Business Papers

1st Ordinary Council Meeting

Tuesday, 17 July 2018
5.30pm

CITY OF DARWIN

Notice of Meeting

To the Lord Mayor and Aldermen

You are invited to attend a 1st Ordinary Council Meeting to be held in the Council Chambers, Level 1, Civic Centre, Harry Chan Avenue, Darwin, on Tuesday, 17 July 2018, commencing at 5.30pm.

SCOTT WATERS
CHIEF EXECUTIVE OFFICER

CITY OF DARWIN

NINETEENTH ORDINARY MEETING OF THE TWENTY-SECOND COUNCIL

TUESDAY, 17 JULY 2018

MEMBERS: The Right Worshipful, Lord Mayor, K Vatskalis, (Chair); Member A J Arthur; Member J Bouhoris; Member S Cullen; Member J A Glover; Member G J Haslett; Member R M Knox; Member G Lambrinidis; Member S J Niblock; Member M Palmer; Member P Pangquee; Member R Want de Rowe; Member E L Young.

OFFICERS: Chief Executive Officer, Mr S Waters; Deputy Chief Executive Officer, Dr D Leeder; Acting General Manager City Performance, Mr L Carroll; Acting General Manager City Operations, Mr N Kleine; Acting General Manager City Life, Mr M Grassmayr; Acting General Manager City Futures, Ms S Gamble; Committee Administrator, Mrs P Hart.

Enquiries and/or Apologies: Penny Hart
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1. ACKNOWLEDGEMENT OF COUNTRY

2. THE LORD'S PRAYER

3. MEETING DECLARED OPEN

4. APOLOGIES AND LEAVE OF ABSENCE
Common No. 2695036

4.1 Apologies

4.2 Leave of Absence Granted

THAT it be noted Member R M Knox is an apology due to a Leave of Absence previously granted on 26 June 2018 for the period 17 to 22 July 2018.

4.3 Leave of Absence Requested

5. ELECTRONIC MEETING ATTENDANCE
Common No. 2221428

5.1 Electronic Meeting Attendance Granted

5.2 Electronic Meeting Attendance Requested

6. DECLARATION OF INTEREST OF MEMBERS AND STAFF
Common No. 2752228

6.1 Declaration of Interest by Members

6.2 Declaration of Interest by Staff

7. CONFIRMATION OF MINUTES OF PREVIOUS MEETING/S

Common No. 1955119

7.1 Confirmation of the Previous Ordinary Council Meeting

THAT the tabled minutes of the previous Ordinary Council Meeting held on Tuesday, 26 June 2018, be received and confirmed as a true and correct record of the proceedings of that meeting.

7.2 Business Arising

8. MATTERS OF PUBLIC IMPORTANCE

9. DEPUTATIONS AND BRIEFINGS

Nil

10. PUBLIC QUESTION TIME

11. CONFIDENTIAL ITEMS

Common No. 1944604

11.1 Closure to the Public for Confidential Items

THAT pursuant to Section 65 (2) of the Local Government Act and Regulation 8 of the Local Government (Administration) Regulations the meeting be closed to the public to consider the following Confidential Items:-

Item	Regulation	Reason
C24.1	8(c)(iv)	information that would, if publicly disclosed, be likely to prejudice the interests of the council or some other person
C27.1.1	8(c)(i)	information that would, if publicly disclosed, be likely to cause commercial prejudice to, or confer an unfair commercial advantage on, any person
C27.2.1	8(c)(iv)	information that would, if publicly disclosed, be likely to prejudice the interests of the council or some other person

11.2 Moving Open Items Into Confidential

11.3 Moving Confidential Items Into Open

12. PETITIONS

13. NOTICE(S) OF MOTION

Nil

14.1 OFFICERS REPORTS (ACTION REQUIRED)

ENCL: YES	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM: 14.1.1

LONG TERM FINANCIAL PLAN 2018 TO 2028 UPDATE ADOPTION

REPORT No.: 18CP0066 IF:ks COMMON No.: 2337805 DATE: 17/07/2018

Presenter: Acting General Manager City Performance, Liam Carroll

Approved: Acting Chief Executive Officer, Diana Leeder

PURPOSE

The purpose of this workshop is to present to Council the Draft Long Term Financial Plan Update 2018 to 2028.

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
5 Effective and Responsible Governance
Outcome
5.5 Responsible financial and asset management
Key Strategies
5.5.1 Manage Council's business based on a sustainable financial and asset management strategy

KEY ISSUES

- The Council should update its Long Term Financial Plan (LTFP) annually.
- The update ensures Council's financial sustainability and helps to inform the annual process.
- The updated LTFP reflects discussions and decisions made during Council's 2018/19 budget development deliberations. Council's Municipal Plan that incorporates the Budget for 2018/19 was adopted by Council at the 2nd Ordinary Council Meeting on 26 June 2018.
- Taking ownership of street lighting assets, the ongoing depreciation, repairs and maintenance are reflected in the LTFP for the first time.
- The LTFP continues to be indicative of Council's ability to sustain current service levels including infrastructure renewal and some capacity to develop additional assets and services for population growth.
- The LTFP is now presented to Council for adoption at **Attachment A**.

RECOMMENDATIONS

A. THAT Report Number 18CP0066 IF:ks entitled Long Term Financial Plan 2018 to 2028 Update Adoption, be received and noted.

B. THAT Council adopt the updated Long Term Financial Plan at **Attachment A** to Report Number 18CP0066 IF:ks entitled Long Term Financial Plan 2018 to 2028 Update Adoption, and furthermore that a new Long Term Financial Plan be developed following finalisation of the Strategic Plan, to inform the 2019/2020 budget development process.

BACKGROUND

Council endorsed its updated Long Term Financial Plan 2016 - 2026 at its 1st Ordinary Council Meeting held on Tuesday 11 October 2016:

DECISION NO.21\3192 (31/03/15)

2016-26 Long Term Financial Plan
Report No. 16A0082 MC:je (11/10/16) Common No. 2337805

A. THAT Report Number 16A0082 MC:je entitled 2015-16 Long Term Financial Plan 2016 to 2026, be received and noted.

*B. THAT Council endorse the updated Draft Long Term Financial Plan 2016 to 2026 in **Attachment A** to Report Number 16A0082 MC:je entitled Long Term Financial Plan 2016 to 2026.*

Since then Council has adopted its Municipal Plan/Budget for both 2017/18 and 2018/19 and there have been a number of changes in circumstances which warrant inclusion and updating of the Long Term Financial Plan. A number of these matters were identified as part of the 2018/19 Municipal Plan workshop held on the 6 November 2017 and subsequent 2018/19 Budget workshops.

DISCUSSION

Assumptions

The rates and charges income in the LTFP have been set at a 3.0% increase per annum, but are subject to review and adjustment at the time of Council adopting its draft Municipal Plan each year.

The assumptions and estimates result in some ratios falling outside Council's adopted preferred range. Each of these is addressed and discussed below:

- **Rates ratio:** The adopted preferred range is 60-70% of Council revenue being achieved through rates (property tax). Less than 60% would mean that Council is at higher risk of being too reliant on fees & charges which may be volatile and unreliable. Greater than 70% might suggest that not enough is

coming from fees & charges. The results are within preferred range until 2022/23 when they trend to exceeding 70% by a relatively small margin.

- **Operating Surplus / (-Deficit):** The adopted preferred result is break even before counting income/contributions for capital purposes. This measure tests that annual recurring operating income covers all expenses including depreciation/consumption of existing assets. The measure is considered to be relatively conservative as some income/contributions for capital purposes inevitably goes towards making good depreciation/consumption of existing assets. In some years the results are an improvement on the current plan although less than break even, by a maximum of $6.6M in (2018/19) and trending to greater than break even by 2023/24. This measure should continue to be monitored.

