to horticulturalists and other industry professional with extensive knowledge in the field.

Methodology

Level of engagement

The engagement was in line with City of Darwin's Community Engagement Policy carried out at the level of ***Consult*** and was open for 2.5 weeks

Consultation Objectives

The goal of the consultation was to give community members and in particular industry experts an opportunity to comment on the work of the Tree Reestablishment Advisory Committee.

The objectives of this consultation were:

- Communicate the benefits of TRAC and this approach by Council
- Be transparent about the draft recommendations
- Listen to stakeholders and community and gather their feedback on the cyclone resilience of tree species found in the Darwin.
- Keep the community informed of the work of Council and the Committee in the Cyclone Marcus Recovery stage.
- To be able to consider this feedback to inform the final report to Council

Approach

The Tree Reestablishment Advisory Committee is in itself part of the Community Engagement process as this committee is made up of Council Alderman, staff, industry experts and knowledgeable community members.

The Tree Reestablishment Advisory Committee:

- Dr Greg Leach (Chairperson)
- Ms Yvette Brady - Greening Australia
- Ms Fiona Eddlestone - Australian Institute Landscape Architects
- Mr Richard Kenyon - NT Arboriculture Association
- Mr Simon Smith - Nursery and Garden Industry NT
- Mr Jamie Lewis - City of Darwin (Technical Officer)
- Mr Tony Cox - Community Member
- Mr Adam Grainger - Community Member
- Alderman Peter Pangquee – City of Darwin

There was a long list of species, over 200. Although this consultation was promoted to the broader community, the subject was quite specialised and specifically targeted at those in the community with an interest in trees and plants.

Key Stakeholders:

- Industry and expert contacts through the Committee
- NTG representatives including DIPL, Parks
- NTG MLAs from all Darwin electorates
- City of Darwin Elected Members
- City of Darwin staff
- General community

Tools and Tactics

Communication materials

- Fact sheet (Appendix 6)
- Draft list of tree species categorised for cyclone resilience (Appendix 6)
- Media release
- Cyclone Marcus photographs to be used across media platforms
- Select tree species photographs to be used on Engage Darwin page
- Survey through Engage Darwin

Communication methods

Communication methods included:

- Website - Engage Darwin (with downloadable fact sheets, tree lists, photos of species and a survey)
- Media event was held at George Brown Botanic Gardens
- Emails sent to all key stakeholders listed above
- Facebook – post on day of media event directing people to website
- Media promotion including media release & media briefings

- Promotion and discussion by Elected Members
- Printed Fact Sheets and Tree Lists at Council venues including Civic Centre customer service and libraries
- NT News One Page Advertorial
- Printed Fact Sheets distributed by Committee including at Bunnings and various nurseries

Media

A media event was held on Friday 28 September and a media release was sent out immediately afterwards

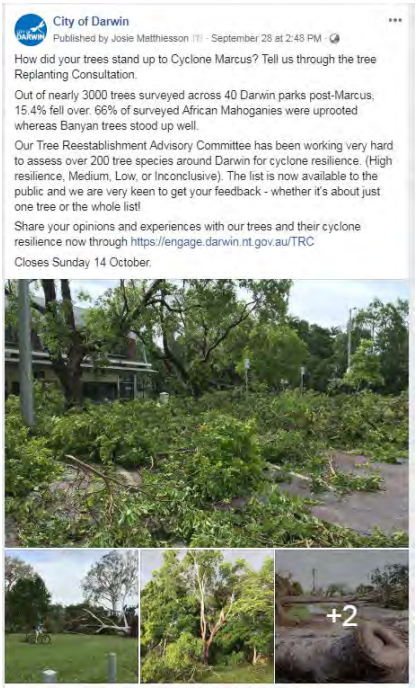
The consultation was included in the media briefings which resulted in coverage on tv, radio and print including:

- Nine Darwin TV news Friday 28 September – short news story - Ch9 tree consult story 28 sept 2018.mp4 (video available on request)

- ABC Radio Darwin – 4.01pm Friday 28 September I/V with Dr Greg Leach available on podcast http://www.abc.net.au/radio/darwin/programs/drive/drive/10293580 at 1.01.30
- ABC Radio Darwin – Sat 29 September Gardening show – I/v with Yvette Brady (available on podcast)http://www.abc.net.au/radio/darwin/programs/saturdaymorning/saturday-morning/10294964 at 48.20)
- NT News – Article, Saturday 29 September

Facebook

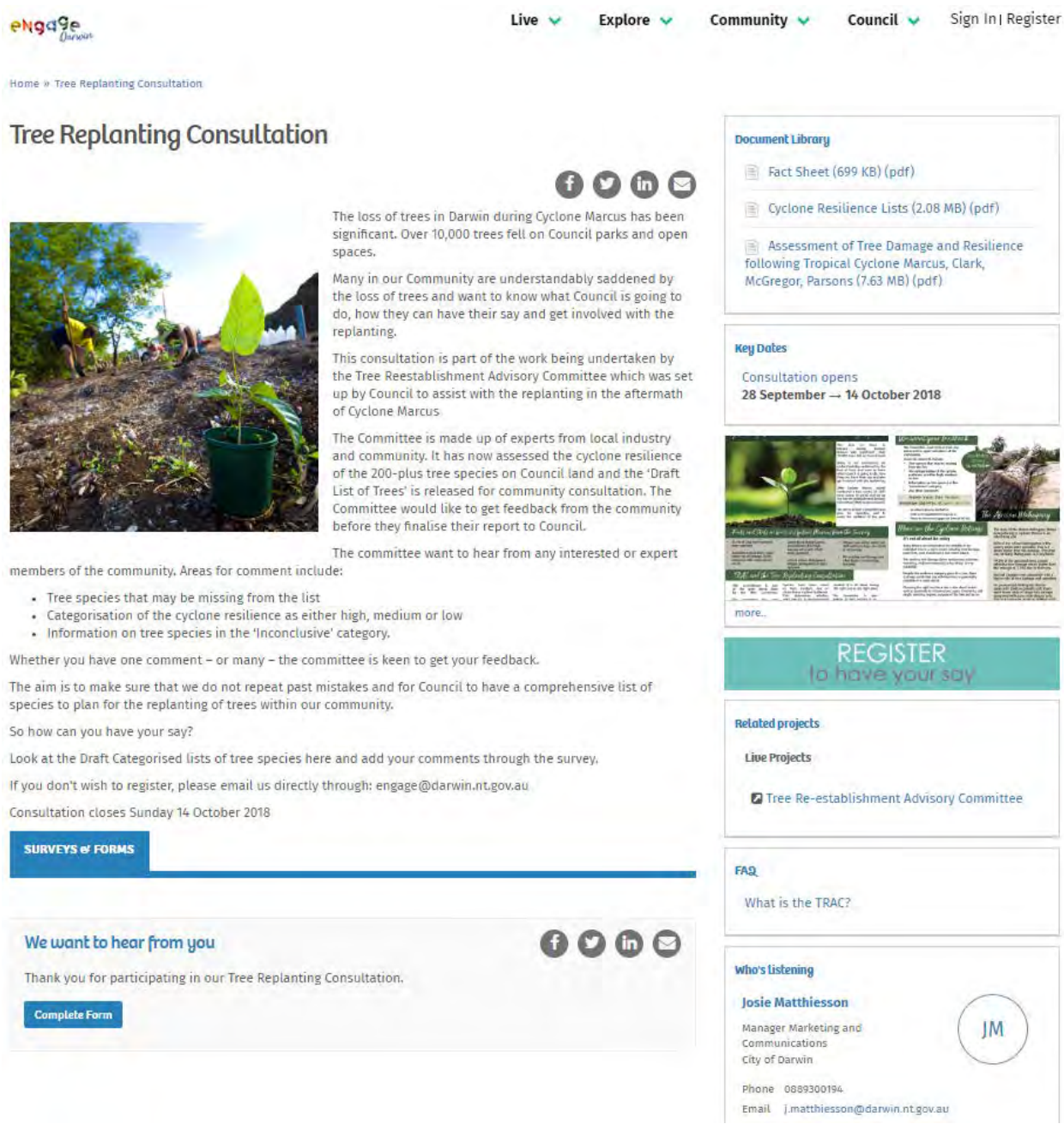
City of Darwin Facebook post reached 13K people with 335 engagements, with 57 shares and 58 comments. This is strong reach and engagement. The Original Post is here. The comments are included in Appendix 3.

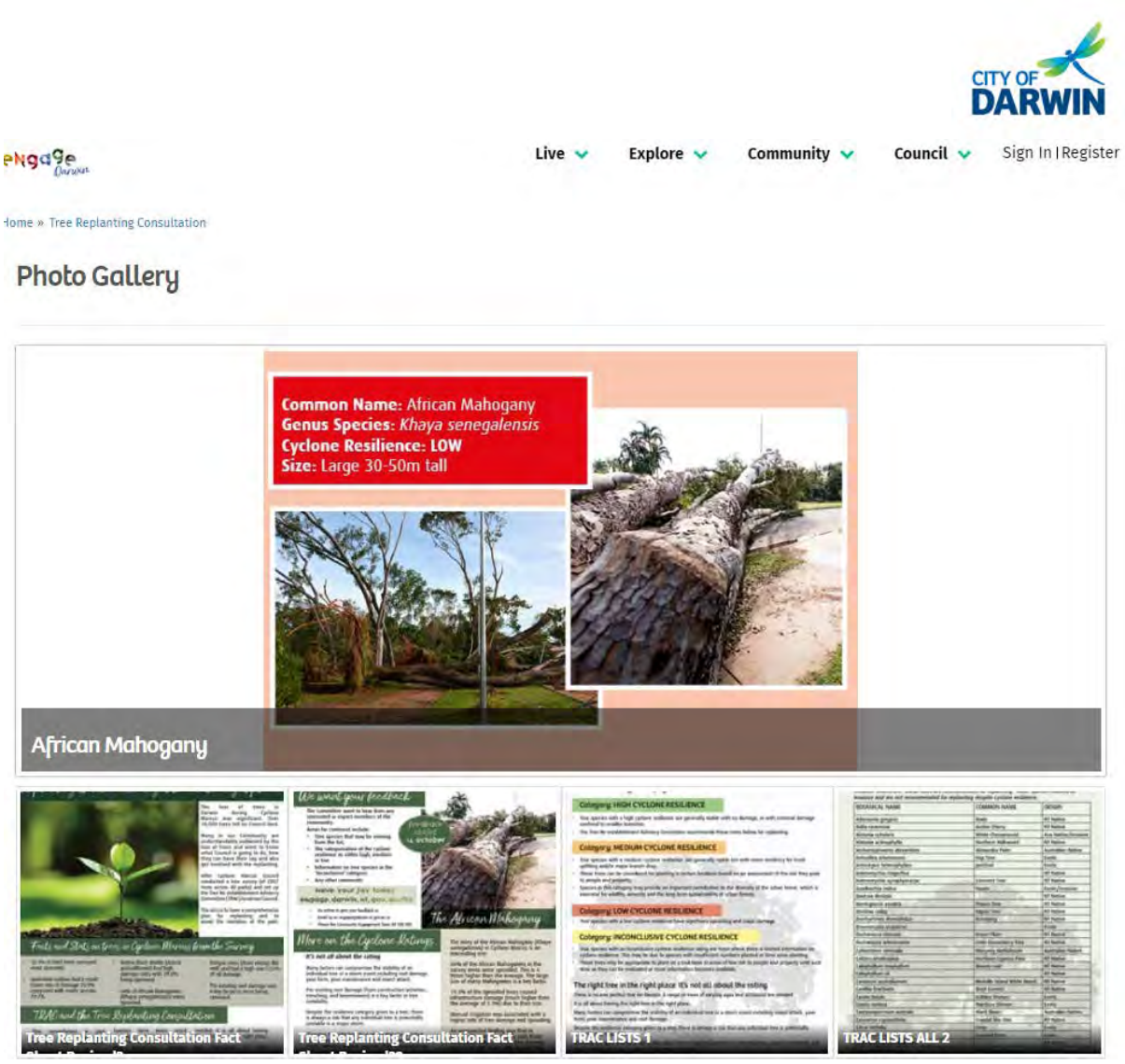


Website – Engage Darwin

There were 589 visits to the Tree Replanting Consultation page.
306 visitors were rated as 'informed participants' with documents downloaded a total of 235 times.

23 people completed the survey (97 opened the survey)





Findings

Feedback was provided through:

- 23 x Survey submissions
- 7 x Written/Other submissions
- Approx 50 x Facebook comments

Over half the responses across all the platforms referred to cyclone resilience of specific species. A considerable amount of feedback was on broader issues such as other benefits and pitfalls of particular species, best practice for planting and so on.

Key themes around species and replanting have been summarised below. (Full detail is in the appendix.)

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Key Themes – Species

Respondents disagreed with draft categorisation of the following species

Several comments on Black Wattles and Rain Trees:

- Acacia auriculiformis (Black Wattle) LOW- mixed response, some believe that it should still be planted under certain conditions.
- Albizia saman (Raintree) MEDIUM - Some consider this to be more resilient and good for replanting
- Corymbia bella and Eucalyptus alba

Other species mentioned:

- Acacia dunnii (Elephant Ear)
- Adenanthera pavonina (Red Bead Tree)
- Artocarpus heterophyllus - Jackfruit
- Carpentaria acuminata
- Cassia fistula
- Corymbia bella/papuana/Eucalyptus alba
- Damson Plum
- Eucalyptus/Corymbia
- Ficus benjamina
- Grevillea pteridifolia
- Leptospermum madidum
- Mangifera indica
- Millettia pinnata - Indian Beech
- Morinda citrifolia
- Peltophorum pterocarpum - Yellow Flame Tree
- Schefflera actinophylla
- Terminalia microcarpa syn. sericocarpa
- Azadirachta indica

Comments on species in Inconclusive Lists

Several comments on

- Albizia saman – Raintree
- Delonix regia - Poincianas

Other species commented on:

- Corymbia jacobsiana
- Corymbia bleeseri
- Cyclophyllum schultzii
- Diospyros maritima
- Eucalyptus oligantha and E. phoenicea
- Melicope elleryana
- Miliusa brahei
- Syzygium jambos - Rose Apple
- Syzygium minutuliflorum –

- Terminalia arostrata –

Species to consider adding to Lists

- Alstonia actinophylla - performed well in Cyclone Tracy
- Anitdesma ghaesembilla
- Brownea species
- Cassia species
- Cordia subcordata
- Cyclophyllum schultzii
- Fragraea racemosa
- Gardenia fucata
- Grevillea decurrens
- Helicia australasica
- Micromelum minutum
- Pandanus basedowii
- Pandanus spiralis
- Saraca species
- Vitex glabrata

General Comments on Species that failed in Marcus included:

- Eucalypts
- Khaya senegalenis - Mahogany
- Mangifera indica - Mango
- Delonix regia – Poinciana

General Comments on Species that stood up well in Marcus included:

- Alstonia actinophylla
- Beauty leaf
- Frangipani
- Lilly Pilly Syzygium smithii
- Mangifera indica - Mango
- Murraya Mock Orange
- Poinciana
- Tamarind
- Milkwood
- Burdekin plum

Some General Comments around Cyclone Resilience Ratings included:

- Requests for more information on the reasons for the categorisations
- Questioning that any Invasive species be included on these lists.
- Questioning the inclusion of shrubs in the lists at all.

Species Suggested for replanting

- By far the most common request was for Natives - more natives, less exotics
- Many requests for more fruit trees - including mangos

Other species suggested for replanting (with less requests):

- Banyan
- Maranthes
- Allosyncarpias
- Syzygium
- Beauty Leaf
- Boab
- Pittosporum moluccanum/P. ferrugineum
- Celtis phillippensis
- Cordia subcordata
- Erythina vespertilio/variegata
- Fragrea Racemsa
- Frangipani
- Ganophyllum falcatum
- Golden Cane
- Miliusa brahei
- Delonix regia - Poinciana
- Swamp Bloodwood

Key Themes – Replanting methods

Watering

- Watering regime appropriate for Darwin and the species i.e. trees that get watered often with little amounts can create shallow root systems.
- Natives plants that are only watered in drought will have stable lateral roots. All the trees knocked over in Marcus had balled root systems, this is from over watering.

Pollarding / Pruning

- Many of the unstable species can be made much more stable by regular pollarding.
- Select trees that can be lopped so they don't get overgrown and topple.

Foundation

- If trees don't have a good foundation then all species will be vulnerable to falling in our cyclones. Make sure the holes are large and deep and trees are well watered through the dry season for the first 4 or 5 years.
- Drill holes 1m diameter 2m deep, line top meter with plastic ring, water in descending stages to the bottom as tree grows.
- Deep root them by bottomless barrel planting.
- It is highly likely the soils in Darwin's parks and some road verges may be excessively compacted due to so many trucks and machines passing over them following Marcus. Compacted soils make it much harder for young trees roots to grow properly and water tends to runoff rather than seep down.

Maintenance

- Consideration should be given to staggered planting of trees. This allows for the continual removal of trees when they get to a size where they are considered a cyclone hazard and not leave large areas without shade. This means you can possibly plant less than ideal species that grow quickly.
- There should be structured, sustained maintenance regimes and sustained investment in, ownership of, and education relating to the importance and function of our Urban Forest.