- **Sustainability Ratio:** Included in the Plan for the first time are two new ratios that were born out of the Deloitte Access Economics Financial Sustainability Review that was considered by Council in early 2018. The sustainability ratio recommended by Access Economics is detailed below:

  Sustainability or Operating Result Ratio (Operating revenue (excluding capital revenue) minus operating expenses expressed as a percentage of operating revenue).

  If a council can maintain a positive underlying operating result over time (that is operating revenue in excess of operating expenses including depreciation), then sufficient revenue is being generated to offset the cost of service provision. It means that ratepayers and service recipients in any year are collectively 'paying their way' and that revenue generated from offsetting depreciation should help ensure that, on average over time, approximately sufficient net cash inflow is generated to substantially accommodate asset renewal outlay needs.

  The prime objective of a council's financial strategy should in most circumstances be to ensure that it achieves and maintains a small underlying operating surplus on an ongoing basis. If it can do that then it should be able to maintain service levels and address asset management needs as and when required.

  Deloitte's believe that it is critical that councils have regard to impacts on financial sustainability when determining service levels. Operating expenses are driven by service levels. Any assessment of a council's financial sustainability is predicated on the range and level of services provided. Acquisition of a new additional asset, or upgrading of an existing asset to provide higher levels of services, even if the capital expenditure is funded by a grant, will lead to higher subsequent operating costs for a council in the form of ongoing asset maintenance and depreciation.

Deloitte Access Economics also favours a focus on 'underlying' performance. That is the reported operating result adjusted for one-off or temporary factors such as the recent abnormal timing of ongoing Commonwealth Financial Assistance Grants.

Council's Sustainability Ratio Indicator (See section 9.0 of LTFP) improves from a negative 5.6% in 2018/19 to a positive 4.5% by 2027/28. Therefore, by the end of the Plan Council's ratio is in the range recommended by Access Economics.

- **Asset Sustainability Ratio:** The adopted preferred range is expenditure on renewing aging capital infrastructure at 50% of the depreciation expense for that year. The results in the LTFP are below 50% in 5 of 10 years. The highest year is renewals of existing assets representing 69% of annual depreciation (2022/23). Some renewals are recurring/annual whereas others are cyclical. Road pavements for example are only replaced over long periods when required, but are usually a high cost. Significant replacements fall outside the 10-year period of this LTFP. During periods where there is a heavy requirement to carry out replacement/renewal such as road pavement the overall capital program has to be prioritised accordingly.

In conclusion while some ratios fall outside the Council's preferred range these are not considered significant (see above explanations). The Council should continue to monitor these and if unfavourable trends develop remedial action should be taken.

Relevant main assumptions are further detailed in the LTFP. Rate increases, parking charges and growth have been modified to reflect the external environment and Council's approaches and decisions over prior year budgets.

Completeness of LTFP and Financial Sustainability

Council's adopted definition of a sustainable financial strategy is defined as:

"Council defines a sustainable financial strategy as one which allows for the adequate provision for its programs (including capital expenditure) and services into the future with the intention that there is a predictable trend in the overall rate burden. The aim of Council's financial strategy is to allow for an equitable distribution of the costs of establishing and maintaining council assets and services between current and future ratepayers."

This is only an update of the plan rather than an in depth strategic reconsideration. It checks the Council's financial capacity to maintain services as well as provide new assets and services for population growth.

It should be recognised that the LTFP is continually developing, improving and changing. It will need further refinement as Council considers and adopts forward looking asset management plans, changing environmental and program requirements based on community engagement, satisfaction surveys and the like.

Take up of ownership of the street lighting assets is for the first time reflected in the LTFP.

There are always risks of asset impairment or environmental changes due to unpredictable events which may lead to the need to reprioritise expenditure.

Growth

Growth normally should lead to some economy of scale and this plan does factor in additional revenue and some costs relating to growth. However growth costs usually stepped and are not consistent so economies of scale are not always easy to predict.

Growth in areas such as Lyons, Muirhead, Muirhead North, 2CRU and increased densification will continue to create increased demand in planning for services such as community facilities and programs, animal and public places management and infrastructure maintenance.

New Initiatives

An allowance of approximately $1M has been provided in the LTFP as non-specific (to be determined) new initiatives that are one off capital works each year.

Asset Sales

The plan assumes asset sales of $9.M in total (mainly vehicle/fleet) over ten years.

Operational Adjustments in the Updated LTFP Include:

- On street dining revenue has been adjusted down to reflect current trends and pricing decisions.
- Developer contributions revenue recognised from 2018/19 based on past trends.
- Election expenses included every four years from 2017/18.
- Adjustments to pool revenues and expenses to recognise rearrangements during construction of new Parap Pool facility.

Parking Fees & Charges

In adopting the CBD Parking Strategy Council resolved to move to a market rate. This was identified as being 5.00% + CPI for the first 5 years. Council has allowed no increase in parking fees for the 2018/19 year. The LTFP model allows increases of the CPI of 1.5% from 2019/20 onwards.

Street Lighting

Council acquired this function from the Northern Territory Government/Power Water Corporation on 1 January 2018. An allowance has been made for capital renewals or repairs and maintenance in this plan. Some reserve funds are held to assist the transition.

Corporate Recoveries

These are assumed to increase at CPI.

Depreciation

Accounting for depreciation is a statutory requirement and is one of a number of indicators used to determine whether or not Council is renewing its assets at an acceptable rate.

Throughout the LTFP the modelled depreciation expenses respond only indicatively to asset purchases and are subject to broad assumptions and estimates.

Long Term Capital Works Program (LTCWP)

Over the 10 years of the plan capital expenditure exceeds $302M. Major projects are as summarised on the LTFP. Otherwise the LTCWP is premised on maintaining the current levels of annual infrastructure renewals with similar provisions for one-off renewals as previously required but with some timing rearrangements as would be expected as a plan progresses.

Borrowing Program

This provides for total borrowing of over the ten years of $17.2M. The major projects to be funded by loan include Barneson Boulevard ($5M), Shoal Bay Waste Management upgrade/waste disposal cells ($9.7M), Street Lighting ($6.6M) Casuarina Pool Refurbishment ($3M) and other capital projects ($4.9M).

Reserve Funds

Reserves are maintained for particular purposes as set out in the statement within the LTFP document. Before actually employing external loan funding Council should be mindful of any internal opportunities to temporarily utilise reserve funds and repay them internally prior to the time they are required.

Waste Operations/Fund

All the costs and incomes of the Waste fund are contained in the plan and do not affect the general outcome for other programs. Internal borrowing from other reserves for developments is factored in as being repaid over 10 year periods at 3% interest rates.

Financial Indicators

- Overall the income statement is positive and revenues are sufficient to cover expenses including depreciation of assets. Although the Council does aim to conservatively err on the side of having a positive income statement result before bringing capital revenue (grants and contributions) to account this is not achieved in the updated LTFP.
- Fund flows are balanced in accordance with Northern Territory legislation/regulations.
- Liquidity is maintained throughout so that named funds are cash backed and general liquidity is greater than $1 of current assets for every $1 of current liability. To achieve that it follows that all employee leave liabilities are appropriately covered.
- New borrowing totals $17.2M as set out in detail in the borrowing statement in **Attachment A** .
- Some financial ratios (KPIs) do not meet Council's preferred targets and should be monitored as the plan progresses. If an adverse trend develops remedial action may be required.

Based on the best information available this update of the LTFP is indicative of financial sustainability and should be endorsed by Council until replaced by the next update or adoption of a new plan. The LTFP now incorporates the 2018/19 budget data.

It is recommended that Council adopt the 2018/19 update of the LTFP, but that following development of Council's new strategic plan a new LTFP be developed to inform the 2019/20 budget development process.

CONSULTATION PROCESS

In preparing this report, the following External Parties were consulted:

- Terry Mathews CPA

POLICY IMPLICATIONS

This report does not propose any specific policy changes.

BUDGET AND RESOURCE IMPLICATIONS

The LTFP is entirely about budget and resource implications. The plan is indicative of financial capacity and sustainability.

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

Legal

Council is required to adopt a Long Term Financial Plan in accordance with Section 126 of the *Local Government Act* covering a period of at least four years. The Long Term Financial Plan must be kept up-to-date and contain:

(a) A statement of the major initiatives the council proposes to undertake during the period to which the plan relates; and

(b) Projections of income and expenditure for each financial year of the period to which the plan relates; and

(c) The council's proposals for the repair, maintenance, management and development of infrastructure for each financial year of the period to which the plan relates.

Council must provide the Department of Local Government a copy of the Long Term Financial Plan by 31 July in the first financial year to which the plan relates. It is best practice to review and resubmit the Long Term Financial Plan on a regular basis in line with the adoption of the budget.

Risk

- Council operates within a business risk framework in conjunction with its Risk Management & Audit Committee.
- The LTFP will be referred to the Risk Management & Audit Committee for comment following its endorsement.
- The LTFP is based on assumptions and estimates. Council manages this risk by reassessing progress and developments each year and adjusting its annual Municipal Plans and LTFP where necessary.
- Council requires its Disaster Contingency Reserve to be maintained at a minimum of $1M.
- Council’s financial sustainability was independently reviewed by Deloitte Access Economics in late 2017. No significant concerns were noted in its report.

ENVIRONMENTAL IMPLICATIONS

Council should consider its environmental and social objectives in any decision making process including the LTFP.

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

LIAM CARROLL
ACTING GENERAL MANAGER
CITY PERFORMANCE

DIANA LEEDER
ACTING CHIEF EXECUTIVE OFFICER

For enquiries, please contact Irene Frazis on 8930 0654 or email: i.frazis@darwin.nt.gov.au.

Attachment A: Draft Long Term Financial Plan – 2018 to 2028

CITY OF DARWIN

CITY OF DARWIN
2018 TO 2028
LONG TERM FINANCIAL PLAN

Tropical | Liveable | Opportunity | Choice

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1.0 Introduction

1.1 Foreword

Welcome to the City of Darwin Long Term Financial Plan. This plan covers ten years from 2018 to 2028 and replaces the previously endorsed plan (2016 to 2026).

The overall objective of this Long Term Financial Plan is to maintain current service levels, identify a capital works program that meets the asset renewal requirements, respond appropriately to population growth and to achieve a balanced budget.

There are challenges that will need to be addressed, particularly in the area of capital works and infrastructure management, but Council is actively working on meeting those challenges and ensuring that service levels are at the very least maintained or, if possible, improved.

As with all indicative forecasts, it must be acknowledged that things change over time and that long term plans are useful as a guidance tool which can identify financial issues in advance and enable a strategy or plan to be developed to deal with them. This Long Term Financial Plan has been prepared using a number of assumptions which are outlined in the document.

Statutory Requirements

Part 10.4 of the *Local Government Act* requires councils to prepare a Long Term Financial Plan for at least four financial years. The City of Darwin prepares and updates a Long Term Financial Plan covering a period of ten years on a regular basis for its own internal planning requirements.

The Long Term Financial Plan must contain:

- A statement of major initiatives the council proposes to undertake during the period to which the plan relates;
- The council's proposal for the repair and maintenance, management and development of infrastructure for each financial year of the period to which the plan relates;
- Projections of income and expenditure for each financial year of the period to which the plan relates.

1.2 CEO Executive Summary

Insert CEO pic here

The Long Term Financial Plan is a key document that assists the Council with improving its management of infrastructure and community resources. It links directly to Council's Strategic Plan and sets the framework to provide cost effective services within available resources for the duration of the plan.

City of Darwin is the custodian of about $1.0B (after accumulated depreciation) of community assets and infrastructure such as pools, community centres, libraries, other buildings, land, roads, stormwater drainage systems, street lights, shared paths, parks and reserves, including trees, plus many more.

These assets deliver important services to our community and a key issue facing all local governments throughout Australia is the management of ageing assets. City of Darwin is focussed on sound asset management principles and has in place an asset management strategy to assist Council in improving the way it delivers services.

It is pleasing to note that the Federal Government is once again providing a CPI increase adjustment to the annual general and roads financial assistance. These grants have been frozen in recent years and this reduction in funding created an extra burden on ratepayers.

Local government faces many other challenges in the future. Infrastructure maintenance obligations, including the establishment and maintenance of Council assets for current residents and future population growth, keeping up service levels within available resources and responding to the ever-changing legislative environment are just a few. It is therefore vital that we have a clear vision of how we will focus our resources in order to best service the community's needs.

Council has been persistent in its efforts to engage support from other levels of government. This is reflected in the $10M Smart Cities Grant for the Switching on Darwin Project. This project is to be funded by $5M from the Commonwealth Government, $2.5M from the NT Government and the remaining $2.5M from Council. Council will continue to invest in the infrastructure needed to provide appropriate services, facilities and opportunities to meet the future needs of Darwin City.

Insert CEO signature

Scott Waters
Chief Executive Officer

2.0 Background

2.1 City Profile

Darwin is the capital city of the Northern Territory, situated on the Timor Sea and is well-known as Australia's gateway to world class nature and cultural experiences. Darwin has a current estimated residential population of 83,465 (2016), making it by far the largest and most populated city in the Northern Territory. It is the most northerly of the Australian capital cities, and acts as the Top End's regional centre.

The municipality of Darwin is spread across 112km^2 and covers 36 suburbs plus RAAF, Navy Bases and Darwin International Airport.

Darwin People

The 2016 ABS Census shows that the single largest age group in the Darwin municipality is the 25 to 39 year olds (27.0%), with the median age of people in Darwin being 33 years old. The under 25 years old represent 32.7% of the population, whilst over 65 years old represent 7.7%. Of Darwin's population 37.3% were born overseas. The percentage of the population that identify themselves as indigenous has increased slightly to 8.7% from 8.4% since the previous Census. This is compared with an average of 2.8% across Australia. Aboriginal traditions and customs are still interwoven with daily life for Darwin's indigenous community. Within Darwin, the Larrakia people are the traditional landowners.

Darwin Economy

The Darwin economy is highly dependent on the government sector, mining and tourism. This dependence makes it highly prone to volatility, particularly once large investments wind down.

In 2018/19, the Darwin economy is expected to continue its transition to a slower growth phase following the construction boom from the Itcthys LNG project. Nevertheless the outlook for the Darwin economic growth over the next five years is 3.1% pa on average and is the equal second highest economic growth forecast of all jurisdictions behind Victoria at 3.2% pa (based on the Deloitte Access Economics Report).

The key factors in this economic growth are expected to be:

- International Goods Exports
- Private Consumption

Deloitte Access Economics (DAE) March Quarter 2018 prepared for the Northern Territory Government has forecast average growth in the following key economic indicators for the five years (2017-22):

	Northern Territory	Australia
Economic Growth Forecast	3.1%	2.9%
Employment Growth Forecast	0.4%	1.7%
Population Growth Forecast	1.3%	1.6%
Consumer Price Index (CPI)	2.1%	2.3%

Over the five years (2017-22), DAE forecasts the Territory's unemployment rate to average 4.2 per cent, the lowest unemployment rate of the jurisdictions and well below the national rate of 5.4 per cent. Despite the slowdown the outlook remains reasonably positive in relation to the overall Australian context.