High density planting

- Research whether planting new trees more densely might help reduce their failure rate with the next cyclone, there's less major tree damage in the monsoon vine forests than the urban parks and gardens.

Qualified horticulturalists and best practice

- Qualified horticulturalists and experienced professionals should be planting and maintaining the trees to ensure successful outcomes.

Council Regulating

- Council needs to be firmer/more proactive when inappropriate trees are planted on verges, near power lines etc. A lot of the trees that fell along verges should not have been planted in the first place.
- Although not the council's direct concern, some thought might be given to what should be done to regulate tree plantings on private land. Perhaps a suggestion that nurseries might agree to provide informed advice to buyers.

Management of existing trees

- Could information be provided to public around the management of existing trees that are listed in the category of 'Low Cyclone Resilience' . All information provided only relates to 'replanting'. Will there be a program in place to replace or remove existing trees in this category if they are identified as a potential risk?

Tree Reestablishment Advisory Committee (TRAC)

Consultation Report Appendix

Prepared by: Community Engagement team

Appendix Content:

1. Survey Report from Engage Darwin - All Responses
2. Written and Other Submissions – All responses plus summary
3. Facebook post and all comments during consultation period
4. Spreadsheet compiling all the species identified and the relevant comments
5. TRAC responses to species identified through consultation
6. Consultation Fact Sheet and draft List

Image supplied by respondent showing a path in Yanyula Park, Anula Before and After Cyclone Marcus.

Survey Report

29 January 2018 - 14 October 2018

We want to hear from you

PROJECT: Tree Replanting Consultation

Engage Darwin

engagement hq
by Bang the Table

Q1 What is your interest in the tree replanting? (eg. Are you an arborist, scientist, gardener, interested community member, other?)

JW 9/28/2018 01:07 PM	Interested Community Member
JB 9/28/2018 01:18 PM	Interested community member, some experience with arborist and gardener contract management.
JKL 9/28/2018 01:46 PM	City of darwin staff / scientist
Squeezer78 9/28/2018 03:51 PM	Horticulturist/CoD staff/resident
Currang2 9/30/2018 09:00 AM	Home owner. Also, I am a practising structural engineer and have been involved in building design and certification in cyclonic areas and assessment of post-cyclone structural damage.
pt 10/01/2018 09:43 AM	Follow George Browns adage. Plant local indigenous trees including a multitude of food source and residential trees for local and migratory birds, animals and reptiles.
Horizon 10/01/2018 10:10 AM	Interested community member, keen gardener and owner occupier in Darwin
pj 10/01/2018 04:51 PM	Community member
glenys 10/01/2018 06:42 PM	Resident
ennero 10/01/2018 09:32 PM	interested community member
Rvdp 10/02/2018 09:09 AM	interested community member
Rach67 10/04/2018 08:44 AM	Gardener
Radhika 10/05/2018 01:33 PM	I care for the balance in environment and nature
FC 10/06/2018 08:28 PM	Gardener
AR 10/08/2018 12:09 PM	scientist (plant ecologist)
RK 10/08/2018 02:25 PM	Gardener

Ronnie 10/08/2018 07:34 PM	From a family of interested community members, gardeners, a scientist, and members of the rural garden club and native plant society - we are Territory born and love our Darwin - and we are cyclone Tracy survivors
Harlay 10/09/2018 02:08 PM	I am an interested community member as well as a keen gardener
TW 10/09/2018 03:04 PM	Master Horticulturist with a life-long interest in Top End vegetation with experience with what vegetation survived Cyclone Tracy and every major Cyclone since.
e_azul 10/10/2018 02:41 PM	Replace imported inapproproate tree species with local species (interested resident)
Paul 10/11/2018 11:00 PM	I am an ex-Darwinite now living in Murchison, WA. I was a co-author along with D. Cameron and S. Rance of a CSIRO report on Damage to and by trees during Cyclones Tracy and Max. Darwin City Council should have copies of this report on file.
GR 10/13/2018 08:05 PM	City of Darwin Anula Greenbelt Neighbour happily for ~ 30 years access to great tree lined straight long walking pathway stretching towards well maintained treed parks connecting neighbouring areas
MK 10/14/2018 11:50 AM	Gardener/interested community member and past owner of Top End Seeds. Also, my neighbour and I have submitted a request to replant trees that were blown over by Cyclone Marcus in Tong Luck Park.

Optional question (23 responses, 0 skipped)

Q2 Do you have any comments on the categorizations of the tree species? Please be specific in your response where possible.

JB 9/28/2018 01:18 PM	The Albizia Saman proved to be very resilient in Cyclone Marcus, perhaps is undersold in this chart.
JKL 9/28/2018 01:46 PM	Great to see so many species on the lists. More information on possible reasons for categorisation especially of the medium risk trees would be helpful for the community to make educated decisions when trying to plant habitat. For example Eucalyptus alba and Corymbia bella are beautiful trees and i would be happy to plant if its main risk was limb drop, as this species is known for this characteristic anyway but planted in the right location can be a key tall growing species in an area.
Currang2 9/30/2018 09:00 AM	Not specifically. However, I would like to see some mention of the tolerance of trees to pruning.
pt 10/01/2018 09:43 AM	Refer to answer one, local, indigenous, food source. Deep root them by bottomless barrel planting. Integrate tropical Flowering trees for all seasons. Introduce bougainvillea tree shapers and ensure regular pruning to keep tree shapes.
Horizon 10/01/2018 10:10 AM	I notice that the Jackfruit tree is categorised as highly resilient. We have a very mature jackfruit tree that was severely affected by Cyclone Marcus despite having withstood other cyclones. Our property backs onto Doctor's Gully. All that remains is about 3 metres of the main trunk and it does not appear to be rejuvenating just yet. We did note driving around Darwin after Cyclone Marcus of the apparent resilience of Frangipani trees - we only saw one that had been uprooted (mature tree on the verge in Nightcliff).
pj 10/01/2018 04:51 PM	I would love to see more edible varieties. Native edible, Nt lemons etc
glenys 10/01/2018 06:42 PM	Black wattle - one big tree brought down the entire back yard. Glad to see they are on the don't plant list
ennero 10/01/2018 09:32 PM	well thought out and researched categories
Radhika 10/05/2018 01:33 PM	Please avoid exotic trees. I believe they only bring aesthetic value but not necessarily hold good during a cyclone. Banyan trees are good as they have a strong system and support a lot of other life like birds, lizards, geckos, possums etc
AR 10/08/2018 12:09 PM	I was particularly curious that a number of shrubs have been listed in the different categories e.g. Jacksonia dilatata (under high) and Dodonaea

	playtptera (under low). Since these species don't grow very tall and would pose a low risk to infrastructure or safety, I thought it was strange that they should be categorised in terms of cyclone resilience rather than being prioritized for their amenity and wildlife habitat values
RK 10/08/2018 02:25 PM	Need more endemic species for wider variety.
Ronnie 10/08/2018 07:34 PM	"In summary and conclusion, a large exotic tree growing in an irrigated Darwin park in saturated deep massive earths with minimum management would have a high chance of being uprooted in a category 2 cyclone." A few myths challenged in this report.
Harlay 10/09/2018 02:08 PM	I would like to suggest that more Cassia species be included on the list of plants to grow. Also maybe Saracas and Browneas in feature settings.
TW 10/09/2018 03:04 PM	1. I would question putting any Eucalyptus/Corymbia into the High Resilience category as they are all prone to dropping branches and snapping in high winds. Even the urban-friendly stands of E. herbertiana were decimated on the top of McMillians Rd and many Eucalypt species were casualties in the Palmerston area. I would recommend that they sit better in the medium resilience category. 2. I would recommend removing all invasive trees and any reference to invasive or gazetted species from the lists. If they are environmental weeds they should not be mentioned, as to give credibility to those that wish to grow them. Cassia fistula is one of these not listed as invasive but should be. It has been known to be invasive in the Top End for over 30 years. Recent social media debate/backlash over Azadirachta indica - Neem being a WONS and illegal to grow in the NT, gave me further insight into the total ignorance and arrogance of some Gardeners/Growers to the ecological damage caused by these invasive species. These people will use Cyclone resilience to justify growing these species. 3. Spathodea campanulata - African Tulip is another noted invasive species that is prone to dieback and definitely not suitable for urban planting. 4. Artocarpus heterophyllus - Jackfruit, in my experience (commercial grower), does not have high resilience. They snap very easily in high winds. I would also not recommend this tree for urban planting as unattended fruit attracts vermin and bats and a good size fruit (10-15kg) has the potential to kill if it falls from the tree. 5. I would also question the medium rating of Damson Plum. My experience with Terminalia microcarpa syn. sericocarpa with its massive buttressing root system, is that it is quite stable in high winds and has quite a good root to canopy ratio. How many came down in Marcus and what was the determination of their demise? 5. The low resilience rating of Millettia pinnata - Indian Beech and Peltophorum pterocarpum - Yellow Flame Tree are probably not an accurate assessment as these native coastal trees, naturally occurring around permanent ground water, are adept at surviving regular coastal storms. I would postulate that the poor planting/culturing practices of median/sidewalk planting and no irrigation over Dry seasons has resulted in this poor rating. 6. Is the process using any other means, i.e. root to canopy ratio, other than anecdotal observance to categorise these species?

e_azul 10/10/2018 02:41 PM	I prefer trees that give food, as well as useful shade. They don't need to be extremely tall, either.
Paul 10/11/2018 11:00 PM	The species Alstonia actinophylla was the best performing tree during the high winds of Cyclone Tracy especially the ones along the Esplanade. Species of Khaya which did not blow over were in yards of owners who did not irrigate them or their lawns during the dry season. The only mango trees (Mangifera indica) which survived intact were ones which had been pollarded prior to Cyclone Tracy.
GR 10/13/2018 08:05 PM	Suggest: Fast and Slow Growing habits could be added column for each Green (good cyclone areas) so helps decide replanting choices? After all, isn't this why decision post Cyclone Tracy to mass plant fast grower African Mahogonies?
MK 10/14/2018 11:50 AM	I believe Acacia auriculiformis is a tree that should be planted, and that many that were blown over were old trees and well past their use by date. A. auriculiformis is quick growing and provides good shade, but it should be used as a "sacrifice tree". Plant them between the slower growing species and remove when the other trees need the space to grow.

Optional question (20 responses, 3 skipped)

Q3 Are there any species that should be added to the lists? and why?

JB 9/28/2018 01:18 PM	no
JKL 9/28/2018 01:46 PM	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
pt 10/01/2018 09:43 AM	See answers one and two
ennero 10/01/2018 09:32 PM	More palm species because they are extremely resilient
Radhika 10/05/2018 01:33 PM	Mango. Although it is a fruit tree, it is strong and can sustain cyclones.
FC 10/06/2018 08:28 PM	While not strictly a tree I'd like to see clumping bamboos on the favoured list, they are great wind breaks, good for erosion issues, self mulching and great screeners
RK 10/08/2018 02:25 PM	Erythina vespertilio/variegata (coral tree) a small endemic tree that adds colour Fragrea Racemsa because very fragrant Need more native perfumed trees that smell beautiful at night
Ronnie 10/08/2018 07:34 PM	I can offer no comment on what trees might be the most suitable as the survey has covered this issue extremely well. The recommendations are excellent and the panel of experts consulted, particularly Dr Ian Cowie make me feel that the selection of appropriate and resilient species and the planting of them to start beautifying and cooling down Darwin again is in good hands.
Harlay 10/09/2018 02:08 PM	I would like to suggest that more Cassia species be included on the list of plants to grow. Also maybe Saracas and Browneas in feature settings.
TW 10/09/2018 03:04 PM	A complete investigation of suitable species growing in the Pan-Tropic region should be undertaken and a list of preferred species compiled for future reference for the greening of Darwin. Interestingly, Singapore uses many of our Native Trees in their streetscape plantings. Is there a lesson here?

e_azul 10/10/2018 02:41 PM	Syzygium suborbiculare - A native species, so it's used to the seasons, climate and soil.
Paul 10/11/2018 11:00 PM	Compare your lists to the ones in the CSIRO report.
Marj King 10/14/2018 11:50 AM	Celtis phillippensis – Top End native, hardy, big shady trees, buttressed roots Pittosporum moluccanum/P. ferrugineum - Top End natives, smallish shade trees, ideal for nature strips.

Optional question (16 responses, 7 skipped)

Q4 Do you have any information regarding cyclone resilience of trees in the 'Inconclusive' list? For example, in the recent survey there were not enough Poincianas (Delonix regia) to provide conclusive cyclone resilience data.

Horizon 10/01/2018 10:10 AM	A couple of mature Poinciana trees in Doctor's Gully at the back of our property lost most of their branches except the main trunk. The trees are rejuvenating quickly.
glenys 10/01/2018 06:42 PM	We had a Delonix regia. With every wind gust it lifted out of the ground and slammed back again. Many branches snapped off. It was never watered
ennero 10/01/2018 09:32 PM	no
Radhika 10/05/2018 01:33 PM	Not knowledgeable in this area.
AR 10/08/2018 12:09 PM	The Poinciana at the Jingili Preschool/Kindy complex was unaffected by the cyclone (some small branches came off only).
RK 10/08/2018 02:25 PM	Trees that have the potential to be weeds should be avoided, such as poincianas
Harlay 10/09/2018 02:08 PM	I believe these trees would be most resilient to cyclones however recommend any tree that is placed on the list be thoroughly researched to ensure it is suitable for both our climate and growing environment.
TW 10/09/2018 03:04 PM	Like Albizia saman - Raintree, if pruned/shaped properly to supress height and encourage spread Delonix regia - Poincianas are quite resilient to Cyclonic events and sit well in medium category. Others on inconclusive list are not widely enough used in the landscape to be able to make informed comment. Saying that I had a pre-Tracy Syzygium jambos - Rose Apple
e_azul 10/10/2018 02:41 PM	No
Paul 10/11/2018 11:00 PM	Many of the unstable species can be made much more stable by regular pollarding such as is done in the towns of Port Hedland and Exmouth in Western Australia.
GR 10/13/2018 08:05 PM	nil
MK 10/14/2018 11:50 AM	Corymbia jacobsiana and Corymbia bleeseri - I believe these 2 species would have similar characteristics to the other bloodwoods. Cyclophyllum schultzii – small shrub, shouldn't be a problem Diospyros maritima - shouldn't

be a problem Eucalyptus oligantha and E. phoenicea - I believe these 2 species would have similar characteristics to the other eucalypts. Melicope elleryana - I think this is a fast-growing species and therefore maybe prone to losing limbs Miliusa brahei – lovely tree, shouldn't be a problem Syzygium minutuliflorum – this is a riverine species, if it doesn't get adequate water it's probably not suitable Terminalia arostrata – not sure how this goes in a humid climate.

Optional question (14 responses, 9 skipped)

Q5 Any additional comments or feedback.