Photo by David Burrow

2.2 City of Darwin

City of Darwin (formerly known as Darwin City Council) was established in 1957 and operates under the Northern Territory *Local Government Act*. There are 13 Elected Members including the Lord Mayor, all of whom are elected by the people. It has an authorised staff establishment of approximately 349 full time equivalent employees who work within five departments being:

1. Office of the Chief Executive
2. City Performance
3. City Life
4. City Operations
5. City Futures

The main public services that Council provides include:

Office of the Chief Executive
- Communications and Marketing
- Elected Members Support
- Governance

City Performance
- Property Management
- Contracts Administration
- Employee Relations
- Organisational Development
- Finance
- Information Technology
- Records
- Work Health and Safety
- Risk Management
- Strategy and Outcomes

City Futures
- Climate Change and Environment
- Planning and Development
- Business and Economic Development
- International Relations
- Car Parking
- Smart Cities

City Operations
- Asset Management
- Design
- Parks and Reserves
- Roads and Traffic Management
- Stormwater Drainage
- Street Cleaning
- Urban and Streetscape Enhancement
- Waste Management

City Life
- Libraries
- Community Development
- Darwin Safer City
- Family and Children Services
- Youth Services
- Community Events
- Recreation and Leisure Services
- Youth Services
- Darwin Entertainment Centre
- Regulatory Services
- Animal Management
- Community Engagement
- Customer Services

In 2017/18, Council raised $59.6M in rates and $6.8M in waste management charges. It received $12.9M in grants and contributions and $2.7M in interest income. Fees, charges and other income totalled $25.4M.

Total assets managed were valued at $0.953B (after accumulated depreciation). Capital expenditure in 2017/18 totalled $31.4M, depreciation $24.4M, employee costs $31.5M and materials, contracts and other expenses totalled $49.8M.

As at 30 June 2017 (audited), Council had $61.0M in cash-backed reserves. Of these $31.5M were subject to external legal restrictions. The remainder, $29.5M of these funds relate to Council strategies such as on and off street car parking ($5.4M), Carry Forward Works ($10.7M held to complete previous year's budget commitments), Asset Replacement & Refurbishment ($4.6M) Disaster Contingency ($1.0M), Plant and Vehicle Replacement ($2.5M) and Darwin Entertainment Centre ($133,000) etc.

The liquidity ratio over and above cash backed specific reserves was 0.74:1 meaning that Council has $0.74 of current assets to fund every $1.00 of current liability/debt. The deterioration in Council current ratio after subtracting reserves occurs as a result of Council taking up a provision under current liabilities of $9.5M for cell capping works at the Shoal Bay tip. This provision was taken up for the first time in 2016/17 (excluding the provision for cell capping works from current liabilities for the purposes of the calculation results in a liquidity ratio of 1.05:1 which is consistent with previous years).

Photo by Nathan Lewis

2.3 Link to Strategic Plan

The City of Darwin has adopted a Strategic Plan 'Evolving Darwin Towards 2020'. The five goals that the City of Darwin aspires to for the benefit of our community are summarised below:

1. Being part of a community that connects with the unique Darwin way of life
2. The built environment matches the Darwin lifestyle
3. Ongoing commitment to the environment and ensuring the sustainability of Darwin
4. Being recognised for our history and celebrating the arts
5. Ensuring that the City of Darwin is run in an open, efficient and accountable manner

The Long Term Financial Plan assists Council in demonstrating effective, open and responsible governance but responsible financial management underpins all of Council's core operations.

A Long Term Financial Plan:

- Needs to be underpinned by a clear financial strategy with measurable financial targets.
- Should be based on an organisation achieving its affordable service level objectives while also maintaining, or where necessary, improving its financial sustainability.
- Should include a description of the financial strategy that the plan is based on including its financial targets and their rationale.

Council has adopted the following definition of a sustainable financial strategy:

Council defines a sustainable financial strategy as one which allows for the adequate provision for its programs (including capital expenditure) and services into the future with the intention that there is a predictable trend in the overall rate burden. The aim of Council's financial strategy is to allow for an equitable distribution of the costs of establishing and maintaining council assets and services between current and future ratepayers.

The purpose of a long-term financial plan is to express in financial terms the activities that the Council proposes to undertake over the medium to longer term to achieve its stated objectives. It is similar to, but less detailed than the Annual Budget and helps guide Council's future actions depending on the longer-term revenue and expenditure proposals.

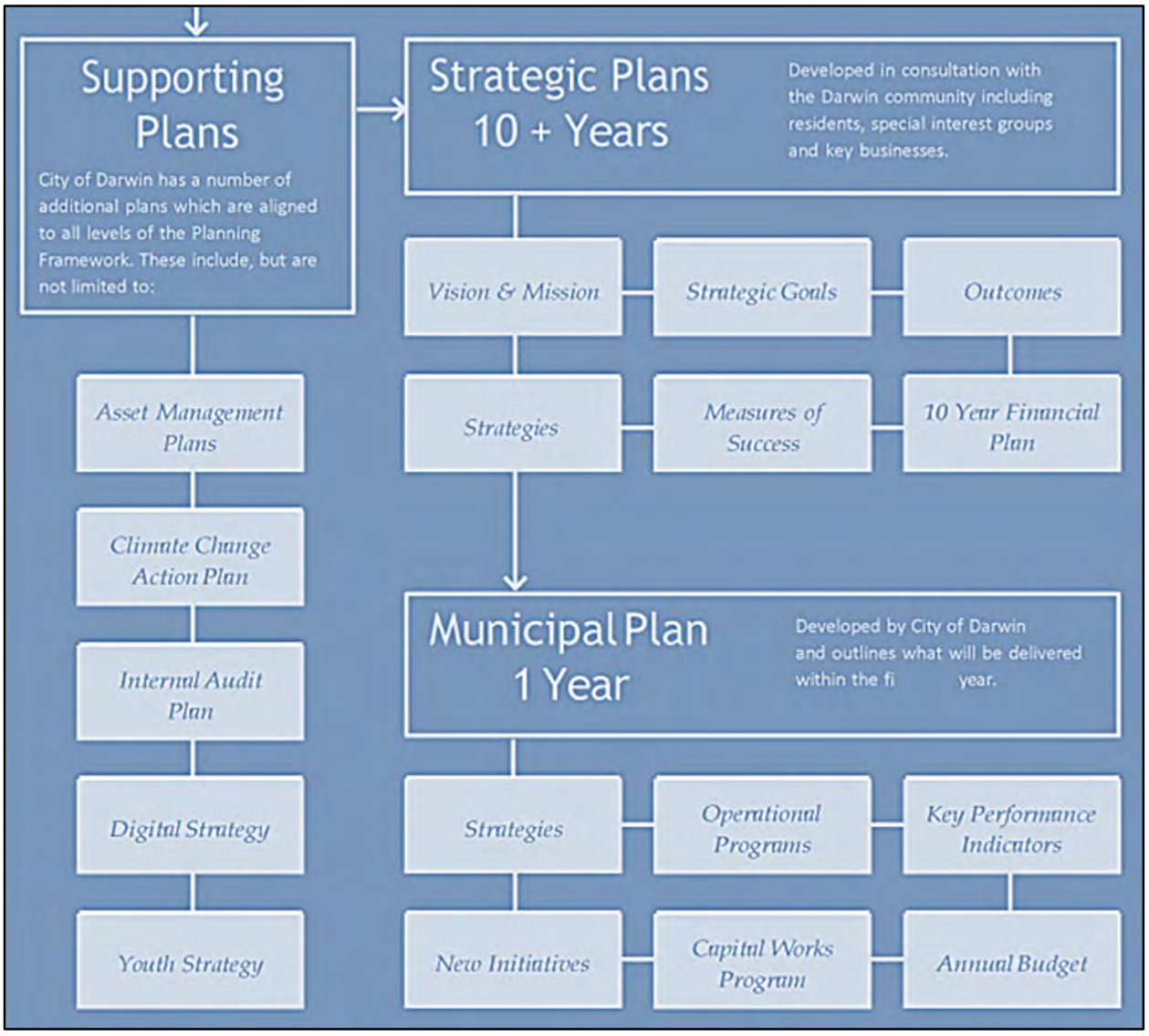
Long-term financial plans are particularly important for entities with a high level of long-lived assets and significant asset management responsibilities relative to their income base. Such entities may have long periods with modest levels of asset renewal requirements and then other periods when very significant outlays are necessary. They need to be generating revenue in an equitable manner over time and ensure that they have capacity to finance peaks in asset management and other outlays when, and including by way of borrowings where, necessary.