JW 9/28/2018 01:07 PM	Could information be provided to public around the management of existing trees that are listed in the category of 'Low Cyclone Resilience' . All information provided only relates to 'replanting'. Will there be a program in place to replace or remove existing trees in this category if they are identified as a potential risk?
J B 9/28/2018 01:18 PM	Plant more Albizia Saman, they are by far the best looking tree and have a high resilience for fast growing trees due to their fine leaf canopy. Large shade tree to quickly replace African Mahogany. Also more beauty leaf.
JKL 9/28/2018 01:46 PM	As eluded to in the fact sheet presented I would like to see more information on the impact of tree age, health and planting medium of trees that led to these rankings how many trees needed to be impacted to define a ranking. Especially as it was mentioned as unexpected findings such as gravelly soils. Please highlight more that all trees pose some risk and no one tree is guaranteed to be completely resilient. Please limit the phrasing of bats as nuisance wildlife.
Squeezer78 9/28/2018 03:51 PM	Council needs to be firmer/more proactive when inappropriate trees are planted by residents on verges, near power lines etc. A lot of the trees that fell along verges/road sides/foot paths should not have been planted in the first place.
Currang2 9/30/2018 09:00 AM	There is a common misconception that soils become weaker when they are saturated. That is not quite correct. At a shallow depth below ground line all soils are permanently damp and generally saturated. During the wet season, the water table is generally at the ground line, particilarly in country with little vertical relief. In most soils the soil strength properties are independent of whether they are saturated or not. However, the presence of water and saturation of the ground can destabilise structures such as trees by creating bouyant conditions and halving the aparent density of the ground. The effect is most pronounced in sandy and rocky soils. Clays tend not to notice a high groundwater level when subject to short to loading such as winds. I am not too surprised at the finding that trees in hallow soil on rock performed as well as in deep soils. From an engineering perspective, a structure is more stable under wind loads if a given soil and root mass is shallow and wide rather than narrow and deep. However, every failure case needs to be examined individually to discover the dominant factors. From a structural perspective, the presence of trees provides essential ground roughness that reduces the velocity of wind at adjacent structuures and provide physical shielding of buildings and therefore reduced wind pressures. Modern houses are now designed and constructed in a way that vitually eliminates the occurrence of pure wind pressure damage. Most if not all building damage (other than water damage) is now caused by incidental tree damage, for which buildings are not designed). A tree will be stable during a cyclone if the force on the wind area and moment from the lever arm does not exceed the stability of the tree base. Trimming the head of of a tree can convert the tree from a wind hazard

	to usefull shield, and that is a truism applicable to all tree types. Branch breakage is also a threat to buildings, and can me managed similarly. Some trees cannot be readilly trimmed without killing them or ruining their appearance. It would be great to get practical advice about that.
pt 10/01/2018 09:43 AM	We need tropical flowers and greenery. Marcus might have blown over 10,000 but the NTG in Darwin and around the suburbs has destroyed about 100,000 more and this will have a HUGE impact on Darwin and our climate. New trees will take 20 years or more to replace what we had. There are some great nurseries around Darwin and Joseph Perner down in Katherine, my suggestion is to use them all and take their advice and suggestions maybe through a special consultative consortium. Maybe also look for trees that can be kept lopped so they do not get overgrown and topple.
pj 10/01/2018 04:51 PM	More community gardens
glenys 10/01/2018 06:42 PM	Cuban royals developed a big lean post cyclone and were removed
ennero 10/01/2018 09:32 PM	We were very fortunate to have no damage on our property during the cyclone as we only have palm trees and palm shrubs. We also have a bush apple tree on our nature strip, thanks Darwin council.
Rvdp 10/02/2018 09:09 AM	Am really disappointed in council referring to bats as "nuisance wildlife". Firstly, no wildlife is a nuisance. Secondly, to single out bats is particularly bad as many members of the public already have (mainly negative) misconceptions about bats.
Rach67 10/04/2018 08:44 AM	Can DCC or NTG apply for funding to utilise recycled sewage water to green Darwin. It's shocking that this resource is sent out to sea while Darwin looks like a dust bowl
Radhika 10/05/2018 01:33 PM	The trees that withstood cyclone Marcus - some of them have branches are deformed and are growing over the driveway and roofs posing a hazard. These branches need to be trimmed back.
RK 10/08/2018 02:25 PM	I support endemic species but would like to see more species included in lists. I support suburban parks having some fruit trees such as thornless lime and mandarin trees
Ronnie 10/08/2018 07:34 PM	Although not the council's direct concern, some thought might be given to what should be done to regulate? tree plantings on private land. Perhaps a suggestion that nurseries might agree to provide informed advice to buyers.
Harlay 10/09/2018 02:08 PM	Darwin desperately needs more trees.
TW 10/09/2018 03:04 PM	Although we definitely have inappropriate species in our Urban Landscape i.e. Khaya senegalensis - African Mahogany and Acacia auriculiformis - Darwin Black Wattle our major issue moving forward is not just selecting appropriate species. The Darwin Urban Forest into the future requires; 1. Informed design and species selection processes 2. Appropriate planting methods 3. Structured, sustained maintenance regimes 4. Qualified and experienced Professionals to maintain the botanical asset. 5. Sustained investment in, ownership of, and education relating to the importance and

	function of our Urban Forest. " The time is over, for just sticking trees in the ground and hoping for the best!" Have these following references been utilised? There was a report done post Tracy by a Forestry Officer whose details escape me (Stockton?) and I have lost my original copy. Should be in Archives though. Also; 'Tree damage in Darwin parks and gardens during cyclones Tracy and Max' Author links open overlay panelD.M.Cameron1S.J.Rance1P.J.Lukitsch2
e_azul 10/10/2018 02:41 PM	na
Paul 10/11/2018 11:00 PM	I was wondering if any part of your survey was carried out in the Darwin Botanic Garden. As George Brown was away on holiday during and after Cyclone Tracy, I was seconded by CSIRO to the Australian Navy crew to select which downed trees needed to be saved and which to cut up and haul away.
GR 10/13/2018 08:05 PM	I request replanting Anula Greenbelt pathways with nod to past felled line of African Mahogonies of Avenue of Promenade type uniform mixed or same tree species in repeated row. Tree lined promenade fulfils practical, aesthetic modern landscaped shade over pathway. Uniform neat Tree lined paths give suburbs distinct beauty, and can become visitor / resident attractions at flowering time which could be webcam picture yearly onto Council's website.
MK 10/14/2018 11:50 AM	I would like to commend the people who have put the report together in such a short time. Well done. I think a long term view of tree planting should be considered where there is staggered planting of trees and this then allows for the continual removal of trees when they get to a size where they are considered a cyclone hazard and not leave large areas without shade. This means you can possibly plant less than ideal species that grow quickly. I realise this would be an expensive proposition but would probably cost less than a cyclone clean-up.

Optional question (20 responses, 3 skipped)

Tree Replanting Consultation - Written Submissions

Themes

- High density planting; to help reduce failure rate in cyclones and to create shading, cooling, greening and revitalising our city
- Focus on 'how' the trees are planted and maintained; Australian best practices, watering regime to suit Darwin and tree species, qualified horticulturalists, realistic time frame for maintenance and maturity, consider soil density issues, consider climate change implications
- Recommended trees;
    - Boab Tree
    - Swamp Bloodwood
    - Golden Cane
    - Cordia subcordata
    - Ganophyllum falcatum
    - Miliusa brahei
- Reconsider the identified cyclone resilience category for the following trees;
    - Move up a level
        - Acacia auriculiformis
        - Acacia dunnii
        - Adenanthera pavonina
        - Ficus benjamina
        - Grevillea pteridifolia
        - Mangifera indica
        - Peltophorum pterocarpum
        - Schefflera actinophylla
        - Carpentaria acuminata
        - Corymbia bella/papuana/Eucalyptus alba
        - Morinda citrifolia
    - Move down a level
        - Leptospermum madidum

FULL SUBMISSION	KEY POINTS
Submission #1 (HN) My name is xxxxxxxx, and I have some ideas that you might like to hear. As a keen gardener and someone who would like to see our city thriving with colourful shady canopies I have come up with a plan for our streets. For those of you who haven't read my post on social media, here below is what I came up with and posted. 1000 trees to be planted in our CBD streets I have some ideas that I think you might appreciate. You may have noticed my posts here and elsewhere over the years about greening our city. I think there are others out there who could contribute to these ideas and help make a plan of real action. Randal Ashford, Dan Brown, and others are just some local talent that have shown great initiative and results here in Darwin in their prospective fields. My idea is to get our Lord Mayor, Chief Minister, REINT, Urban planners, civil engineers, architects and Landscape professionals + more together to	• Create a task force to plant 1000 trees and revitalise our streets. A combination of street art, local feature street benches, landscape features, colourful awnings and tree planting. • Landscape theme for each city centre main street i.e. Cavenagh all Poinciana trees, Smith St all Frangipani trees. The smaller side and connecting streets would break up the single species canopies along the 6 main arteries. The side streets planted with NT Native cluster plants in a mix to promote biodiversity. • It needs to be mass tree planting, every 8m rather than 15-20m, with larger garden beds to create a corridor of cool and colourful canopies. We want our city to create what is seen in Singapore, Cairns, and all over the world. A city that is cool, green and full of vibrancy and life.

come up with a task force and re think how we go about one aspect of revitalising our city. I have emailed many of these departments but nothing works better than power of the people for a positive change I believe.

So far there are some very bold ideas including water theme parks, 5 star hotels, museums , Cavanagh shade structures and many more. All are different and have there pros & cons but I think we're missing a vital opportunity here.

After Cyclone Marcus we now have some vital research findings to recommend plant species.

I feel that with all the ideas and projects in the pipeline we're missing a very important opportunity. Our city's main hub consists of 5-6 main streets which run the length of the CBD. These should have a landscape theme to run the entire street. Imagine if Cavanagh was entirely lined with poinciana trees in full red bloom, Beautiful shady canopies sprawling our sidewalk and road surfaces, and Smith street with our iconic Frangipani in white scented flowers, the temps and overall feel would be amazing. And our Mitchell st with medium shade trees that blocked out the heat and had night lights all along it? Wow.

I know there are issues some will have with leafs , or that our underground services need taking into account but surely we have a choice? We continue with what we have? Searing hot roads, stark run down buildings, and struggle street trees offering almost no visual appeal and no shade. In order to achieve this we need mass tree planting, and not every 15 -20 metres. We need them bunched together every 8m with larger garden beds to create a corridor of cool and colourful canopies inviting us all to come out, and walk the city streets again.

If we as the Nations Northern Territory City want people to visit, stay and play and for locals to enjoy then we need to get together and make this a priority project. It needs to be a combination of ideas including the street art, local feature street benches, colourful awnings and to help with this the backing of public and private investment and for our government to make the task force.

Darwin City GREEN TEAM

My vision includes the smaller side and connecting streets to break up the single species canopies along or 6 main arteries. We plant these side streets with NT natives cluster planted and in a mix to promote bio diversity. And to have some well thought out landscape features including man made large anthills, Litchfield boulders, dry creek beds that fill and drain in the wet giving locals and tourists an amazing stormy experience we as locals all played in as kids (and for some still as adults)

We might even elevate local artist made dragon flies suspended in air over intersections or replica old war planes which once lined our hangers.

If we planned now, planted in November and made this happen, the trees would have an immediate affect on our city's vibe and visual appeal.

3-5 years and it would transform Darwin's city with green majestic feature trees as far as you could see.

Please, if anyone is able to assist, share, and tag so we can help get our leaders together and talk about the idea of mass planting our CBD. 1000 trees should be the goal! 🌸

Regards

xxxxxxxxxx

Since posting this I have had contact with Mayor Kon V, Luke Gosling and Quentin Kilian at REINT.

I have a lot of ideas and know how when it comes to creating beautiful spaces but desperately need our local government, council and city planners to come together with yourselves as professionals of your certain fields. It appears what we need are some concept drawings made to present to our leaders. But with no funding and no Support officially as yet this needs to be a purely community driven project, so I am hoping some of you out there are able to assist in getting these ideas onto a concept drawing both as an over all project with all main streets in colour, / side streets in green & landmark sections of Mitchell street, the esplanade and Smith street / Knuckey intersection perhaps as an option.

Specific landscape inclusions in high traffic areas or suitable areas could include,

1. Park benches under canopies on sidewalks 2. Large artist made anthills integrated in native lined side streets 3. Dry creek beds in natural stone that create shallow drains 4. Suspended artist made dragon flies & war planes over intersections or the mall.

5. Transportable planter boxes filled with flowers and feature trees that can fill in areas that can't be planted out. 6. Tree frogs, brolgas, jabirus, frilled neck lizards and other species that are common to Darwin and the Top End. 7. More street art on buildings. 8. Garden beds not concrete boxes for the tree planting. This is by far the leading cause for our tree growth failure. Large garden beds with shrubs and flowers will allow for real reticulation maintenance, rain penetration and overall visual appeal. It is these very garden beds that we can line the park benches with. 9. Mass tree planting. In order to achieve canopy's of shade, cool and colour they need to be spaced far closer. I propose 8m and to achieve this make use of the existing side walk, current tree beds (to be enlarged), in between parking bays (with narrow strips to maximise spaces for cars) and median strips. 10. A mixture of large / medium , wide and narrow trees to integrate with existing infrastructure and buildings if needed. Imagine our streets telling a story about our Top End frontier through visual Art, trees and green spaces. The people will want to come, stay and play. They will choose to be outside on our street benches which will be lined along these canopy filled outdoor spaces. This is where the heart of our Territory lies, not inside their office spaces sitting at their desks re heating last nights dinner to avoid going outside in the searing heat. If we truly want this city to come alive, surely we need to bring the life? The second half of my plan includes the maintenance schedule and how we will actually go about maintaining such a big project. This is almost as important because what we currently have in Darwin City is the lack of understanding on how the maintain and create a green space. Part of this plan is a designated Darwin City Green Team with a purpose designed truck that can water, fertilise, maintain and support the mass tree plantings. This can also help to engage the community by seeing the team in high vis GREEN TEAM logo shirts, truck and even watering cans handed to local cafes, restaurants and shopfront owners. I have a lot more I can add to this but for now let's focus on the concept drawings, and your ideas you might have to include. The people are tired of the same old approach to planting a unsuitable species of tree, not maintaining it, and 10 years on its either dead or provides no real shade or visual appeal. We want our city to create what is seen in Singapore, Cairns, and all over the world. A city that is cool, green and full of vibrancy and life. If you have contacts or friends who you think might have something to offer here, please forward them or cc them.	
Submission #2 (HM) It concerns me greatly the way in which not so much 'which tree species ' are planted in Darwin however 'How' the species is planted . Taking a step back when mahoganies were planted in Darwin after cyclone Tracy they came with a 'how to plant ' instruction information paper . An example of the 'test of time ' . Is those that were planted following this methods . So as they have self seeded and automated watering system installed combined with our climatic and soil conditions we have created a monster with a bad reputation . Remembering all trees have a life span like people some live longer than others depending how they are cared for and maintained over their life . There is no plant that is no maintenance . We know more now than let's say 40 years ago about tree planting. This should not be ignored. If we plant tree species with Australian best practices in mind with a watering regime that is adjusted to suit Darwin and have a realistic time frame for	• The focus should be more on 'how' the trees are planted rather than 'which tree is planted' • Plant trees in line with Australian best practices, a watering regime to suit Darwin and have a realistic time frame for maintenance and maturity we would see a much needed sustainable green space Darwin evolving. • Unless we have qualified horticulturalists planting in Darwin you will continue to see episodes where trees have to be removed due to the way in which they were planted. • Water systems need to be appropriate for the species being used, not all species require the same water amount. Often trees in parks get watered from lawn or turf irrigation which is shallow, little and often, creating shallow root systems for the trees as they never have to go down looking for water. No anchoring system so to speak, which is why with Cyclone Marcus parks got hit hard, while water logged soils with little structure gave

maintenance and maturity we would see a much needed sustainable green space Darwin evolving . We have in Darwin two good wholesale Nurseries growing plants suitable for the top end , that have decades of knowledge regarding plant species their growth habit and of coarse availability, using their advice would be cost effective . I have owned a nursery in another state so understand how nurseries operate and grow for a demand . I am currently a landscape consultant . My landscape projects both residential and commercial Hastings on Mindle stage one Arafura Park Ross Smith ave Tindal base removal of mahoganies and tree replacement Katherine . have proved to be sustainable requiring little maintenance due to fact best practices are followed closely . I can only see unless we have qualified horticultural people planting species in darwin you will continue to see episodes like Salonika street where the trees had to be removed due to ...not the perfectly suitable species that was chosen but the way in which they were planted . Speaking from experience Just recently council contracted a company to plant on my nature strip a species that would be number1 preferable council species however so poorly planted leaning towards my front boundary that it will need to be removed yet in the ground less than a year . In conclusion the choice of tree species is largely irrelevant it's more to do with the initial planting and irrigation methodology and the on going care that should be of concern. Of course using top end natives may be beneficial in some aspects but still needing maintenance. Water systems need to be appropriate for the species being used , not all species require the same water amount . Often trees in parks get watered from lawn or turf irrigation which is shallow little and often , creating shallow root systems for the trees as they never have to go down looking for water . No anchoring system so to speak . Which is why with cyclone Marcus parks got hit hard, while water logged soils with little structure gave way. Perhaps the question should be 'how to plant trees correctly in Darwin to create shade yet be sustainable'. I look forward to your response and hope I can be of some assistance.	way. • In conclusion the choice of tree species is largely irrelevant it's more to do with the initial planting and irrigation methodology and the ongoing care that should be of concern. Of course using top end natives may be beneficial in some aspects but still needing maintenance.
Submission #3 (JF) Top 3 recommendations for trees: Boab Tree Swamp Bloodwood Golden Cane	Top 3 recommendations for trees: • Boab Tree • Swamp Bloodwood • Golden Cane
Submission #4 (MM) I would like to suggest a few native trees for council plantings: 1) *Cordia subcordata* – this is a coastal monsoon vine forest tree – the red tail black cockatoos love it. I have one in my front yard and at the moment while it is in fruit the cockatoos visit it every day. It would be great to have more of them along the foreshore and parks. 2) *Ganophyllum falcatum* – medium sized shade tree – fast growing – the birds love the fruits. I have had them in my yard at 2 properties for over 20 years and they are hardy and pretty. 3) *Miliusa brahei* – common tree in Casuarina Coastal Reserve – has self-seeded in my yard and has been a wonderful medium sized shapely bird	Recommended for planting: • Cordia subcordata • Ganophyllum falcatum • Miliusa brahei

attracting tree. Appears to tolerate not much water.

Submission #5 (GL)

Although it is awesome that serious consideration is being done before replanting takes place and that consultation is included, I do have some recommendedalterations.

Red Trees => Orange Trees

Firstly, some of those that are in your draft Category: LOW CYCLONE RESILIENCE but I recommend could be reconsidered to be moved up a level.

Acacia auriculiformis

The Black Wattle, is an easy to propagate fast growing tree that provides screening, shade, wind breaking and habitat quickly. If cut before they are become old and more hazardous, they can be very effective pioneer species and will provide a cheap and quick greening of our parks whilst helping slower trees establish.

Acacia dunnii

The Elephant Ear Wattle, grows fast and has spectacular flowers. It can quickly provide screening, shade, wind breaking and habitat. They are mostly short and bushy, but if cut before they are become tall and more hazardous, they can be very effective pioneer species and will provide a pretty and quick greening of our parks whilst helping slower trees establish.