The preparation of a long-term financial plan generates improved information to guide Council's decisions about the mix and timings of outlays on operating activities and additional assets and the funding implications of these. Without a soundly based long-term financial plan, the Council with its significant asset management responsibilities is unlikely to have sufficient data to determine sustainable service levels with affordable asset strategies, appropriate revenue targets and treasury management.

The long-term plan is normally reviewed annually and provides a financial plan for the next 10 years. The previous plan was adopted by Council on 11 October 2016.

2.4 Current Planning Process

The City of Darwin's integrated planning and reporting process, including the Municipal Plan, works together as illustrated by the diagram below.



3.0 Major Initiatives

For the purposes of developing the Long Term Financial Plan the capital works have been based on the Ten Year Capital Works Plan (CWP) as developed by the City Operations Department including asset management planning requirements for the replacement of assets. The Ten Year Capital Works Plan is reviewed on an annual basis and provides an indication of the expected capital works requirements into the future. As can be expected with long term plans of this type, capital works scheduled in the later years of the plan can only be considered to be an indicative estimate.

The major capital initiatives proposed in the plan are as listed below.

These initiatives are measured at rough order magnitude of costs, meaning that these are estimates based on the best available information. Variances to these estimates will occur as Council obtains more information and is able to better measure the expected outcomes. All projects in the Long Term Financial Plan are proposed and do not have the full approval of Council until they are approved as part of the annual budget program.

Casuarina Pool Facility
Council has allowed $3.0M in the 2021/23 period of the LTFP Capital Works Program for refurbishment works at the Casuarina Pool.

Barneson Boulevard
This plan makes provision for a contribution of $5 million by Council to NTG for Barneson Boulevard (external borrowing). This contribution is scheduled for the 2019/20 financial year.

Multi-Storey Car Parking Development
The estimated value is $44.4M and is predicted to provide an additional 800 parking bays. Design and construction is forecasted for 2025-27. The project is proposed to be funded by CBD Car Parking Developer Contributions ($14.9M), Car Parking Shortfall Rates Reserve ($23.6M), Off & On-Street Car Parking Reserve ($0.9M) General Revenue ($5.0M).

Other Notable Capital Projects Include:

- Shared/foot paths program (new and renewals) $15.2M
- General upgrades and refurbishment works at the Darwin Entertainment Centre of $1.6M over the life of the CWP
- Civic Centre (air conditioning & roof replacement) $5.9M, 2022-28
- Lee Point Road, new works $5.6M 2018-23
- Lakeside Drive & Boulter Roads new works, $9.3M, 2018-23
- Coastal foreshore erosion & fencing works, $1.2M, 2018-26
- Shoal Bay Waste – new cells and site developments $32.6M over 10 years
- Stormwater works (new and renewals) $20.7M over 10 years
- Playground refurbishment and shade program $4.2M over 10 years
- Road renewal and reconstruction $22.9M over 10 years
- Plant & equipment renewal/replacement $31.9M over 10 years

Street Lighting:
Council acquired this function from the NTG on 1 January 2018. An allowance of $14.1

million has been made for capital renewals and upgrades in this plan. Some reserve funds are being used to assist in funding improvements to Council's lighting assets and to improve the efficiency of the system.

Photo by Kirsten Strickland

4.0 Infrastructure Management

As at 30 June 2017, Council is the custodian of community assets and infrastructure, including land, which has a total value of $0.953B after accumulated depreciation. The major asset categories are as follows:

- Land
- Buildings
- Roads
- Pathways (Footpaths, Driveways, Walkways and Cycle paths)
- Stormwater Drainage
- Other Infrastructure

Council continues to develop its Asset Management Strategy to provide high quality information on Council's infrastructure assets in order to aid its decision making process. Asset management plans for each class of assets are being developed and significant progress has been made towards upgrading and improving asset management systems.

It is expected that Council's plans for its assets over the next ten years will evolve as higher quality and more detailed data becomes available.

4.1 Road Network

The Council road network in Darwin is approximately 463km long. Maintenance expense is provided for initially at $4.5M pa, increased annually by CPI and growth factors. Street lighting; electricity costs are $1.2M pa. Council assumed responsibility of the street lighting network from 1 January 2018 and a provision of $1.4M has been made for repairs & maintenance for the first full financial year. Operating costs for lighting are anticipated to reduce to under $1.0M in 2019/20 because of the capital outlay in 2017-20 in upgrading these assets

A total of $55.3M of capital expenditure on the road network is programmed over the 10-year plan. Of this about 62% or $34.3M relates to renewals and replacements (such as road resurfacing and reconstruction). The balance of 38% or $21.0M is additional (new and improved) services (such as Barneson Boulevard and Lee Point Road).

Council aims to provide a network that best meets the comfort, safety and aesthetic needs and expectations of all road users and the community as a whole.

Works are undertaken in accordance with Australian Standard guidelines. It includes routine maintenance and operational activities relating seal and pavement repairs, traffic signals, signs, line marking, street lighting, kerbing and guttering, street trees, sweeping and cleaning, traffic monitoring and recording, and pavement and seal condition measurements. Works also include minor and major safety and traffic improvements, new street lighting, road resurfacing and major rehabilitation works.

4.2 Pathways

Council maintains a number of pathway networks throughout the city including:

- Footpaths
- Driveways
- Walkways
- Shared paths

Council will continue to actively monitor the condition of footpaths, driveways and cycle paths throughout the municipality and construct, reconstruct and maintain these facilities as required.

Council's footpath network is approximately 470km long. During the life of this plan provision for operational costs commences at $0.8M pa (thereafter adjusted for CPI and growth, note this does not include depreciation).

The total capital program for pathways over 10 years is $15.2M of which about 50% is considered to be renewing and replacing existing pathways assets with the balance being additional (new and upgraded) services.

East Point; Lake Alexander cycle path (new) $500,000 is tentatively programmed for 2020-22.

There are over 20,894 driveways within the municipality that Council maintains. An annual allocation of a minimum of $238,000 in 2018/19 and increased annually by CPI has been made to reconstruct driveways that have reached intervention level in accordance with Council's Driveway Policy.

Along with ongoing routine maintenance of the 246 walkways in Darwin an annual allocation of $87,000 increased annually by CPI is made for resurfacing of walkways. Upgrades and lighting to be installed in priority walkways as identified as part of each year's work plans receive an allocation of $75,000 also increased annually by CPI.

In addition to the cyclical and routine maintenance such as sweeping and surface repairs of the 77km long Council shared pathway network construction and reconstruction averages $606,000 pa.

4.3 Stormwater Drainage Network

Council's stormwater system comprises of approximately 351km of underground pipes, 22km of open unlined drains, 15km of open lined drains and 11,000 pits and 300 culverts.

The capital works program (new and renewals) for stormwater totals $19.4M over 10 years (averaging $1.9M pa). Of this about 4% or $750,000 relates to renewals the balance is maintenance and upgraded services. Maintenance is $0.7M in 2018/19 and is adjusted annually by CPI after that.

Council endeavours to provide and maintain a stormwater system that meets the needs of the Darwin community through continual improvements to manage flooding and safety

issues and minimise impacts from pollutants entering the system.

This is achieved through upgrading of existing systems, the installation of gross pollutants traps to collect waste as it enters or before it leaves the system, installation of subsoil drainage in areas where underground water close to the surface has damaged pavements and caused slippery footpath conditions, installation of erosion protection devices where required, and systematic minor repairs and routine maintenance.

4.4 Cleaning Services

This service is the street, public place and public toilets cleaning program plus litter bin replacements.

The 2017/18 Council budget for operations/expenses is $3.3M and is adjusted annually by CPI after that.

4.5 Other Infrastructure

Council maintains various other infrastructure assets and structures including, street and park furniture, fencing barriers, parking meters and vending machines, park equipment, office furniture, signage, gazebos, shelters, barbeques, water features and monuments, irrigation systems, lighting, footbridges and boardwalks. Annual allocations are made to ensure that adequate standards are maintained and upgrades are made where possible.

Photo by Kirsten Strickland

5.0 Projections of Income & Expenses

The projections of income and expenses are based on the 2017/18 adopted budget with some adjustments for arising matters such as:

- New contract arrangements for the operation of the swimming pools.
- Street Lighting operational costs from 1 January 2018.
- Outdoor dining, changes to fee structure.
- Additional depreciation expenses associated with waste remediation and street lighting.

Assumptions and interventions for other known factors have been applied to arrive at the forward projections such as:

- Developer contributions revenue recognised from 2018/19 based on past trends.
- Election expenses included every 4 years from 2017/18.
- Adjustments to pool revenues and expenses to recognise new contractual arrangements for swimming pools.

Discontinued activities:

There are no financial adjustments for discontinuing activities. The plan assumes that all current programs (other than one off grants and the like) will either continue or an equivalent amount would be transferred to other priorities.

Depreciation expense:

The figures for depreciation expense although they do respond to the capital expenditure program are indicative only. As stated above, additional depreciation expenses in relation with the waste remediation and street lighting have been included. Further, the active capital expenditure program which is increasing service levels through acquisition of new and better assets will tend to increase depreciation.

6.0 Assumptions

The Long Term Financial Plan has been developed with the overriding assumption that Council will prioritise projects in accordance with available funding. This assumption is in line with Council's definition of a sustainable financial strategy. Another key assumption is that Council will continue to maintain its current service levels with no reduction in staff numbers.

Growth and some limited economies of scale resulting from population increases and property development are included in the income and cost assumptions.

The Long Term Financial Plan includes the following specific assumptions:

6.1 General Assumptions

Item	Assumption	Comment
Growth	1.3%	NTG is forecasting the Territory's population to grow by an average rate of 1.3% per cent per annum, compared to an average of 1.6% per cent per annum nationally. The plan also assumes some limited economies of scale from growth.
CPI	1.5%	This is slightly lower than the most recent advice from (DAE) which is forecasting a long term CPI for Darwin for the period 2017-22 of 2.1% (March 2018).The 2018/19 Budget was formulated on a CPI increase of 1%. On this basis it is considered reasonable to allow a CPI of 1.5% over the 10years .This is slightly less than the DAE forecast.

6.2 Revenue Assumptions

Item	Assumption	Comment
Rates Increase	3.0%	Previous plans relied on a 4.5% increase pa based on the long term average since 1999-2000.This plan is based on a 3.0% rate increase pa (1.5% above the LTFP CPI allowance) to provide sufficient funding in each year of the Long Term Financial Plan. Prior to setting the budget each year Council will reconsider the general rate increase in line with available funding opportunities and requirements.
Waste Management Fees & Charges	3.0%	Annual Charges consist of waste management domestic kerbside and recycling charges. Council is currently considering significant developments and continues to improve life cycle planning.
Parking shortfall rates	CPI	Parking Rates increase each year by CPI in line with the Darwin Parking Local Rates Regulation. (This rate applies to specific CBD properties and was initiated before developer contributions policies for car parking. Revenue may reduce over time as new developments make car parking provision or capital/developer contributions).
Grants – Operating	CPI and past trends/cycles	Operating Grants include Federal Financial Assistance (CPI) and operating subsidies for the libraries (CPI).
Grants – Capital	N/A	Included as per the Ten Year Capital Works Plan plus developer contributions from 2018/19 based on past trends and future forecasts.
Grants – Capital Roads to Recovery	Funding until 2018/19	The plan includes Roads to Recovery funding until the end on the current program in 2018/19. Projects to be funded by future Roads to Recovery grant allocations will be included in the future LTFPs as formal approval is obtained.
User Charges & Fees	CPI except where otherwise stated	All other user charges & fees are increased by the CPI.
Car Parking Charges	Yr 1 no increase Yrs 2-10 CPI%	The car parking strategy indicated CPI + 5% for a number of years however this plan update moderates that to the CPI in view of the current economic situation.
Interest & Investment Revenue	2.65%	Interest is calculated on the forecast cash and investment balances.
Other Revenues	CPI	Other revenues consist of property lease income, reimbursements and sundry income.

6.3 Operating Expenditure Assumptions

Item	Assumption	Comment
Employee & Related Costs	3.5%	Statutory EB increase (2.5%) plus estimated award increment increase (1.0%). This plan allows for total 3.5% pa increase. Provision has been made for the increasing superannuation guarantee requirements (9.5% for 2013-21 then add 0.5% p.a. for each year thereafter to achieve 12% from and including 2025/26).
Materials & Contracts	1.5% except where otherwise stated	Elections are in 2021/22 and every 4 years thereafter and are provided for in the year of requirement from funds built up in the intervening years.
Interest on new external borrowings	4.0%	New external loans and any re-financing will be sensitive to changes in the interest rates. As the assumed rates are based on historic lows there is some risk of these increasing above 4%.
Interest on internal borrowings	2.65%	New internal loans from reserves are generally based on opportunity cost of interest on investments. Existing and new loans are set at 2.65% pa.
Interest - unwinding of waste facilities – net present value discounts	CPI and NPV calculation	In the determination of present value, the unwinding of the discount rate is typically recognised as a finance cost. The unwinding effectively reflects the passage of time which results in an annual increase in the liability that is to be recognised as a finance cost. The cost to council in 2016-17 of this tip provision adjustment was $485,000.
Depreciation	N/A	Depreciation is varied in proportion to the average depreciation rate applied to new capital works. Therefore care should be taken in interpreting the financial information based on these depreciation estimates. Additional depreciation costs associated with street lighting and waste remediation have been included for the first time.

6.4 Capital Assumptions

Item	Comment
Capital Expenditure	Included as per the Ten Year Capital Works Plan.
Item	**Comment**
Borrowings	Repayments on the existing loan are forecast in accordance with the banks loan repayment schedule. New borrowings for assets are assumed to be for 10 years. External loans may be substituted with internal loans or other funding arrangements at a later stage. Loans already resolved to be internal are “off balance sheet” in this plan and repaid by transfers from the borrowing reserve/fund to the lending reserve/fund.
Asset Revaluations	Land, Buildings and Infrastructure revaluations every three years in accordance with Council’s revaluation policy are not expected to increase significantly in the current economic environment and have been omitted from this modelling.
Reserves	Cash-backed reserve balances have been calculated with the net increase/decrease shown as a transfer to or from reserve. The result from the statement of cash flows must be sufficient to cover any net transfer to cash-backed reserves during the year.

6.5 Reserve Assumptions

Item	Comment
Asset Replacement & Refurbishment	Transfers from reserve are made in accordance with the Ten Year Capital Works Plan.
Car Parking Shortfall – Developer Contributions	Interest applies to average annual reserve balance. Funds in this reserve can only be used in accordance with the Developer Contribution Plan.
Car Parking Shortfall – Rate Levy Income	Interest applies to average annual reserve balance. Funds in this reserve will be used for the CBD Multi Storey Car Park project.
Darwin General Cemetery	Transfers from reserve are made in accordance with the Ten Year Capital Works Plan.
DEC Air Conditioning Replacement	Funding agreement for Darwin Entertainment Centre (DEC) specifies a $36,000 per annum transfer to reserve.
Developer Contributions	Interest applies to average annual reserve balance and transfers from reserve are made in accordance with the Ten Year Capital Works Plan.
Election Expenses	Assume election expenses are every four years ($432,465 2017-18) and matched with transfer to reserve of $108,116 pa. There is no specific provision for the risk of a by election.
Environmental	Funds from this reserve are to be used for environmental projects.
Market Site Development	Lease agreements specify income from Mindil, Parap and Rapid Creek markets must be transferred to reserve but can be used to fund projects at respective market sites.
Nightcliff Community Hall	Lease agreement specifies 20% income from Nightcliff Community Hall must be transferred to reserve but can be used to fund projects on the hall.
Public Art	Reserved for future public art projects.
Off & On Street Parking	Interest applies to average annual reserve balance and the net result from parking operations is transferred to or from the reserve.
Plant & Vehicle Replacement	The net result from fleet operations is transferred to or from the reserve and utilised along with sale proceeds for capital purchases.
Street Lighting	Savings from the transition to paying repairs and maintenance of street lighting to assist future anticipated costs including capital charge.
Tree Risk Management	This reserve was created by Council following recommendations on tree maintenance practices within the municipality following a coroner's report. Funds of $100,000 (2015/16) and $400,000 (2016/17) were resolved by Council for this purpose however this plan assumes that all the funds are spent by the end of the 2018/19 financial year.
Waste Management	Interest applies to average annual reserve balance and the net result from waste operations is transferred to or from the reserve and used to assist capital and remediation program.