I have a 4 metre *Acacia dunnii* on my nature strip and it barely noticed Marcus, not 10 metres from where a massive african mahogany fell.

Adenanthera pavonina

The Red Bead Tree is a nitrogen-fixing pioneer species that has been recommended to be planted in a cyclone impacted area as a fast growing windbreak tree. The tree is easy to propagate, fast-growing, with an attractive and shady spreading canopy. The several healthy ones I know survived Marcus, and the assessment report states there was only one specimen in thestudy.

Ficus benjamina

The weeping fig is, like the banyan, an important tree for diversity of form, and it doesn't tend to become too large when subject to the drought of the Dry every year. The several that I know of survived Marcus unscathed. Indeed this Cairns report places this tree in the "moderately resistant species" category for cyclone planting.

Grevillea pteridifolia

Fern-Leaved Grevilleas are small trees and as such could not be the danger that large trees can be. Unless they are watered as they would be in a swamp, they would not be expected to grow large anyway. They are iconic calendar plants and besides their beauty are important to feed nectar and seed eating wildlife. My neighbour had a large tree uprooted but their *Grevillea pteridifolia* a few metres away was unscathed by Marcus.

Mangifera indica

Our mango trees survived Marcus unscathed as did many others and they are a beloved and iconic

old-Darwin species. Indeed this Cairns report places this tree in the "moderately resistant species" category for cyclone planting.

Peltophorum pterocarpum

The yellow flame tree is still a common tree around Darwin, with many healthy specimens still to be seen after Marcus - along Bagot Road and around Darwin High school for instance. It is widely appreciated for providing excellent shade and is used in shelterbelts because it is wind firm. As a fast growing tree it can be used as a pioneer species and also fixes nitrogen which can then become available to neighbouring trees. These trees

Trees listed in 'Low Cyclone Resilience' category but I recommend to be reconsidered to be moved up a level:

- Acacia auriculiformis
- Acacia dunnii
- Adenanthera pavonina
- Ficus benjamina
- Grevillea pteridifolia
- Mangifera indica
- Peltophorum pterocarpum
- Schefflera actinophylla

Trees listed in Category 'Medium Cyclone Resilience' but I recommend could be reconsidered to be moved up alevel.

- Carpentaria acuminata
- Corymbia bella/papuana/Eucalyptus alba
- Morinda citrifolia

Tree in the category 'High Cyclone Resilience' but I recommend could be reconsidered to be moved down alevel.

- Leptospermum madidum

Soil Compaction is an Issue

- It is highly likely the soils in Darwin's parks and some road verges may be excessively compacted due to so many tracks and machines passing over them following Marcus
- Compacted soils make it much harder for young trees roots to grow properly and water tends to runoff rather than seep down

Planting intensity may also be worth considering

- It may be worth researching whether planting the new trees more densely might help reduce their failure rate with the next big blow.
- Following Cyclone Tracey, there was less major tree damage in the monsoon vine forests than the urban parks and gardens. There is evidence in this thesis to suggest that well-planned and well-managed urban tree cover can play important protective roles ameliorating microclimate, sequestering carbon and mitigating cyclone impacts.

Cross referencing with Climate Change Expectations

- It might be worth researching which of our fast-growing, cyclone resilient

provide both habitat and food for our wildlife whilst providing a showy abundance of yellow flowers to bring in the Buildup.

Schefflera actinophylla

The umbrella tree might also not be deserving of being cut out of new plantings in Darwin, indeed in this report following Queensland's Cyclone Larry, found this trees leaves were blown off however "stems are very flexible". And in this report it is included in the category "moderately resistant species" for post-cyclone planting, even though they reported it lost some branches. With its broad green umbrella-like leaves and spectacular flowers, it contributes to the diversity of flora in Darwin and it also feeds our wildlife.

Orange Trees => Green Trees

Secondly, some of those that are in your draft Category: MEDIUM CYCLONE RESILIENCE but I recommend could be reconsidered to be moved up a level.

Carpentaria acuminata

Really? This Queensland report finds Carpies "wind resistant" to cyclones. The post-Marcus assessment report found only 5.6% of 71 Carpentaria palms studied were damaged. Only 4.2% had major damage though there was no uprooting. No irrigation was associated with a higher rate of damage to Carpies, but it cant have been that serious as so few were damaged. Carpies are iconic Darwin palms and are the favoured food of the gorgeous Torres Strait Pigeons.

Corymbia bella/papuana/Eucalyptus alba

In Darwin, there are loads of ghost gums still standing happily after Marcus and they are so beautiful. The assessment report, found that of 65 *Corymbia bella* trees sampled, only 1.5% were uprooted: clearly not enough to stop them from being planted across Darwin.

Morinda citrifolia

The rotten cheesefruit tree is tough as nails and can be seen growing green with fruit on Fannie Bays' beach in the Dry! Indeed in this Yasi report, this plant was included in a list of trees that showed "consistently low rates of cyclone damage" with 0% reported for this species. The assessment of the Darwin parks reportedly encountered this species only once. In Darwin this tree is usually more of a bush and so couldn't be considered a harmful tree. It has international attention as it grows noni fruit which have been found to have medicinal properties.

Green Trees => Orange Trees

Thirdly, some of those that are in your draft Category: HIGH CYCLONE RESILIENCE but I recommend could be reconsidered to be moved down a level.

Leptospermum madidum

The weeping tea-tree has many trunks and isn't tall so is considered a safe cyclone tree. However, as it's favoured habitat is along watercourses and in sandstone gullies, it may not be so safe when not well watered. We experienced our beautiful large many trunked tea-tree become uprooted by Marcus and damaged the awning and the clothesline. It is possible we hadn't watered it sufficiently the previous Dry.

Soil Compaction is an Issue

Unfortunately, it is highly likely the soils in Darwin's parks and some road verges may be excessively compacted due to so many tracks and machines passing over them following Marcus. Besides the mulchers and cherrypickers, there were huge watering lorries, trenchers and of course the usual mowers and general council trucks and cars parking in the parks regularly for many weeks and months following the cyclone. They treated the parks as space and not as an area where there were small animals like worms and beetles as well as pores in the soil waiting for when the trees to be planted would need water and air. Compacted soils make it much harder for young trees roots to grow properly and water tends to runoff rather than seep down. If we are to prevent massive tree loss next time a big blow comes to Darwin, we must stop treating our soils so poorly!

There needs to be a comprehensive reexamination into vehicular activities in parks - I would suggest allowing massive water-tankers to drive on

native shady trees are also most likely to cope with the horrid heat we are rapidly working towards due to climate change. The devastatingly red list on page 37 of this report is a start.

- If we are to plan for a shadier and cooler Darwin, we MUST desist with fossil fuels and ban gas for export in the NT.

park soils to be more detrimental than acceptable. All vehicles obtained for using within the parks should be assessed for both need and lightness. When contractors check parks for rubbish and fallen branches, or blow the sand clean, it really isn't too hard to walk to the road or have a path the truck always adheres to. And on no occasions should it be acceptable for workers to park their vehicles in the park, whether they be working there or finding a quiet spot for a break. What is required is clear comprehensive instructions for all workers in parks to avoid compacting the soils. **Planting intensity may also be worth considering** Another aspect that may be worth researching is whether planting the new trees more densely might help reduce their failure rate with the next big blow. This can be done successively to reduce workload and plant costs. An example is the forest in the main park of Tiwi on Tiwi Gardens Road which has good biodiversity and was shady almost everywhere most months of the year. Each tree has its own few metres. There were some old mahoganies that fell from Marcus, but it isn't wasteland now and hopefully the sunny gaps will be replanted. In contrast there were nearly no trees down in the managed strip between Rocklands Drive and the Casuarina monsoon vine forest. Those trees grow in clumps close together with mowed areas around them. Perhaps both methods can be used to test which is indeed best. Following Cyclone Tracey, there was less major tree damage in the monsoon vine forests than the urban parks and gardens. There is evidence in this thesis to suggest that well-planned and well-managed urban tree cover can play important protective roles ameliorating microclimate, sequestering carbon and mitigating cyclone impacts. **Cross referencing with Climate Change Expectations** Although it is still possible we can sprint to a reduced climate threat scenario, it is unfortunately likely that we continue to plod along increasing our climate pollutants as fast as we can, and the worse case scenarios become reality. In the latter option that could mean few of the current trees survive due to heat stress. Nevertheless it might be worth researching which of our fast-growing, cyclone resilient native shady trees are also most likely to cope with the horrid heat we are rapidly working towards. The devastatingly red list on page 37 of this report is a start. If we are to plan for a shadier and cooler Darwin, we MUST desist with fossil fuels and ban gas for export in the NT.	
Submission #6 (CL DIPL) Feedback received by DIPL regarding trees as part of the consultation on landscaping for Barneson Boulevard. General comments regarding trees • Choose trees that encourage and cater for native fauna and birds x 4 similar comments • Low maintenance trees (minimal water and tidying required) x 3 similar comments • Wide shade canopy like Garden's Road (Singapore) x 2 similar comments • No foreign trees x 2 similar comment • No palms as no tangible shade benefit • Don't plant shade trees and then not let the grow (by trimming or not watering) • Trees that don't lose leaves and have too disruptive roots • Replant existing beautiful old trees that need to be removed • Leave existing trees where they are and plant additional trees. Tree species: • Haliconias • Bougainvillea • Raintrees • No raintrees or flametrees • Mimisop elangi • Allosyncarpia ternate • Maranthes corymbosa	Feedback from Barneson Boulevard consultation regarding trees: • Encourage native fauna • Low maintenance • Shade (no palms due to low shade) • Don't lose leaves • No disruptive roots • No foreign trees Tree species for Barneson: • Haliconias • Bougainvillea • Raintrees • No raintrees or flametrees • Mimisop elangi • Allosyncarpia ternate • Maranthes corymbosa • Calophyllum sil • Mimusops elengi • Peltophorum pterocarpum - Yellow Flame Tree • Ganophyllum falcatum - Scaly Ash • Delonix regia – Poinciana • Maniltoa lenticellata - Silk Handkerchief Tree

• Calophyllum sil • Mimusops elengi • Peltophorum pterocarpum - Yellow Flame Tree • Ganophyllum falcatum - Scaly Ash • Delonix regia – Poinciana • Maniltoa lenticellata - Silk Handkerchief Tree • Grevillea dryandra / formosa / pteridifolia, Cochlospermum fraserii - Kapok Bush, Melastoma malabathricum - Native Lasiandra, Bossiaea bossiaeoides.	• Grevillea dryandra / formosa / pteridifolia, Cochlospermum fraserii - Kapok Bush, Melastoma malabathricum - Native Lasiandra, Bossiaea bossiaeoides.
Submission #7 I have lived in Darwin for most of my life and have spent much time working in horticulture and native bush regeneration and have a keen interest in the role of trees in the urban environment. I think Darwin has for too many years has not had sufficient tree cover in public spaces, and this has of course worsened after Cyclone Marcus. In the days after Marcus I drove around the city observing tree damage and which species proved vulnerable to wind damage and which ones proved resilient. I passed on these observations to council via email in the week after Marcus but never received a response or acknowledgement. My observations aligned closely with the report released by council and I support its conclusions about appropriate species to plant in Darwin, however I think that council is limiting the scope for trees by not considering the survival of trees in other cyclone affected areas, such as the impacts of Cyclone Althea on Townsville in 1971, and more recently the impacts of Yasi, as well as other systems to have hot populated areas of Queensland. I think the impacts of cyclones on the Townsville treescape is particularly relevant to Darwin, considering our mutual Wet/Dry climates as well as both cities sitting on impoverished and thin soils. What I would like to draw council's attention to firstly is the large numbers of banyan trees that survived STC Althea, species such as Ficus bengalensis faring very well with minimal damage with numerous individual trees that survived Althea, as well as more recent cyclones such as Yasi and Debbie. These trees, while large growing, make stable trees that are very suitable for planting in large public spaces and make imposing avenue trees, as well as thriving in beachfront areas with continual winds and salt sprays, and do not require water during the Dry. Townsville, and many other cities and towns in northern Queensland, make great use of banyans such as F. bengalensis, and their structural and architectural appearances has made many of them well known landmarks and give great character to an area. It is well known that the shade of a banyan is known for being very cool shade, and this is something that tropical cities require in abundance, and is sorely lacking in Darwin's urban environment. I would like to emphasise to the committee the value of planting banyans, both NT natives, Australian natives and exotic species, in council's efforts to replant trees in Darwin. I cannot state this strongly enough, we need more banyans and other shady trees to make our outdoor environments more liveable. The other point I wish to emphasise is that the way a tree is planted has a massive impact on its long term viability and wind tolerance. I have noticed many council plantings have been done in a very 'rushed' and ineffective manner. My observations have been that more often than not, trees are planted in holes dug too small and shallow, or are planted in top soil that has been overlaid on compacted (often by machinery) soils as a topdressing. This causes problems with the roots being able to penetrate deeply and instead become shallow and vulnerable to falling in high winds. I believe that council staff (and contractors) are sometimes too inexperienced or lacking knowledge in how to properly plant a trees is what has lead to the loss of so many trees in TC Marcus, and this can be avoided in future by appropriate training in how to dig a hole and plant a tree properly. Darwin has a lot of potential to be a beautiful, cool and shady tropical city, but this potential is not being achieved with the current approach to greening Darwin. I would like to suggest that council send some staff to Queensland cities such as Townsville, to meet with council staff there and see first hand how a dry tropical city such as Townsville (much drier than Darwin), can achieve a green and shady environment that is worthy of a tropical city, and to mirror ways of choosing and planting species that serves the long term interests of Darwin residents.	• Insufficient tree cover in Darwin • Comments on Ficus bengalensis faring very well with minimal damage • The way a tree is planted has a massive impact on its long term viability and wind tolerance

City of Darwin

Published by Josie Matthiesson · September 28 at 2:48 PM ·

How did your trees stand up to Cyclone Marcus? Tell us through the tree Replanting Consultation.

Out of nearly 3000 trees surveyed across 40 Darwin parks post-Marcus, 15.4% fell over. 66% of surveyed African Mahoganies were uprooted whereas Banyan trees stood up well.

Our Tree Reestablishment Advisory Committee has been working very hard to assess over 200 tree species around Darwin for cyclone resilience. (High resilience, Medium, Low, or Inconclusive). The list is now available to the public and we are very keen to get your feedback - whether it's about just one tree or the whole list!

Share your opinions and experiences with our trees and their cyclone resilience now through https://engage.darwin.nt.gov.au/TRC

Closes Sunday 14 October.


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By Tanya Zerek
Completed
People Reached
7.5K
Messaging Conversati...
2
View Results
Boosted on Sep 28, 20
By Josie Grace
People Reached
3
112
58 Comments 57 Shares

City of Darwin Greening Australia George Brown Darwin Botanic Gardens Plants Direct N.TNorthern Territory Parks and Wildlife Allora Gardens Nursery

Like · Reply · Commented on by Josie Matthiesson [?] · 5d

Sue Cunningham Why is council even considering exotics, all replanting should be NT or Australian Natives surely!

Like · Reply · Message · 5d 11

City of Darwin Hi Sue, Exotic trees are important in Darwin's urban forest as they contribute to the overall diversity of the forest and provide unique amenity values. It's about selecting the right tree for the right location, and exotic trees can complement native trees to provide the best outcomes. Thanks - Tanya

Like · Reply · Commented on by Tanya Zerek [?] · 3d 1

Michelle VP Samuel, over 10% 😔😳!

Like · Reply · Message · 5d

Jason Price Why not consult with some local arborist that work with them every day. We know better than most

Like · Reply · Message · 5d 3

Adam Thacker Haha that would make sense dcc dont do that

Like · Reply · Message · 5d 1

City of Darwin Hi Jason and Adam, there are arborists on the Committee and you are right, they do have incredible knowledge of how trees fared in the cyclone and the factors that affected whether a tree 'failed' or not.

Like · Reply · Commented on by Josie Matthiesson [?] · 5d 2

Jason Price I thought we were talking about the replanting phase. Any tree can fail in a cyclone. Its choosing trees that are suited to the dynamic environment in the territory. Hardy to termite and infection as that's the main reasons for removal.

Like · Reply · Message · 4d 1

City of Darwin Hi Jason, the NT Arboricultural society sits on the panel and members of the public can submit comments through the society. Alternatively you can make submissions as part of this consultation process. The tree species are being assessed based on a ran... See More

Like · Reply · Commented on by Tanya Zerek · 3d

2

Write a reply...

Curtis Thomas There's some big trees on Ross Smith Ave inside the parap school that are still standing

Like · Reply · Message · 5d

1

Pu₮₮y Putland Tim Orwin 1

Like · Reply · Message · 5d

Sarah Hanks Maureen Cook Darwin City Council have released numbers, this is what we were talking about yesterday with the mahoganies falling down. 66% of them.

Like · Reply · Message · 5d

1

Matt Cartwright Why must I register to provide feedback? That in itself will reduce the number of people doing surveys. There's some feedback...

Like · Reply · Message · 5d

City of Darwin Hi Matt you don't have to register if you'd rather not. You can send your comments by email to engage@darwin.nt.gov.au . Registering means that we can easily keep you updated on what happens next with the consultation, report and replanting.

Like · Reply · Commented on by Josie Matthiesson · 5d

Craig Hill I GOT A SEVENTY FOOT MANGO tree in me backyard at Alawa not a branch broke in the cyclone

Like · Reply · Message · 5d

1

Georgia Glen @ Loz Ard

Like · Reply · Message · 5d

Georgia Glen Local arborists would have a great overview of what fell down rather than just individual anecdotes. It would be worth consulting them if you haven't already.

Like · Reply · Message · 5d · Edited

3

City of Darwin Hi Georgia, thanks for your comment. There are arborists on the Committee and yes they do have great insight and practical knowledge of what occurred.

Like · Reply · Commented on by Josie Matthiesson [?] · 5d 1

Georgia Glen City of Darwin great 👍 This is going to be such a useful resource for the replanting of Darwin.

Like · Reply · Message · 5d 1

Write a reply...

Georgia Glen Lia Gill Em Lu Ping Sky Dirk Peek Grusha Leeman you might wish to contribute to this.

Like · Reply · Message · 5d 2

Roger M Steele We can only keep trying and hope not dying. The issue is to grow trees properly asap. In 20.years those responsible will have achieved great things. My hobby horse is to blanket the Old hospital site with bottle trees of recognition for our worker... See More

Like · Reply · Message · 5d 2

Roger M Steele I think the. People of. Darwin need to show a. Bit. Of. Bingy And insist on action.....

Like · Reply · Message · 5d 1

Max Browne Chris Campbell and still cleaning up the mess lol

Like · Reply · Message · 5d 1

Shiralee Blac My most beautiful tree which was the selling point for my house was shredded sob sob

Like · Reply · Message · 5d

Darryl Vickers Carol Goznik

Like · Reply · Message · 5d

Grusha Leeman Hopefully all the heavy machinery driving all over all the parks and all the workers cars and watering lorries and such compacting all the soils wont mean the parks are destined to be wastelands when the next big blow comes along.

Like · Reply · Message · 5d 1

Paige Shreeve Jaz Pop

Like · Reply · Message · 5d

Hayden James Noble Hi there, I have sent this via email to DCC but thought I would also post on this page to assist in planting out our city. It also may assist in getting real action on the matter. I have previously sent emails to the local gov, council to try and get t... See More

Hayden James Noble Hi there, I have sent this via email to DCC but thought I would also post on this page to assist in planting out our city. It also may assist in getting real action on the matter. I have previously sent emails to the local gov. council to try and get trees planted along the median strip opposite the Rapid Creek shops, around the carparks within the popular markets, and out the front (there are currently a number of very small and inappropriate trees which provide zero shade) These requests have had zero action in over 10 years now.

Over the years I have been told that it has been put forward numerous times but no funds allocated within the budget. I am a long term Darwin resident who prides himself of keeping his Verge, local streets and neighbor hood green by purchasing, planting, mulching, fertilising and even laying reticulation down for locals to assist in plugging in their hoses and keeping the verge trees alive. I even consulted the owners & council guidelines before hand.

What I would like is to have the local council and Gov to work together here and offer water & mulch to the bus stop garden at the end of Oliver St which I have planted out, maintained and watered for over ten years and my own cost.
This provides greenery and a pleasant experience for all locals who walk past every Sunday to the markets, most of whom say g'day and admire the native grasses and hedged native hibiscus. This to me makes for what we all strive for don't we?, community. Help out, say g'day , and make a difference to our locals.

The median strip is a local gov road I believe and so needs to be given the go ahead from there. Darwin is getting warmer each and every year, there's zero doubt about it. And with such a prominent Darwin attraction as our local Parap, Nightcliff and Rapid Creek markets it's obvious to me which one is missing trees. If the median strip, carparks had a line of large shade providing trees to mark what should be a tropical green local produce, food and arts market. Surely this would be something that is relatively easy to achieve. All it would need is 10 or so large rain trees along the median strip which are fast growing, tough and importantly seemingly resilient to strong winds. These are lined all along Singapore's main roads if you have visited, and provide much cooling and Beautifying to the city.

The council has planted a number of trees out the front of the shops which have struggled to grow for years. The area surrounding the trees is far too small, the trees are the wrong species for shade and to top it off the dirt mound surrounding them are above the concrete level so that any rain or watering it does get, simply runs down and onto the concrete. It needs to be made 4 times the size with rain catching grates to allow real water penetration. By planting a raintree or large shade tree and allowing water to reach the roots zones they will thrive, not simply survive at 2m tall forever. I have seen councils around Australia use this method and it really works well. Large garden beds around each tree.

There are trees at opposite ends of this road at casuarina high school median strip, and to the west at a school crossing.

I would be willing to plant them myself but due to ohs and today's insurance concerns I'm sure I would not be approved to get the job done.

Now is the best time to be planting these trees and mulching them ready for the wet.

Trees= cool and vibrancy which we desperately need.

Regards
Your local tree and green space enthusiast
Hayden Noble

Like · Reply · Message 4d · Edited 2

City of Darwin Hi Hayden, thank you for your message. It is great to see our residents are genuinely passionate about greening Darwin's public spaces. To put forth specific feedback regarding tree species and replanting in specific areas and zones, please either contact our City of Darwin City Operations Team at darwin@darwin.nt.gov.au and/or follow the link to our Engage page to participate in the consultation. Thank you - Tanya

Like · Reply · Commented on by Tanya Zerek 1? · 3d 1

Hayden James Noble City of Darwin thanks Tanya, will do.

Like · Reply · Message · 3d

Jimmy Cricket How about you do your research before undertaking these projects in the first place.

Like · Reply · Message · 3d

City of Darwin Thanks Hayden James Noble. Also, we have forwarded your message to the Team at NTG as Trower Road is an NTG road, therefore your feedback may be of interest to them. Thank you - Tanya

Like · Reply · Commented on by Tanya Zerek 1? · 3d

Hayden James Noble City of Darwin cheers. Yes, as per my message and email the median strip is the local gov.
Sent it to them also thanks.

Like · Reply · Message · 2d 1

Jimmy Cricket How to we go about making a claim for damaged clothing due to the Esplanade sprinklers coming on during the day without warning, damaging several people's shoes, clothing and lunches ?? This is a serious question... There is also a young lady that has calcium damage all over her brand new vehicle due to the poor range set up of them. Disgraceful !!!

Like · Reply · Message · 3d

1

City of Darwin Hi Jimmy. The City of Darwin Team can be contacted on 08 8930 0300 or darwin@darwin.nt.gov.au. Thank you - Tanya

Like · Reply · Commented on by Tanya Zerek · 3d

Jimmy Cricket NT News....

Like · Reply · Message · 3d

Lizzy Mellick I was noticing the trees planted by George Brown along Dick Ward drive the other day ... stood up to Marcus remarkably well

Like · Reply · Message · 2d

1

Lizzy Mellick The massive mango tree in our backyard survived beautifully and has provided an abundance of delicious mangoes in the past few weeks.

Like · Reply · Message · 2d

1

Jacob Wedlock One question Darwin City. How come when I was working from start to finish with a tree company I didn't see much of your guys??Think the army fellas did a little bit more then you

Like · Reply · Message · 2d

Peter Alp Where was this ?

Like · Reply · Message · 1h

Jacob Wedlock Peter Alp all over Darwin

Like · Reply · Message · 1h

Peter Alp I seen a ton of council workers out an about making safe for public, clearing road ways , sorting out parks , fixing drainage. It was a team effort from everyone involved, just because you didn't see any council workers do much as you say , think again

Like · Reply · Message · 1h

Meg Gayoso Need to plant Maranthes, Allosyncarpias & Syzygiums, all evergreen, all native.

Like · Reply · Message · 2d

1

Aurora Bayle I have tried to get the agency owner to remove a nasty black wattle tree in front of the house but they would not do it. It won't stand a chance in another cyclone , massive branches are already falling in driveway with that wind and almost hit me or my car plus if it falls it would take the power line right under it but does not seem that important to them 😡 lucky another mahogany behind the house was removed just a couple of weeks before the cyclone or the house would have been destroyed for sure 😳
And thanks Darwin council for fixing the cracks at the front of my driveway 🙂

Like · Reply · Message · 2d · Edited

1

Barbara Saunders Rachel Elston Pam Puckridge Jay Ash

Like · Reply · Message · 1d

Douglas Albion I came to Darwin in 1970 so i have seen a lot of change over the years. One thing i have observed is it is very important how our trees are planted. Darwin has a shallow topsoil with a rocky layer underneath. If a tree has not got a good foundation it wont matter what species it will always be vulnerable to falling in our cyclones. I have planted a few gardens in my time here and i always made sure the holes were large and deep and the trees were well watered thru the dry season for the first 4 or 5 years. They are all still standing as far as i know.

Like · Reply · Message · 1d

2

Brad Cross A assortment of tropical fruit trees would be a good idea.

Like · Reply · Message · 1d

Shirley Lewis Grow natives that belong to the area

Like · Reply · Message · 1d

Judith Sealy Why aren't we just planting native trees for our environment. Not to be pretty but able to cope with the weather? !!!!

Like · Reply · Message · 23h

Michael Kirwin Don't know if you sore but there were plenty of native trees down as well!

Like · Reply · Message · 21h

Judith Sealy Michael Kirwin Can't argue with nature!!!!😮

Like · Reply · Message · 21h

Judith Sealy Michael Kirwin not sore, makes more sense!!!!! 😮


Michael Kirwin Yep they did fine!
Like · Reply · Message · 21h
Peter Toll Maree Toll
Like · Reply · Message · 19h
Yvette Brady Crackerjack Plants Colleen Chalmers Regina Downes
Like · Reply · Message · 1h
Yvette Brady Jess Derham
Like · Reply · Message · 1h
Write a comment...
GIF

Junella Scott Where any of these trees stood back up and replanted.

Like · Reply · Message · 1w

City of Darwin Hi Junella, unfortunately we were unable to replant any fallen trees. All our available resources were dedicated to the emergency response body of work to ensure the safety of the community. This included clearing the roads and property access from fa... See More

Like · Reply · Commented on by Tanya Zerek [?] · 1w

2

Jennifer Scobie City of Darwin has the structural integrity of the rain tree
in the Hinkler St park been affected the roots have badly lifted and arborists have already cut it back about two metres from the ground ,is this tree going to be left alone to regrow or will it be removed ,when will new trees/shrubs be planted!

Like · Reply · Message · 1w

Write a reply...

Abigail Emma Poulton Nice work on the Esplanade!

Like · Reply · Message · 1w

Irene Angel Mahogany are a weed as should be classed as such the seed blows and they sprout everywhere . Hillier road is an example . ..as for winds beauty leaf stood up well and tamarind , and the Millwood

Like · Reply · Message · 1w

2

Brad Davies No it's actually not a weed....

Like · Reply · Message · 1w

Rose Spartano

Like · Reply · Message · 2d

Rose Spartano

Like · Reply · Message · 2d

Rose Spartano Gum trees x 3 down

Like · Reply · Message · 2d · Edited

Veronica McClintic Although Banyan trees may have stood up to the cyclone, they can be a terrible menace if they are in a park and close to the fence of a property. They start off with one trunk and within a few years that increases immensely with the result of bringing it closer to the fence line. The result of this is damages to fence and house from the roots and branches. In addition to this there is a constant mess of leaves in the yards and roof drains. If these trees are to be grown, do that in the middle of the parks!

Like · Reply · Message · 1d

Carol McKenzie

Like · Reply · Message · 1d

Carol McKenzie Maraya mock orange hedge did not move.

Like · Reply · Message · 1d · Edited

Carol McKenzie Lilly Pilly Syzygium smithii did not move either! - this tree about 8-10 years old but pruned regularly!

Like · Reply · Message · 1d · Edited

Nadine Lavelle

Like · Reply · Message · 17h

Like · Reply · Message · 17h

Paul Greville First option Drill holes one meter diameter 2m deep line top meter with plastic ring put tree in water in descending stages to the bottom as tree grows , lots of dedication needed . Second option don't plant big trees .

Like · Reply · Message · 2h

Write a comment...

Jake Sadler Are we going to prevent damage this cyclone season by removing and cutting back certain African mahogany trees in bad areas before they fall and cause outages for days and damage!?

Like · Reply · Message · 1d · Edited

Julie Esson Trees that don't attract termites. 6 months after Marcus the termites are going crazy through palms in the northern suburbs.

Like · Reply · Message · 1d

1

Irene Angel Beauty leaf tree , milkwood , burdekin plum , tamarind.. all stand well and don't spread like weeds .

Like · Reply · Message · 19h

Lydia Esguerra Don't plant trees close to the properties.

Like · Reply · Message · 2d

Write a comment...

Respondant	Source	Themes	Species identified	Comments
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Acacia auriculiformis	Move up a level from Red to Orange - see submission #5 Acacia auriculiformis The Black Wattle, is an easy to propagate fast growing tree that provides screening, shade, wind breaking and habitat quickly. If cut before they are become old and more hazardous, they can be very effective pioneer species and will provide a cheap and quick greening of our parks whilst helping slower trees establish.
MK	Survey	Cyclone Resilience Ratings - Disagree	Acacia auriculiformis	I believe Acacia auriculiformis is a tree that should be planted, and that many that were blown over were old trees and well past their use by date. A. auriculiformis is quick growing and provides good shade, but it should be used as a "sacrifice tree". Plant them between the slower growing species and remove when the other trees need the space to grow.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Acacia dunnii	Move up a level from Red to Orange - see submission #5 The Elephant Ear Wattle, grows fast and has spectacular flowers. It can quickly provide screening, shade, wind breaking and habitat. They are mostly short and bushy, but if cut before they are become tall and more hazardous, they can be very effective pioneer species and will provide a pretty and quick greening of our parks whilst helping slower trees establish. I have a 4 metre Acacia dunnii on my nature strip and it barely noticed Marcus, not 10 metres from where a massive african mahogany fell.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Adenanthera pavonina	Move up a level from Red to Orange - see submission #5 The Red Bead Tree is a nitrogen-fixing pioneer species that has been recommended to be planted in a cyclone impacted area as a fast growing windbreak tree. The tree is easy to propagate, fast-growing, with an attractive and shady spreading canopy. The several healthy ones I know survived Marcus, and the assessment report states there was only one specimen in the study.
JB	Survey	Cyclone Resilience Ratings - Disagree	Albizia Saman	The Albizia Saman proved to be very resilient in Cyclone Marcus, perhaps is undersold in this chart.
TW	Survey	Cyclone Resilience Ratings - Disagree	Artocarpus heterophyllus - Jackfruit	. Artocarpus heterophyllus - Jackfruit, in my experience (commercial grower), does not have high resilience. They snap very easily in high winds. I would also not recommend this tree for urban planting as unattended fruit attracts vermin and bats and a good size fruit (10-15kg) has the potential to kill if it falls from the tree.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Carpentaria acuminata	Orange Trees => Green Trees MEDIUM CYCLONE RESILIENCE but I recommend could be reconsidered to be moved up a level from Orange to green. Carpentaria acuminata Really? This Queensland report finds Carpies "wind resistant" to cyclones. The post-Marcus assessment report found only 5.6% of 71 Carpentaria palms studied were damaged. Only 4.2% had major damage though there was no uprooting. No irrigation was associated with a higher rate of damage to Carpies, but it cant have been that serious as so few were damaged. Carpies are iconic Darwin palms and are the favoured food of the gorgeous Torres Strait Pigeons.
TW	Survey	Cyclone Resilience Ratings - Disagree	Cassia fistula	. I would recommend removing all invasive trees and any reference to invasive or gazetted species from the lists. If they are environmental weeds they should not be mentioned, as to give credibility to those that wish to grow them. Cassia fistula is one of these not listed as invasive but should be. It has been known to be invasive in the Top End for over 30 years. Recent social media debate/backlash over Azadirachta indica - Neem being a WONS and illegal to grow in the NT, gave me further insight into the total ignorance and arrogance of some Gardeners/Growers to the ecological damage caused by these invasive species. These people will use Cyclone resilience to justify growing these species.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Corymbia bella/papuana/Eucalyptus alba	Orange Trees => Green Trees MEDIUM CYCLONE RESILIENCE but I recommend could be reconsidered to be moved up a level from Orange to green. In Darwin, there are loads of ghost gums still standing happily after Marcus and they are so beautiful. The assessment report, found that of 65 Corymbia bella trees sampled, only 1.5% were uprooted: clearly not enough to stop them from being planted across Darwin.
TW	Survey	Cyclone Resilience Ratings - Disagree	Damson Plum	. I would also question the medium rating of Damson Plum.
TW	Survey	Cyclone Resilience Ratings - Disagree	Eucalyptus/Corymbia	I would question putting any Eucalyptus/Corymbia into the High Resilience category as they are all prone to dropping branches and snapping in high winds. Even the urban-friendly stands of E. herbertiana were decimated on the top of McMillians Rd and many Eucalypt species were casualties in the Palmerston area. I would recommend that they sit better in the medium resilience category.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Ficus benjamina	Move up a level from Red to Orange - see submission #5 The weeping fig is, like the banyan, an important tree for diversity of form, and it doesn't tend to become too large when subject to the drought of the Dry every year. The several that I know of survived Marcus unscathed. Indeed this Cairns report places this tree in the "moderately resistant species" category for cyclone planting.