6.6 Other Assumptions

Item	Comment
New Initiatives	This plan allows generally allows for $1.0M pa of general provision for new initiatives in the early years of the plan over and above specific named projects. In the later years of the LTFP the new initiatives allowance is in the order of $2M per annum. This allows Council the capacity to fund projects that are yet to be identified. The previous plan did not provide any allowance for new initiatives.

7.0 Risks & Challenges

The City of Darwin has developed a comprehensive Risk Management Framework. The preparation of a Long Term Financial Plan assists Council in evaluating the impact that future decisions may have on its budget and avoid making decisions which may have long term negative impacts. This is particularly important when evaluating the impact of large projects involving borrowings and ongoing operating costs. In addition, the Long Term Financial Plan also allows Council to see how it may defer or bring forward projects to best suit its cash flow projections and thus smooth out planned expenditures.

Council identification of Strategic Risks includes the following:

- Proposed major enhancement initiatives are beyond the financial capacity and resourcing capabilities of Council.
- Cost of providing and maintaining sporting and recreational facilities to requisite standards is beyond the sole capacity of Council.
- The social and economic environment.

Risk of budget variation:

The usual risks associated with of variation of budgets are applicable to this ten year financial plan. As the Municipal Plan and budget is being prepared for the ensuing year Council reviews how it is tracking against its ten year plan and what adjustments may be prudent.

Asset Management Planning:

As with many Local Government entities, a major challenge for Council is the management of ageing assets in need of renewal and replacement. Infrastructure assets such as pathways, kerbs, roads, stormwater drains and public buildings present particular challenges as their condition and longevity can be difficult to determine. The creation of new assets also presents challenges in terms of funding for initial construction and ongoing service costs.

It is important to also note that not all of Council's assets mature in a regular and cyclical manner nor within the ten-year timeframe of this plan. Where a significant proportion of assets were constructed in a similar time frame then it is likely they will also require replacement in a similar timeframe causing a peak in demand for Council funding which may require savings in advance, debt funding and/or increases in rates/pricing.

Risk mitigation:

As well as identifying, reviewing and treating risk under its Risk Management Framework, Council also holds comprehensive insurance covers appropriate to Local Government.

In terms of disaster contingency (e.g. cyclone) Council maintains a minimum of $1M in reserve funds.

8.0 Outcomes

8.1 Budgeted Financial Statements

The following section provides a set of financial statements for the years 2018/19 to 2027/28 based on the assumptions already outlined.

Budgeted Funding Summary
This is a summary of the budgeted income statement and all other funding inflows and outflows. Council complies with legal requirements as the net funding result or requirement is not a deficit. The City of Darwin like any other business must manage its cash/fund flows and ensure it maintains appropriate levels at all times.

Budgeted Income Statement (not separately disclosed - included within above summary)

This statement contained within the above Budgeted Funding Summary outlines:

- All sources of Council's income (revenue).
- All operating expenses. These expenses related to operations and exclude capital expenditure. Depreciation of assets is included as an expense and represents the consumption of non-current assets for the period.

Budgeted Statement of Financial Position
This statement outlines what Council owns (its assets) and what it owes (liabilities) at a point in time. Council's net worth is determined by deducting total liabilities from total assets - the larger the net equity, the stronger the financial position.

Total assets (after accumulated depreciation) remain throughout in this plan at about $1.0B.

Budgeted Statement of Changes in Equity
This statement summarises the change in Council's real worth throughout the financial year. Council's net worth can change as a result of:

- A 'surplus' or 'deficit' as recorded in the Income Statement; or
- An increase or decrease in the net value of non-current assets resulting from a revaluation of those assets.

Net assets/equity in this plan also remain about $1.0B (rounded) as the Councils liabilities of $47-$54M over the period of this plan are not significant in relation to its total assets.

Budgeted Statement of Cash Flows
This summarises the actual flows of cash for a period and explains the change in the cash balance held from the start of the period through to the end of the reporting period. This shows from where Council received its cash and then what it is spent it on.

This plan indicates strong positive cash flows from operations which is another prerequisite of financial sustainability and being able to renew assets as required.

Budgeted Statement of Reserves
Council has a number of cash-backed reserves that it holds for specific purposes. A statement of reserve balances is shown. Some cash backed reserves are subject to external legal restrictions and others (internally restricted reserves) are created for particular purposes by resolution of Council.

Budgeted Statement of Borrowings
This statement provides details of Council's existing borrowings as well as any proposed new borrowings. Council's Borrowing Policy describes the set of circumstances which should exist before new borrowings are considered. This Plan includes new external borrowings. In some instances, Council has the option to fund some of these projects internally using internal loans between reserves. These funding options are best considered when Council next reviews its Treasury Management arrangements.

Ratios
This document includes a number of ratios that have been developed by Council's audit and risk committee. Also included in this document for the first time are two new ratios that come out of the Deloitte Access Economics Financial Sustainability Review that was considered by Council in January 2018[1].

a) **Operating Result Ratio (Operating revenue (excluding capital revenue) minus operating expenses expressed as a percentage of operating revenue).**

If a council can maintain a positive underlying operating result over time (that is operating revenue in excess of operating expenses including depreciation), it means sufficient revenue is being generated to offset the cost of service provision. It also means that ratepayers and service recipients in any year are collectively 'paying their way' and that revenue generated from offsetting depreciation should help ensure that, on average over time, approximately sufficient net cash inflow is generated to substantially accommodate asset renewal outlay needs.

The prime objective of a council's financial strategy should in most circumstances be to ensure that it achieves and maintains a small underlying operating surplus on an ongoing basis. If it can do that then it should be able to maintain service levels and address asset management needs as and when required.

Deloitte Access Economics ('DAE') believes that it is critical that councils have regard to impacts on financial sustainability when determining service levels. Operating expenses are driven by service levels. Any assessment of a council's financial sustainability is predicated on the range and level of services provided. Acquisition of a new additional asset, or upgrading of an existing asset to provide higher levels of services, even if the capital expenditure is funded by a grant, will lead to higher subsequent operating costs for a council in the form of ongoing asset maintenance and depreciation.

DAE also favours a focus on 'underlying' performance. That is the reported operating result adjusted for one-off or temporary factors such as the recent abnormal timing of ongoing Commonwealth Financial Assistance Grants.

Council's Sustainability Ratio Indicator (See section 9.0) improves from negative 5.6% in 2018/19 to a positive 4.5% by 2027/28. So, by the end of the Plan Council's ratio is in the range recommended by DAE.

b) Net Financial Liabilities Ratio (An entity's total liabilities less financial assets expressed as a percentage of operating income.)

Deloitte Access Economics prefers this measure of borrowing levels and capacity relative to others such as debt-servicing ratios in a local government context. Debt-servicing ratio scores are influenced by loan repayment terms and are not an indicator of debt levels. (A council may have a short repayment duration and relatively high repayments but nevertheless relatively low debt.)