Respondant	Source	Themes	Species identified	Comments
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Grevillea pteridifolia	Move up a level from Red to Orange - see submission #5 Fern-Leaved Grevilleas are small trees and as such could not be the danger that large trees can be. Unless they are watered as they would be in a swamp, they would not be expected to grow large anyway. They are iconic calendar plants and besides their beauty are important to feed nectar and seed eating wildlife. My neighbour had a large tree uprooted but their Grevillea pteridifolia a few metres away was unscathed by Marcus.
Horizon	Survey	Cyclone Resilience Ratings - Disagree	Jackfruit tree	I notice that the Jackfruit tree is categorised as highly resilient. We have a very mature jackfruit tree that was severely affected by Cyclone Marcus despite having withstood other cyclones. Our property backs onto Doctor's Gully. All that remains is about 3 metres of the main trunk and it does not appear to be rejuvenating just yet.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Leptospermum madidum	Green Trees => Orange Trees HIGH CYCLONE RESILIENCE but I recommend could be reconsidered to be moved down a level. The weeping tea-tree has many trunks and isn't tall so is considered a safe cyclone tree. However, as it's favoured habitat is along watercourses and in sandstone gullies, it may not be so safe when not well watered. We experienced our beautiful large many trunked tea-tree become uprooted by Marcus and damaged the awning and the clothesline. It is possible we hadn't watered it sufficiently the previous Dry.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Mangifera indica	Move up a level from Red to Orange - see submission #5 Our mango trees survived Marcus unscathed as did many others and they are a beloved and iconic old-Darwin species. Indeed this Cairns report places this tree in the "moderately resistant species" category for cyclone planting.
TW	Survey	Cyclone Resilience Ratings - Disagree	Millettia pinnata - Indian Beech	The low resilience rating of Millettia pinnata - Indian Beech and Peltophorum pterocarpum - Yellow Flame Tree are probably not an accurate assessment as these native coastal trees, naturally occurring around permanent ground water, are adept at surviving regular coastal storms. I would postulate that the poor planting/culturing practices of median/sidewalk planting and no irrigation over Dry seasons has resulted in this poor rating.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Morinda citrifolia	Orange Trees => Green Trees MEDIUM CYCLONE RESILIENCE but I recommend could be reconsidered to be moved up a level from Orange to green. Carpentaria acuminata Really? This Queensland report finds Carpies "wind resistant" to cyclones. The post-Marcus assessment report found only 5.6 The rotten cheesefruit tree is tough as nails and can be seen growing green with fruit on Fannie Bays' beach in the Dry! Indeed in this Yasi report, this plant was included in a list of trees that showed "consistently low rates of cyclone damage" with 0% reported for this species. The assessment of the Darwin parks reportedly encountered this species only once. In Darwin this tree is usually more of a bush and so couldn't be considered a harmful tree. It has international attention as it grows noni fruit which have been found to have medicinal properties.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Peltophorum pterocarpum	Move up a level from Red to Orange - see submission #5 yellow flame tree is still a common tree around Darwin, with many healthy specimens still to be seen after Marcus - along Bagot Road and around Darwin High school for instance. It is widely appreciated for providing excellent shade and is used in shelterbelts because it is wind firm. As a fast growing tree it can be used as a pioneer species and also fixes nitrogen which can then become available to neighbouring trees. These trees provide both habitat and food for our wildlife whilst providing a showy abundance of yellow flowers to bring in the Buildup.
TW	Survey	Cyclone Resilience Ratings - Disagree	Peltophorum pterocarpum - Yellow Flame Tree	The low resilience rating of Millettia pinnata - Indian Beech and Peltophorum pterocarpum - Yellow Flame Tree are probably not an accurate assessment as these native coastal trees, naturally occurring around permanent ground water, are adept at surviving regular coastal storms. I would postulate that the poor planting/culturing practices of median/sidewalk planting and no irrigation over Dry seasons has resulted in this poor rating.
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Schefflera actinophylla	Move up a level from Red to Orange - see submission #5 The umbrella tree might also not be deserving of being cut out of new plantings in Darwin, indeed in this report following Queensland's Cyclone Larry, found this trees leaves were blown off however "stems are very flexible". And in this report it is included in the category "moderately resistant species" for post-cyclone planting, even though they reported it lost some branches. With its broad green umbrella-like leaves and spectacular flowers, it contributes to the diversity of flora in Darwin and it also feeds our wildlife.
TW	Survey	Cyclone Resilience Ratings - Disagree	Terminalia microcarpa syn. sericocarpa	My experience with Terminalia microcarpa syn. sericocarpa with its massive buttressing root system, is that it is quite stable in high winds and has quite a good root to canopy ratio. How many came down in Marcus and what was the determination of their demise?

Respondant	Source	Themes	Species identified	Comments
TW	Survey	Cyclone Resilience Ratings - Disagree / invasive species	Azadirachta indica	. I would recommend removing all invasive trees and any reference to invasive or gazetted species from the lists. If they are environmental weeds they should not be mentioned, as to give credibility to those that wish to grow them. Cassia fistula is one of these not listed as invasive but should be. It has been known to be invasive in the Top End for over 30 years. Recent social media debate/backlash over Azadirachta indica - Neem being a WONS and illegal to grow in the NT, gave me further insight into the total ignorance and arrogance of some Gardeners/Growers to the ecological damage caused by these invasive species. These people will use Cyclone resilience to justify growing these species.
JKL	Survey	Cyclone resilience ratings - various	Corymbia bella	Great to see so many species on the lists. More information on possible reasons for categorisation especially of the medium risk trees would be helpful for the community to make educated decisions when trying to plant habitat. For example Eucalyptus alba and Corymbia bella are beautiful trees and i would be happy to plant if its main risk was limb drop, as this species is known for this characteristic anyway but planted in the right location can be a key tall growing species in an area.
AR	Survey	Cyclone resilience ratings - various	Dodonaea playtptera	I was particularly curious that a number of shrubs have been listed in the different categories e.g. Jacksonia dilatata (under high) and Dodonaea playtptera (under low). Since these species don't grow very tall and would pose a low risk to infrastructure or safety, I thought it was strange that they should be categorised in terms of cyclone resilience rather than being prioritized for their amenity and wildlife habitat values
JKL	Survey	Cyclone resilience ratings - various	Eucalyptus alba	Great to see so many species on the lists. More information on possible reasons for categorisation especially of the medium risk trees would be helpful for the community to make educated decisions when trying to plant habitat. For example Eucalyptus alba and Corymbia bella are beautiful trees and i would be happy to plant if its main risk was limb drop, as this species is known for this characteristic anyway but planted in the right location can be a key tall growing species in an area.
AR	Survey	Cyclone resilience ratings - various	Jacksonia dilatata	I was particularly curious that a number of shrubs have been listed in the different categories e.g. Jacksonia dilatata (under high) and Dodonaea playtptera (under low). Since these species don't grow very tall and would pose a low risk to infrastructure or safety, I thought it was strange that they should be categorised in terms of cyclone resilience rather than being prioritized for their amenity and wildlife habitat values
paul	survey	Cyclone resilience ratings - various		**Compare your lists to the ones in the CSIRO report.**
glenys	Survey	Cyclone resilience ratings - various	Acacia auriculiformis Black Wattle	Black wattle- one big tree brought down the entire back yard. Glad to see they are on the don't plant list
ennero	survey	Cyclone resilience ratings - various		well thought out and researched categories
Ronnie	survey	Cyclone resilience ratings - various		I can offer no comment on what trees might be the most suitable as the survey has covered this issue extremely well. The recommendations are excellent and the panel of experts consulted, particularly Dr Ian Cowie make me feel that the selection of appropriate and resilient species and the planting of them to start beautifying and cooling down Darwin again is in good hands.
TW	survey	Inconclusive list	Albizia saman - Raintree	Like Albizia saman - Raintree, if pruned/shaped properly to supress height and encourage spread Delonix regia - Poincianas are quite resilient to Cyclonic events and sit well in medium category. Others on inconclusive list are not widely enough used in the landscape to be able to make informed comment. Saying that I had a pre-Tracy Syzygium jambos - Rose Apple
MK	survey	Inconclusive list	Corymbia jacobsiana Corymbia bleeser	Corymbia jacobsiana and Corymbia bleeseri - I believe these 2 species would have similar characteristics to the other bloodwoods.
MK	survey	Inconclusive list	Cyclophyllum schultzii	Cyclophyllum schultzii – small shrub, shouldn't be a problem
glenys	survey	Inconclusive list	Delonix regia	We had a Delonix regia. With every wind gust it lifted out of the ground and slammed back again. Many branches snapped off. It was never watered
AR	survey	Inconclusive list	Delonix regia	The Poinciana at the Jingili Preschool/Kindy complex was unaffected by the cyclone (some small branches came off only).
RK	survey	Inconclusive list	Delonix regia	Trees that have the potential to be weeds should be avoided, such as poincianas
TW	survey	Inconclusive list	Delonix regia - Poincianas	Like Albizia saman - Raintree, if pruned/shaped properly to supress height and encourage spread Delonix regia - Poincianas are quite resilient to Cyclonic events and sit well in medium category. Others on inconclusive list are not widely enough used in the landscape to be able to make informed comment. Saying that I had a pre-Tracy Syzygium jambos - Rose Apple
MK	survey	Inconclusive list	Diospyros maritima	Diospyros maritima - shouldn't be a problem
MK	survey	Inconclusive list	Eucalyptus oligantha and E. phoenicea	Eucalyptus oligantha and E. phoenicea - I believe these 2 species would have similar characteristics to the other eucalypts.
MK	survey	Inconclusive list	Melicope elleryana	Melicope elleryana - I think this is a fast-growing species and therefore maybe prone to losing limbs
MK	survey	Inconclusive list	Miliusa brahei	Miliusa brahei – lovely tree, shouldn't be a problem

Respondant	Source	Themes	Species identified	Comments
Harlay	survey	Inconclusive list	Poinciana	A couple of mature Poinciana trees in Doctor's Gully at the back of our property lost most of their branches except the main trunk. The trees are rejuvenating quickly.
TW	survey	Inconclusive list	Syzygium jambos - Rose Apple	Like Albizia saman - Raintree, if pruned/shaped properly to supress height and encourage spread Delonix regia - Poincianas are quite resilient to Cyclonic events and sit well in medium category. Others on inconclusive list are not widely enough used in the landscape to be able to make informed comment. Saying that I had a pre-Tracy Syzygium jambos - Rose Apple
MK	survey	Inconclusive list	Syzygium minutuliflorum –	Syzygium minutuliflorum – this is a riverine species, if it doesn't get adequate water it's probably not suitable
MK	survey	Inconclusive list	Terminalia arostrata –	Terminalia arostrata – not sure how this goes in a humid climate.
TW	Survey	Invasive species	Spathodea campanulata - African Tulip	Spathodea campanulata - African Tulip is another noted invasive species that is prone to dieback and definitely not suitable for urban planting
Rose Sppartano	F	Marcus - trees that failed	Eucalypts	3 x gums down on property - see pics for species
irene Angel	F	Marcus - trees that failed	Mahogany	Mahogany are a weed as should be classed as such the seed blows and they sprout everywhere . Hillier road is an example . .
Enri	F	Marcus - trees that failed	Mangifera indica - Mango	I had one in my backyard and it didn't survived!
Jennifer Scobie	F	Marcus - trees that failed	Poinciana	Despite previous requests to have it cut back to a safe height a beautiful big poinciana on council land ,fell onto our property in Fannie Bay and caused considerable damage during the cyclone the trunk of this tree was hollow inside from disease ,I think proper maintenance of any tree is a major issue and communication or should I say lack of it is also an issue.
Paul	Survey	Marcus - Trees that stood up well	Alstonia actinophylla	The species Alstonia actinophylla was the best performing tree during the high winds of Cyclone Tracy especially the ones along the Esplanade.
Lizzy Mellick	F	Marcus - Trees that stood up well	Beauty leaf ??	I was noticing the trees planted by George Brown along Dick Ward drive the other day ... stood up to Marcus remarkably well
Horizon	Survey	Marcus - Trees that stood up well	Frangipani	We did note driving around Darwin after Cyclone Marcus of the apparent resilience of Frangipani trees - we only saw one that had been uprooted (mature tree on the verge in Nightcliff).
Carol Mckenzie	F	Marcus - Trees that stood up well	Lilly Pilly Syzygium smithii	Lilly Pilly Syzygium smithii did not move either! - this tree about 8-10 years old but pruned regularly!
Craig Hill	F	Marcus - Trees that stood up well	Mangifera indica - Mango	I GOT A SEVENTY FOOT MANGO tree in me backyard at Alawa not a branch broke in the cyclone
Lizzy Mellick	F	Marcus - Trees that stood up well	Mangifera indica - Mango	The massive mango tree in our backyard survived beautifully and has provided an abundance of delicious mangoes in the past few weeks.
Carol Mckenzie	F	Marcus - Trees that stood up well	Maraya Mock Orange	Maraya mock orange hedge did not move.
Sally Osbourne	F	Marcus - Trees that stood up well	Poinciana	Our very large poincianas withstood extremely well, A's did the large black wattle, casuarinas mostly did ok except for one or two which pierced our roof.
Irene Angel	F	Marcus - Trees that stood up well	Tamarind, beauty leaf, Milkwood, burdekin plum	as for winds beauty leaf stood up well and tamarind , and the Millwood burdekin plum
Veronica McClimtic	F	Replanting - Species Suggestion	Banyan	Although Banyan trees may have stood up to the cyclone, they can be a terrible menace if they are in a park and close to the fence of a property. They start off with one trunk and within a few years that increases immensely with the result of bringing it closer to the fence line. The result of this is damages to fence and house from the roots and branches. In addition to this there is a constant mess of leaves in the yards and roof drains. If these trees are to be grown, do that in the middle of the parks!
Mag Gayoso	F	Replanting - Species suggestion - Natives	Marathes, Allosyncarpias Syzygiums	Need to plant Maranthes, Allosyncarpias & Syzygiums, all evergreen, all native.
Sue Cunningham	F	Replanting - Species suggestion - Natives	Natives	Why is council even considering exotics, all replanting should be NT or Australian Natives surely!
David Rourke	F	Replanting - Species suggestion - Natives	Natives	Should have arid tolerant native grass, between native trees/shrubs, that only requires 'drought' watering

Respondant	Source	Themes	Species identified	Comments
Judith Sealy	F	Replanting - Species suggestion - Natives	Natives	Why aren't we just planting native trees for our environment. Not to be pretty but able to cope with the weather? !!!!
Shirley Lewis	F	Replanting - Species suggestion - Natives	Natives	Grow natives that belong to the area
David Rourke	F	Replanting - Species suggestion - Natives & Fruit	Natives & fruit	most natives only need watering for first couple years, after that watering is dangerous as we found out. only non natives should be fruit trees, but include native fruit trees
Jason Price	F	Replanting - Species suggestion - Termites	termite resistant	I thought we were talking about the replanting phase. Any tree can fail in a cyclone. Its choosing trees that are suited to the dynamic environment in the territory. Hardy to termite and infection as that's the main reasons for removal.
JB	survey	Replanting - Species suggestions	Albizia Saman	Plant more Albizia Saman, they are by far the best looking tree and have a high resilience for fast growing trees due to their fine leaf canopy. Large shade tree to quickly replace African Mahogany. Also more beauty leaf.
FC	Survey	Replanting - Species suggestions	Bamboo	While not strictly a tree I'd like to see clumping bamboos on the favoured list, they are great wind breaks, good for erosion issues, self mulching and great screeners
radhika	survey	Replanting - Species suggestions	Banyan	Please avoid exotic trees. I believe they only bring aesthetic value but not necessarily hold good during a cyclone. Banyan trees are good as they have a strong system and support a lot of other life like birds, lizards, geckos, possums etc
Jb	survey	Replanting - Species suggestions	beauty leaf.	Plant more Albizia Saman, they are by far the best looking tree and have a high resilience for fast growing trees due to their fine leaf canopy. Large shade tree to quickly replace African Mahogany. Also more beauty leaf.
Sub #3 JF	W/O	Replanting - Species suggestions	Boab Tree	nil
PT	Survey	Replanting - species suggestions	bougainvillea	Follow George Browns adage. Plant local indigenous trees including a multitude of food source and residential trees for local and migratory birds, animals and reptiles.Deep root them by bottomless barrel planting. Integrate tropical Flowering trees for all seasons. Introduce bougainvillea tree shapers and ensure regular pruning to keep tree shapes.
MK	survey	Replanting - Species suggestions	Celtis phillippensis	Celtis phillippensis – Top End native, hardy, big shady trees, buttressed roots
Sub #4 MM	W/O	Replanting - Species suggestions	*Cordia subcordata*	Cordia subcordata – this is a coastal monsoon vine forest tree – the red tail black cockatoos love it. I have one in my front yard and at the moment while it is in fruit the cockatoos visit it every day. It would be great to have more of them along the foreshore and parks.
RK	survey	Replanting - Species suggestions	Erythina vespertilio/variegata (coral tree)	Erythina vespertilio/variegata (coral tree) a small endemic tree that adds colour
RK	Survey	Replanting - Species suggestions	Fragrea Racemsa	Fragrea Racemsa because very fragrant Need more native perfumed trees that smell beautiful at night
Sub #1 HJ	W/O	Replanting - Species suggestions	Frangipani	for smith street - see submission #1 for detail on Greening Darwin
Brad Cross	F	Replanting - Species suggestions	Fruit	A assortment of tropical fruit trees would be a good idea.
Sub #4 MM	W/O	Replanting - Species suggestions	*Ganophyllum falcatum*	Ganophyllum falcatum – medium sized shade tree – fast growing – the birds love the fruits. I have had them in my yard at 2 properties for over 20 years and they are hardy and pretty.
Sub #3 JF	W/O	Replanting - Species suggestions	Golden Cane	nil
radhika	survey	Replanting - Species suggestions	Mangifera indica - Mango	Mango. Although it is a fruit tree, it is strong and can sustain cyclones.
Sub #4 MM	W/O	Replanting - Species suggestions	*Miliusa brahei*	common tree in Casuarina Coastal Reserve – has self-seeded in my yard and has been a wonderful medium sized shapely bird attracting tree. Appears to tolerate not much water.
PJ	Survey	Replanting - Species suggestions	Native Edible	I would love to see more edible varieties. Native edible, Nt lemons etc
Ennero	Survey	Replanting - Species suggestions	Palms	More palm species because they are extremely resilient
MK	survey	Replanting - Species suggestions	Pittosporum moluccanum/P. ferrugineum -	Pittosporum moluccanum/P. ferrugineum - Top End natives, smallish shade trees, ideal for nature strips.
Sub #1 HJ	W/O	Replanting - Species suggestions	Poinciana	to line cavanagh street - see submission #1 for detail on Greening Darwin
Sub #3 JF	W/O	Replanting - Species suggestions	Swamp Bloodwood	nil
e-azul	survey	Replanting - Species suggestions	Syzygium suborbiculare	**Syzygium suborbiculare - A native species, so it's used to the seasons, climate and soil.**
TW	survey	Replanting - Species suggestions		A complete investigation of suitable species growing in the Pan-Tropic region should be undertaken and a list of preferred species compiled for future reference for the greening of Darwin. Interestingly, Singapore uses many of our Native Trees in their streetscape plantings. Is there a lesson here?

Respondant	Source	Themes	Species identified	Comments
Wati Dzuikifly	F	Replanting - Species suggestions - Fruit	Mangifera indica - Mango rambutan mangosteen	Pls plant more fruit trees in our parks: mango, rambutan, mangosteen n chikus!
Paul	Survey	Species comment	Khaya	Species of Khaya which did not blow over were in yards of owners who did not irrigate them or their lawns during the dry season.
Paul	Survey	Species comment	Mangifera indica - mango Mangifera indica	The only mango trees (Mangifera indica) which survived intact were ones which had been pollarded prior to Cyclone Tracy.
JKL	Survey	Species to add to lists	Anitdesma ghaesembilla	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
Harlay	Survey	Species to add to lists	Browneas	I would like to suggest that more Cassia species be included on the list of plants to grow. Also maybe Saracas and Browneas in feature settings.
Harlay	Survey	Species to add to lists	Cassia species	I would like to suggest that more Cassia species be included on the list of plants to grow. Also maybe Saracas and Browneas in feature settings.
JKL	Survey	Species to add to lists	Cordia subcordata	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
JKL	Survey	Species to add to lists	Cyclophyllum schultzii	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
JKL	Survey	Species to add to lists	Fragraea racemosa	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
JKL	Survey	Species to add to lists	Gardenia fucata	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
JKL	Survey	Species to add to lists	Grevillea decurrens	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
JKL	Survey	Species to add to lists	Helicia australasica	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii

Respondant	Source	Themes	Species identified	Comments
JKL	Survey	Species to add to lists	Micromelum minutum	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
JKL	Survey	Species to add to lists	Pandanus basedowii	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
JKL	Survey	Species to add to lists	Pandanus spiralis	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
Harlay	Survey	Species to add to lists	Saracas	I would like to suggest that more Cassia species be included on the list of plants to grow. Also maybe Saracas and Browneas in feature settings.
JKL	Survey	Species to add to lists	Vitex glabrata	The following species should be included in the ranking as I believe they are common across Darwin and the greater Darwin region and have been in planting lists used by Council in years gone by. They are also included in the Council pucblication Creating Habitat for Darwin Gardens and having information on these trees and their resilience to severe weather would be beneficial. Anitdesma ghaesembilla Micromelum minutum Vitex glabrata Cyclophyllum schultzii Fragraea racemosa Helicia australasica Cordia subcordata Gardenia fucata Grevillea decurrens Pandanus spiralis Pandanus basedowii
GR	Survey	suggestion		Suggest: Fast and Slow Growing habits could be added column for each Green (good cyclone areas) so helps decide replanting choices? After all, isn't this why decision post Cyclone Tracy to mass plant fast grower African Mahogonies?

Appendix 5

TRAC Responses - Tree Species identified in consultation

Respondant	Source	Themes	Species identified	Committee Action
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Acacia auriculiformis	CC - stay as low
MK	Survey	Cyclone Resilience Ratings - Disagree	Acacia auriculiformis	CC - stay as low - use smaller species for screen planting
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Acacia dunnii	CC - stay as low - but low risk
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Adenanthera pavonina	CC - change to medium
JB	Survey	Cyclone Resilience Ratings - Disagree	Albizia Saman	CC - stay as medium
TW	Survey	Cyclone Resilience Ratings - Disagree	Artocarpus heterophyllus - Jackfruit	CC - change to medium - not to be planted
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Carpentaria acuminata	CC - stay as medium - not to be planted
TW	Survey	Cyclone Resilience Ratings - Disagree	Cassia fistula	CC - stay as not to be planted
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Corymbia bella/papuana/Eucalyptus alba	CC - stay as medium
TW	Survey	Cyclone Resilience Ratings - Disagree	Damson Plum	CC - change to high
TW	Survey	Cyclone Resilience Ratings - Disagree	Eucalyptus/Corymbia	Leave as is
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Ficus benjamina	CC - leave as low
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Grevillea pteridifolia	Stay as low - move to preferred list
Horizon	Survey	Cyclone Resilience Ratings - Disagree	Jackfruit tree	CC - change to medium - not to be planted
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Leptospermum madidum	CC - stay as high

Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Mangifera indica	CC - change to medium - move to preferred
TW	Survey	Cyclone Resilience Ratings - Disagree	Millettia pinnata - Indian Beech	CC - stay as low - move to preferred
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Morinda citrifolia	CC - change to high - move to preferred
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Peltophorum pterocarpum	CC - leave as medium - change to preferred
TW	Survey	Cyclone Resilience Ratings - Disagree	Peltophorum pterocarpum - Yellow Flame Tree	CC - leave as medium - change to preferred
Sub #5 GL	W/O	Cyclone Resilience Ratings - Disagree	Schefflera actinophylla	CC - change to medium - remove not to be planted
TW	Survey	Cyclone Resilience Ratings - Disagree	Terminalia microcarpa syn. sericocarpa	CC - leave as high
TW	Survey	Cyclone Resilience Ratings - Disagree / invasive species	Azadirachta indica	CC - leave on sheet - not to be planted
JKL	Survey	Cyclone resilience ratings - various	Corymbia bella	CC - leave as medium
AR	Survey	Cyclone resilience ratings - various	Dodonaea playtptera	CC - can be a small tree
JKL	Survey	Cyclone resilience ratings - various	Eucalyptus alba	CC - agree with comments
AR	Survey	Cyclone resilience ratings - various	Jacksonia dilatata	CC - can be a small tree
paul	survey	Cyclone resilience ratings - various		CSIRO report
glenys	Survey	Cyclone resilience ratings - various	Acacia auriculiformis Black Wattle	CC - agree with comments
ennero	survey	Cyclone resilience ratings - various		CC - agree with comments
Ronnie	survey	Cyclone resilience ratings - various		CC - agree with comments
TW	survey	Inconclusive list	Albizia saman - Raintree	CC - agree with comments
MK	survey	Inconclusive list	Corymbia jacobsiana Corymbia bleeser	CC - change to medium
MK	survey	Inconclusive list	Cyclophyllum schultzii	CC - change to high
glenys	survey	Inconclusive list	Delonix regia	CC - agree with comments
AR	survey	Inconclusive list	Delonix regia	CC - agree with comments
RK	survey	Inconclusive list	Delonix regia	CC - agree with comments
TW	survey	Inconclusive list	Delonix regia - Poincianas	CC - agree with comments

MK	survey	Inconclusive list	Diospyros maritima	CC - change to high
MK	survey	Inconclusive list	Eucalyptus oligantha and E. phoenicea	CC - agree with comments - change to medium
MK	survey	Inconclusive list	Melicope elleryana	CC - leave as unknown
MK	survey	Inconclusive list	Miliusa brahei	CC - change to high
Harlay	survey	Inconclusive list	Poinciana	CC - agree with comments
TW	survey	Inconclusive list	Syzygium jambos - Rose Apple	CC - leave as inconclusive
MK	survey	Inconclusive list	Syzygium minutuliflorum –	CC - change to medium
MK	survey	Inconclusive list	Terminalia arostrata –	CC - stay as inconclusive
TW	Survey	Invasive species	Spathodea campanulata - African Tulip	CC - agree with comments
Rose	F	Marcus - trees that failed	Eucalypts	CC - species undefined
irene	F	Marcus - trees that failed	Mahogany	CC - agree with comments
Enri	F	Marcus - trees that failed	Mangifera indica - Mango	CC - small sample for comment
Jennifer	F	Marcus - trees that failed	Poinciana	CC - agree with comments
Paul	Survey	Marcus - Trees that stood up well	Alstonia actinophylla	CC - agree with comments
Lizzy	F	Marcus - Trees that stood up well	Maranthes	CC - agree with comments
Horizon	Survey	Marcus - Trees that stood up well	Frangipani	CC - agree with comments
Carol	F	Marcus - Trees that stood up well	Lilly Pilly Syzygium smithii	CC - not on list
Craig	F	Marcus - Trees that stood up well	Mangifera indica - Mango	CC - small sample for comment
Lizzy	F	Marcus - Trees that stood up well	Mangifera indica - Mango	CC - small sample for comment
Carol	F	Marcus - Trees that stood up well	Maraya Mock Orange	CC - not a tree
Sally	F	Marcus - Trees that stood up well	Poinciana	CC - small sample for comment
Irene	F	Marcus - Trees that stood up well	Tamarind, beauty leaf, Milkwood, burdekin plum	CC - agree with comments
Veronica	F	Replanting - Species Suggestion	Banyan	CC - agree with comments
Mag	F	Replanting - Species suggestion - Natives	Marathes, Allosyncarpias Syzygiums	CC - agree with comments
Sue	F	Replanting - Species suggestion - Natives	Natives	CC - noted
David	F	Replanting - Species suggestion - Natives	Natives	CC - noted
Judith	F	Replanting - Species suggestion - Natives	Natives	CC - noted
Shirley	F	Replanting - Species suggestion - Natives	Natives	CC - noted

David	F	Replanting - Species suggestion - Natives & Fruit	Natives & fruit	CC - noted
Jason	F	Replanting - Species suggestion - Termites	termite resistant	CC - noted
JB	survey	Replanting - Species suggestions	Albizia Saman	CC - agree with comments
FC	Survey	Replanting - Species suggestions	Bamboo	CC - not a tree
radhika	survey	Replanting - Species suggestions	Banyan	CC - agree with comments
Jb	survey	Replanting - Species suggestions	beauty leaf.	CC - agree with comments
Sub #3 JF	W/O	Replanting - Species suggestions	Boab Tree	CC - agree with comments
PT	Survey	Replanting - species suggestions	bougainvillea	CC - not a tree
MK	survey	Replanting - Species suggestions	Celtis phillippensis	CC - now included on list
Sub #4 MM	W/O	Replanting - Species suggestions	*Cordia subcordata*	CC - now included on list
RK	survey	Replanting - Species suggestions	Erythina vespertilio/variegata (coral tree)	CC - now included on list
RK	Survey	Replanting - Species suggestions	Fragrea Racemsa	CC - now included on list
Sub #1 HJ	W/O	Replanting - Species suggestions	Frangipani	CC - agree with comments
Brad	F	Replanting - Species suggestions	Fruit	CC - variable performance
Sub #4 MM	W/O	Replanting - Species suggestions	*Ganophyllum falcatum*	CC - agree with comments
Sub #3 JF	W/O	Replanting - Species suggestions	Golden Cane	CC - agree with comments
radhika	survey	Replanting - Species suggestions	Mangifera indica - Mango	CC - agree with comments
Sub #4 MM	W/O	Replanting - Species suggestions	*Miliusa brahei*	CC - now included on list
PJ	Survey	Replanting - Species suggestions	Native Edible	CC - noted
Ennero	Survey	Replanting - Species suggestions	Palms	CC - variable performance
MK	survey	Replanting - Species suggestions	Pittosporum moluccanum/P. ferrugineum -	CC - noted
Sub #1 HJ	W/O	Replanting - Species suggestions	Poinciana	CC - disagree
Sub #3 JF	W/O	Replanting - Species suggestions	Swamp Bloodwood	CC - agree with comments
e-azul	survey	Replanting - Species suggestions	Syzygium suborbiculare	CC - agree with comments
TW	survey	Replanting - Species suggestions		CC - noted
Wati	F	Replanting - Species suggestions - Fruit	Mangifera indica - Mango rambutan mangosteen	CC - noted
Paul	Survey	Species comment	Khaya	CC - noted
Paul	Survey	Species comment	Mangifera indica - mango Mangifera indica	CC - noted

JKL	Survey	Species to add to lists	Anitdesma ghaesembilla	CC - included except for pandanus
Harlay	Survey	Species to add to lists	Browneas	To be added with saracca
Harlay	Survey	Species to add to lists	Cassia species	On list
JKL	Survey	Species to add to lists	Cordia subcordata	On list
JKL	Survey	Species to add to lists	Cyclophyllum schultzii	On list
JKL	Survey	Species to add to lists	Fragraea racemosa	On list
JKL	Survey	Species to add to lists	Gardenia fucata	On list
JKL	Survey	Species to add to lists	Grevillea decurrens	On list
JKL	Survey	Species to add to lists	Helicia australasica	On list
JKL	Survey	Species to add to lists	Micromelum minutum	On list
JKL	Survey	Species to add to lists	Pandanus basedowii	CC - Not a tree
JKL	Survey	Species to add to lists	Pandanus spiralis	CC - Not a tree
Harlay	Survey	Species to add to lists	Saracas	To be added
JKL	Survey	Species to add to lists	Vitex glabrata	To be added
GR	Survey	suggestion		CC - noted
*CC - Committee Consensus				

Replanting Darwin - The right tree in the right place

The loss of trees in Darwin during Cyclone Marcus was significant. Over 10,000 trees fell on Council land.

Many in our Community are understandably saddened by the loss of trees and want to know what Council is going to do, how they can have their say and also get involved with the replanting.

After Cyclone Marcus Council conducted a tree survey (of 2857 trees across 40 parks) and set up the Tree Re-establishment Advisory Committee (TRAC) to advise Council.

The aim is to have a comprehensive plan for replanting and to avoid the mistakes of the past.

• Facts and Stats on trees in Cyclone Marcus from the Survey

- 15.4% of total trees surveyed were uprooted.
- Australian natives had a much lower rate of damage 20.9% compared with exotic species 39.7%
- Native Black Wattle (*Acacia auriculiformis*) had high damage rates with 29.8% being uprooted.
- 66% of African Mahoganies (*Khaya senegalensis)* were uprooted.
- Banyan trees (*Ficus virens*) did well and had a high rate 53.5% of nil damage.
- Pre-existing root damage was a key factor in trees being uprooted.

TRAC and the Tree Replanting Consultation

This consultation is part of the work being done by the TRAC Committee.

The Committee has now assessed the cyclone resilience of 200-plus tree species on Council land and this Draft List is released for comment.

Species have been rated as high, medium, low or inconclusive cyclone resilience. This determines whether each species is recommended (or not) for replanting.

There is no one perfect tree for Darwin. A range of trees of varying ages and attributes are needed. It is all about having the right tree in the right place.

The Committee is also looking at best practice in re-establishing trees in Darwin from propagation to planting and looking after the trees.

We want your feedback

The Committee want to hear from any interested or expert members of the community.

Areas for comment include:

- **Tree species that may be missing from the list,**
- **The categorization of the cyclone resilience as either high, medium or low**
- **Information on tree species in the 'Inconclusive' category.**
- **Any other comments**

FEEDBACK CLOSES **14 october**

Have your say today

engage.darwin.nt.gov.au/trc

- Go online to give your feedback or,
- Email us on engage@darwin.nt.gov.au or,
- Phone the Community Engagement Team 89 300 300.

The African Mahogany

More on the Cyclone Ratings

It's not all about the rating

Many factors can compromise the stability of an individual tree in a storm event including root damage, poor form, poor maintenance and insect attack.

Pre-existing root damage (from construction activities, trenching, and lawnmowers) is a key factor in tree instability.

Despite the resilience category given to a tree, there is always a risk that any individual tree is potentially unstable in a major storm.

Choosing the right tree for a site is also about factors such as proximity to infrastructure, space constraints, soil depth, watering regime, purpose of the tree and so on.

There may be species that are highly cyclone resilient but would not be planted in particular locations for other reasons such as being allergenic/poisonous, having nuisance fruits or attracting nuisance wildlife such as bats.

The story of the African Mahogany (*Khaya senegalensis)* in Cyclone Marcus is an interesting one.

66% of the African Mahoganies in the survey areas were uprooted. This is 4 times higher than the average. The large size of many Mahoganies is a key factor.

19.3% of the uprooted trees caused infrastructure damage (much higher than the average of 3.3%) due to their size.

Manual irrigation was associated with a higher rate of tree damage and uprooting.

An unexpected finding was that in areas with shallow gravelly soils there were lower rates of major tree damage compared with areas with deeper soils. This is a surprising result as shallow soils under laid with unweathered rock are often blamed for tree uprooting. This could be a result of these deeper soils being more saturated following heavy monsoonal rains previous to the cyclone.

What do the categories of Cyclone Resilience mean?

Category: HIGH CYCLONE RESILIENCE

- Tree species with a high cyclone resilience are generally stable with no damage, or with minimal damage confined to smaller branches.
- The Tree Re-establishment Advisory Committee recommends these trees below for replanting.

Category: MEDIUM CYCLONE RESILIENCE

- Tree species with a medium cyclone resilience are generally stable but with some tendency for trunk splitting and/or major branch drop.
- These trees can be considered for planting in certain locations based on an assessment of the risk they pose to people and property.
- Species in this category may provide an important contribution to the diversity of the urban forest, which is essential for wildlife, amenity and the long term sustainability of urban forests.

Category: LOW CYCLONE RESILIENCE

- Tree species with a low cyclone resilience have significant uprooting and major damage.

Category: INCONCLUSIVE CYCLONE RESILIENCE

- Tree species with an Inconclusive cyclone resilience rating are trees where there is limited information on cyclone resilience. This may be due to species with insufficient numbers planted or time since planting.
- These trees may be appropriate to plant on a trial basis in areas of low risk to people and property until such time as they can be evaluated or more information becomes available.

The right tree in the right place: It's not all about the rating

There is no one perfect tree for Darwin. A range of trees of varying ages and attributes are needed.

It is all about having the right tree in the right place.

Many factors can compromise the stability of an individual tree in a storm event including insect attack, poor form, poor maintenance and root damage.

Despite the resilience category given to a tree, there is always a risk that any individual tree is potentially unstable in a major storm.

Choosing the right tree for a site is also about factors such as proximity to infrastructure, space constraints, soil depth, watering regime, purpose of the tree and so on.

There may be species that are highly cyclone resilient but would not be planted in particular locations for other reasons such as being allergenic/poisonous, having nuisance fruits or attracting nuisance wildlife such as bats.

Category: HIGH CYCLONE RESILIENCE

High resilience trees generally stable and no or minimal damage confined to smaller branches. *These trees are recommended for replanting. Note: species marked as Invasive and are not recommended for replanting despite cyclone resilience.*

BOTANICAL NAME	COMMON NAME	ORIGIN
Adansonia gregorii	Boab	NT Native
Aidia racemosa	Archer Cherry	NT Native
Alstonia scholaris	White Cheesewood	Aus Native/Invasive
Alstonia actinophylla	Northern Milkwood	NT Native
Archontophoenix alexandrea	Alexandra Palm	Australian Native
Arfeuillea arborescens	Hop Tree	Exotic
Artocarpus heterophyllus	Jackfruit	Exotic
Asteromyrtus magnifica		NT Native
Asteromyrtus symphyocarpa	Liniment Tree	NT Native
Azadirachta indica	Neem	Exotic/Invasive
Banksia dentata		NT Native
Barringtonia asiatica	Poison Tree	NT Native
Bombax ceiba	Kapok Tree	NT Native
Brachychiton diversifolius	Kurrajong	NT Native
Browneopsis ucayalina		Exotic
Buchanania obovata	Green Plum	NT Native
Buchanania arborescens	Little Gooseberry Tree	NT Native
Callistemon viminalis	Weeping Bottlebrush	Australian Native
Callitris intratropica	Northern Cypress Pine	NT Native
Calophyllum inophyllum	Beauty Leaf	NT Native
Calophyllum sil		NT Native
Canarium australianum	Melville Island White Beech	NT Native
Carallia brachiata	Bush Current	NT Native
Cassia fistula	Golden Shower	Exotic
Cassia nodosa	Rainbow Shower	Exotic
Castanospermum australe	Black Bean	Australian Native
Casuarina equisetifolia	Coastal She-Oak	NT Native
Citrus latifolia	Lime	Exotic
Cocos nucifera	Coconut Palm	Exotic
Coelospermum reticulatum		NT Native
Corymbia ptychocarpa	Swamp Bloodwood	NT Native
Cupaniopsis anacardioides	Tuckeroo	NT Native
Denhamia obscura	Denhamia	NT Native
Diospyros compacta	Australian Ebony	NT Native
Dypsis madagascariensis	Malagasy Palm	Exotic
Dypsis lutescens	Golden Cane	Exotic

Category: HIGH CYCLONE RESILIENCE

High resilience trees generally stable and no or minimal damage confined to smaller branches.

These trees are recommended for replanting. Note: species marked as Invasive and are not recommended for replanting despite cyclone resilience.

BOTANICAL NAME	COMMON NAME	ORIGIN
Elaeis guineensis	African Oil Palm	Exotic
Erythrophleum chlorostachys	Ironwood	NT Native
Eucalyptus apodophylla	White bark	NT Native
Eucalyptus herbertiana	Herbert's Gum	NT Native
Eucalyptus nesophila	Melville Island Bloodwood	NT Native
Ficus virens	Banyan	NT Native
Ficus racemosa	Cluster Fig	NT Native
Ficus opposita	Sandpaper Fig	NT Native
Ficus scobina	Sandpaper Fig	NT Native
Ficus coronulata	Peach-Leaf Fig	NT Native
Gardenia megasperma		NT Native
Gmelina arborea	Gmelina	Exotic/Invasive
Grevillea angulata	Holly Leaf Grevillea	NT Native
Grevillea heliosperma	Rock Grevillea	NT Native
Hibicus tiliaceous	Beach Hibiscus	NT Native
Hibicus tiliaceous var rubra	Red Beach Hibiscus	NT Native
Horsefieldia australiana	Nut Horsfieldia	NT Native
Hydriastele wendlandiana	Florence Falls Palm	NT Native
Hyophorbe verschaffeltii	Spindle palm	Exotic
Jacksonia dilatata	Jacksonia	NT Native
Kigelia pinnata	Sausage Tree	Exotic
Lagerstroemia indica	Crepe Myrtle	Exotic
Latania loddigesii	Blue Latan Palm	Exotic
Leptospermum madidum	Weeping Tea Tree	NT Native
Licuala ramsayii	Queensland Fan palm	Australian Native
Livistona humilis	Sand Palm	NT Native
Livistona inermis	Whispy Fan Palm	NT Native
Livistona mariae subsp. rigida	Mataranka Fan Palm	NT Native
Livistona muelleri	Northern Cabbage Palm	Australian Native
Livistona benthamii	Benthams Fan Palm	NT Native
Lophostemon lactifluus	Swamp box	NT Native
Lophostemon grandiflorus subsp. riparius	Northern Swamp Box	NT Native
Maniltoa lenticellata	Silk handkerchief tree	Australian Native
Maranthes corymbosa	White Cloud Tree	NT Native

Category: HIGH CYCLONE RESILIENCE

High resilience trees generally stable and no or minimal damage confined to smaller branches.

These trees are recommended for replanting. Note: species marked as Invasive and are not recommended for replanting despite cyclone resilience.

BOTANICAL NAME	COMMON NAME	ORIGIN
Melaleuca argentea	Silver-Leaved Paperbark	NT Native
Melaleuca bracteata	Black tea tree	NT Native
Melaleuca cajuputi	Paperbark	NT Native
Melaleuca dealbata	Paperbark	NT Native
Melaleuca leucadendra	Weeping Paperbark	NT Native
Melaleuca nervosa	Fibrebark	NT Native
Melaleuca minutifolia	Paperbark	NT Native
Mimusops elengi var. “cultivated”	Mimusops Red Condoo	Exotic
Mimusops elengi var “NT native”	Mimusops	NT Native
Mimusops elengi var “street elegance”	Mimusops "Street elegance"	Exotic
Myristica insipida	Wild Nutmeg	NT Native
Nauclea orientalis	Leichardt Tree	NT Native
Persoonia falcata	Milky Plum	NT Native
Petalostigma pubescens	Quinine Tree	NT Native
Phaleria clerodendron	Butterfly Tree/Scented Daphne	Australian Native
Planchonia careya	Cocky Apple	NT Native
Pleiogynium timoriense	Burdekin Plum	Australian Native
Plumeria obtusa	Singapore Frangipani	Exotic
Plumeria rubra	Frangipani	Exotic
Ptychosperma macarthurii	Macarthur Palm	NT Native
Schleichera oleosa	Ceylon Oak	Exotic
Sterculia quadrifida	Peanut Tree	NT Native
Syzygium armstrongii	Bush Apple	NT Native
Syzygium fibrosum	Small Red Bush Apple	NT Native
Syzygium forte	White Bush Apple	NT Native
Syzygium suborbiculare	Red Bush Apple	NT Native
Syzygium nervosum	Daly River Satinash	NT Native
Syzygium eucalyptoides subsp. eucalyptoides		NT Native
Tabernaemontana orientalis	Iodine Bush	NT Native
Tamarindus indica	Tamarind	Exotic
Terminalia ferdinandiana	Billy Goat Plum	NT Native
Timonius timon	Tim-Tim	NT Native
Veitchia merillii	Manilla palm	Exotic
Xanthostemon paradoxus	Bridal Tree	NT Native

Category: MEDIUM CYCLONE RESILIENCE

Medium - Trees generally stable but with tendency for trunk splitting and/or major branch drop.

These trees would be considered for planting in certain locations based on an assessment of the risk that would pose to people and property at each location.
Species in this category provide an important contribution to the diversity of the urban forest, which is essential for wildlife, amenity and long term sustainability of urban forests.

BOTANICAL NAME	COMMON NAME	ORIGIN
Acacia latescens		NT Native
Adansonia digitata	African Boab	Exotic
Albizia lebbeck	White Siris	NT Native
Albizia saman	Rain Tree	Exotic
Allosyncarpia ternata	Allosyncarpia	NT Native
Alphitonia excelsa	Red Ash	NT Native
Artocarpus altilis	Breadfruit	Exotic
Averrhoa carambola	Star Fruit	Exotic
Barringtonia acutangula	Freshwater Mangrove	NT Native
Bismarkia nobilis	Bismark Palm	Exotic
Carpentaria acuminata	Carpentaria Palm	NT Native
Cassia siamea	Siamese cassia	Exotic
Casuarina papuana		Exotic
Clerodendrum floribundum	Clerodendrum	NT Native
Corymbia arnhemensis	Katherine Gorge Bloodwood	NT Native
Corymbia bella	Ghost Gum/White Gum	NT Native
Corymbia papuana	Ghost Gum	Australian Native
Corymbia polysciada	Apple Gum	NT Native
Delonix regia	Poinciana	Exotic/Invasive
Dillenia alata	Red Beech	NT Native
Dillenia indica	Elephant Apple	Australian Native
Diospyros nigra	Black Sapote	Exotic
Eucalyptus alba	White Gum/Salmon Gum	NT Native
Eucalyptus bigalerita	Northern Salmon Gum	NT Native
Eucalyptus camaldulensis	River Red Gum	NT Native
Eucalyptus miniata	Darwin Woollybutt	NT Native
Eucalyptus tectifica	Darwin box	NT Native
Eucalyptus tetrodonta	Northern Stringybark	NT Native
Eucalyptus tintinnans	Hills Salmon Gum	NT Native
Ficus longifolia		Exotic
Ganophyllum falcatum	Scaly Ash	NT Native

Category: MEDIUM CYCLONE RESILIENCE

Medium - Trees generally stable but with tendency for trunk splitting and/or major branch drop.

These trees would be considered for planting in certain locations based on an assessment of the risk that would pose to people and property at each location.

Species in this category provide an important contribution to the diversity of the urban forest, which is essential for wildlife, amenity and long term sustainability of urban forests.

BOTANICAL NAME	COMMON NAME	ORIGIN
Grevillea refracta	Silver-Leaf Grevillea	NT Native
Lagerstroemia speciosa	Pride Of India	Exotic
Monoon australe	Northern Territory Polyalthia	NT Native
Morinda citrifolia	Rotten Cheesefruit	NT Native
Pittosporum moluccanum		NT Native
Polyalthia longifolia	Polyalthia	Exotic
Polyalthia longifolia subsp. pendula	Indian Mast Tree	Exotic
Psidium guajava	Guava	Exotic
Pterocarpus indicus	PNG Rosewood	Exotic
Roystonea regia	Cuban Royal Palm	Exotic
Staphylea pinnata	European Bladdernut	Exotic
Syzygium angophoroides	Satinash	NT Native
Tabebuia aurea	Silver Trumpet Tree	Exotic
Tabebuia pallida	Pink Trumpet Tree	Exotic
Tabebuia palmerii	Pink Trumpet Tree	Exotic
Tabebuia rosea	Rosy Trumpet Tree	Exotic
Tectona grandis	Teak	Exotic
Terminalia catappa	Indian Almond	NT Native
Terminalia microcarpa	Damson Plum	NT Native
Terminalia platyphylla	Wild Plum	NT Native
Xanthostemon chrysanthus	Golden Penda	Australian Native

Category: LOW CYCLONE RESILIENCE

Low - Trees with significant uprooting and major damage.

The Tree Re-establishment Advisory Committee does not recommend the below trees for replanting.

BOTANICAL NAME	COMMON NAME	ORIGIN
Acacia auriculiformis	Black Wattle	NT Native
Acacia dunnii	Elephant Ear Wattle	NT Native
Acacia torulosa		NT Native
Adenanthera pavonina	Red Bead Tree	NT Native
Bauhinia variegata	Purple Bauhinia	Exotic
Caesalpinia ferrea	Leopard Tree	Exotic
Caryota sp	Fishtail Palm	Exotic/Invasive
Cascabela thevetia	Yellow Oleander	Exotic/Invasive
Citharexylum spinosum	Fiddlewood	Exotic
Dodonea platyptera	Hop Bush	NT Native
Ficus benjamina	Weeping Fig	Australian Native
Ficus microcarpa subsp. hillii	Hill's Weeping Fig	Australian Native
Ficus rubignosa	Port Jackson Fig	Australian Native
Grevillea parallela	Silver Oak	NT Native
Grevillea pteridifolia	Fern-Leaved Grevillea	NT Native
Khaya grandifolia	Big Leaf Mahogany	Exotic
Khaya nyasica	African Mahogany	Exotic
Khaya senegalensis	African Mahogany	Exotic
Mangifera indica	Mango	Exotic
Millettia pinnata	Indian Beech	NT Native
Peltophorum pterocarpum	Yellow Flame Tree	NT Native
Pterocarpus indicus subsp. pendula	Weeping Rosewood	Exotic
Schefflera actinophylla	Umbrella Tree	NT Native
Spathodea campanulata	African Tulip	Exotic
Syzygium cumini	Java Plum	Australian Native
Wodyetia bifurcata	Fox Tail Palm	Australian Native
Wrightia pubescens	Wrightia	NT Native

Category: INCONCLUSIVE CYCLONE RESILIENCE

Inconclusive - Limited information due to species with insufficient numbers planted or time since planting to form an opinion. These plants may be used on a trial basis in areas of low risk to people and property until such time as they can be evaluated or more information becomes available.

If you have had any knowledge or experiences with these trees in regards to cyclone resilience please share with us through our comments page.

BOTANICAL NAME	COMMON NAME	ORIGIN
Berrya cordifolia	Trincomalee	Exotic
Brachychiton rupestris		Australian Native
Casuarina cunninghamiana	Riverine Casuarina	NT Native
Corymbia jacobsiana	String Barked Bloodwood	NT Native
Corymbia bleeseri	Smooth stemmed bloodwood	NT Native
Cyclophyllum schultzii	Canthium	NT Native
Diospyros maritima	Broad Leaved Ebony	NT Native
Eucalyptus oligantha	Broad-leaved Box	NT Native
Eucalyptus phoenicea	Scarlet Gum	NT Native
Ficus brachypoda	Rock fig	NT Native
Gauzuma ulmifolia	West Indian Elm	Exotic
Lyrata pandurata	Fiddleleaf fig	Exotic
Melicope elleryana	Euodia	NT Native
Miliusa brahei	Miliusa	NT Native
Myoporum acuminatum	Boobialla	Australian Native
Pittosporum angustifolium	Native Apricot	NT Native
Sterculia holtzei		NT Native
Syzygium jambos	Rose Apple	Exotic
Syzygium minutuliflorum	Gove Satinash	NT Native
Terminalia arostrata	Nutwood	NT Native
Terminalia bellericia	Bahera	Exotic
Terminalia melanocarpa		Australian Native