8.2 Budgeted Funding Summary

City of Darwin												
10 Year Financial Plan for the Years ending 30 June 2028		Current Year										
BUDGET SUMMARY - GENERAL FUND	Actual	With Carryovers	Projected Years									
Scenario: General rates increase by 3.0% PA	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Income from Continuing Operations												
Rates & Annual Charges	67,428	69,069	71,678	74,443	77,316	80,301	83,403	86,625	89,974	93,453	97,069	100,826
User Charges & Fees	22,826	24,569	22,837	23,400	23,978	24,570	25,179	25,804	26,446	27,105	27,782	28,477
Interest & Investment Revenue	2,688	1,953	1,913	1,968	2,172	2,177	2,182	2,187	1,192	1,397	1,702	1,707
Other Revenues	1,099	1,772	1,549	1,569	1,589	1,610	1,630	1,652	1,673	1,695	1,717	1,740
Grants & Contributions provided for Operating Purposes	9,945	3,366	5,319	5,399	5,480	5,562	5,646	5,731	5,817	5,904	5,992	6,082
Grants provided for Capital Purposes	2,970	5,068	9,925	85	86	87	89	90	91	93	94	96
Contributions provided for Capital Purposes	-	133	190	7,785	2,270	1,991	20	20	20	20	20	20
Net gains from the disposal of assets	-	-	-	-	-	-	-	-	-	-	-	-
Contributed Assets	430	-	-	-	-	-	-	-	-	-	-	-
Total Income from Continuing Operations	**107,386**	**105,930**	**113,411**	**114,649**	**112,891**	**116,299**	**118,149**	**122,109**	**125,213**	**129,667**	**134,377**	**138,948**
Expenses from Continuing Operations												
Employee Benefits & On-Costs	31,499	32,313	33,661	34,839	36,058	37,260	38,750	40,300	41,912	43,589	45,114	46,693
Borrowing Costs	712	291	790	851	1,050	971	990	1,064	984	896	806	718
Materials & Contracts	49,064	50,953	48,102	47,931	48,501	49,589	49,982	50,746	51,523	52,681	53,114	53,924
Depreciation & Amortisation	24,351	24,037	27,353	27,763	28,179	28,602	29,031	29,467	29,909	30,357	30,813	31,275
Net Losses from the Disposal of Assets	4,214	-	-	-	-	-	-	-	-	-	-	-
Total Expenses from Continuing Operations	**109,840**	**107,594**	**109,906**	**111,383**	**113,788**	**116,422**	**118,753**	**121,577**	**124,327**	**127,523**	**129,847**	**132,611**
Net Operating Profit /(Loss) for the Year	**(2,454)**	**(1,664)**	**3,505**	**3,265**	**(897)**	**(124)**	**(604)**	**532**	**886**	**2,144**	**4,530**	**6,337**
Add back Depreciation Expense (non-cash)	24,351	24,037	27,353	27,763	28,179	28,602	29,031	29,467	29,909	30,357	30,813	31,275
Net Operating Profit /(Loss) for the Year Without Depreciation	**21,897**	**22,373**	**30,858**	**31,028**	**27,282**	**28,478**	**28,427**	**29,998**	**30,794**	**32,502**	**35,342**	**37,612**
Capital (Balance Sheet)												
Capital Expenditure	(31,352)	(48,855)	(32,470)	(35,179)	(23,617)	(27,510)	(25,847)	(21,926)	(22,491)	(22,633)	(36,552)	(53,494)
Loan Repayments (External Principal)	(226)	(384)	(423)	(699)	(1,254)	(1,313)	(1,582)	(1,940)	(2,030)	(2,123)	(2,221)	(1,861)
Loan Interest Part Only (Unwinding of present value discounts)	-	-	485	485	465	445	425	433	440	448	455	463
Increase in employee provisions	-	-	205	210	215	221	226	232	238	244	250	256
Increase in rate debtors	-	-	(400)	(404)	(408)	(412)	(416)	(420)	(425)	(429)	(433)	(437)
Non-cash Income Contra Expense	4,214	-	-	-	-	-	-	-	-	-	-	-
Non-cash Income Contra Expense - Tip Provision	485	-	-	-	-	-	-	-	-	-	-	-
New Loan Borrowings (External)	-	2,000	3,000	6,300	-	2,500	3,450	-	-	-	-	-
Proceeds from Sale of intangible & tangible Assets	931	783	801	813	825	837	850	863	876	889	902	916
Non-cash Expense Contra Income - Contibuted Assets	(430)	-	-	-	-	-	-	-	-	-	-	-
Total Capital (Balance Sheet)	**(26,378)**	**(46,456)**	**(28,801)**	**(28,474)**	**(23,774)**	**(25,232)**	**(22,894)**	**(22,759)**	**(23,392)**	**(23,605)**	**(37,599)**	**(54,158)**
Cash Budget Surplus/(Deficit)	**(4,481)**	**(24,083)**	**2,057**	**2,554**	**3,508**	**3,246**	**5,532**	**7,240**	**7,402**	**8,897**	**(2,256)**	**(16,547)**
Reserve Movements												
Net Transfers (to)/from Reserves	4,789	24,503	(2,057)	(2,555)	(3,508)	(3,247)	(5,533)	(7,240)	(7,403)	(8,897)	2,256	16,547
Cash Budget Surplus/(Deficit) After Tansfers	**308**	**420**	**0**	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**	**(0)**	**0**	**0**	**0**

8.3 Budgeted Statement of Financial Position

City of Darwin												
10 Year Financial Plan for the Years ending 30 June 2028												
BALANCE SHEET - GENERAL FUND	Actuals	Current Year	Projected Years									
Scenario: General rates increase by 3.0% PA	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
ASSETS												
Current Assets												
Cash & Cash Equivalents	3,175	1,592	3,649	203	211	958	1,490	15,730	53,132	55,029	43,773	17,227
Investments	70,814	47,814	47,814	53,814	57,314	59,814	64,814	57,814	27,814	34,814	43,814	53,814
Receivables	10,230	7,730	8,130	8,534	8,942	9,354	9,770	10,191	10,615	11,044	11,477	11,915
Inventories	110	110	110	110	110	110	110	110	110	110	110	110
Other	368	368	368	368	368	368	368	368	368	368	368	368
Non-current assets classified as "held for sale"	-	-	-	-	-	-	-	-	-	-	-	-
Total Current Assets	84,697	57,614	60,071	63,029	66,945	70,604	76,552	84,213	92,040	101,365	99,543	83,433
Non-Current Assets												
Infrastructure, Property, Plant & Equipment	953,325	977,360	1,022,726	1,029,329	1,022,942	1,020,012	1,014,979	1,006,575	998,281	989,668	994,505	1,015,809
Total Non-Current Assets	953,325	977,360	1,022,726	1,029,329	1,022,942	1,020,012	1,014,979	1,006,575	998,281	989,668	994,505	1,015,809
TOTAL ASSETS	**1,038,022**	**1,034,974**	**1,082,797**	**1,092,358**	**1,089,887**	**1,090,616**	**1,091,531**	**1,090,788**	**1,090,321**	**1,091,034**	**1,094,048**	**1,099,243**
LIABILITIES												
Current Liabilities												
Bank Overdraft	-	-	-	-	-	-	-	-	-	-	-	-
Payables	14,695	11,695	11,695	11,695	11,695	11,695	11,695	11,695	11,695	11,695	11,695	11,695
Borrowings	241	423	699	1,254	1,313	1,582	1,940	2,030	2,123	2,221	1,861	1,691
Provisions - Employees	7,716	7,716	7,921	8,131	8,347	8,567	8,794	9,025	9,263	9,507	9,757	10,013
Provisions - Tips	9,540	9,540	9,540	9,540	8,540	7,540	6,540	6,540	6,540	6,540	6,540	6,540
Total Current Liabilities	32,192	29,374	29,855	30,621	29,895	29,384	28,968	29,290	29,621	29,962	29,852	29,938
Non-Current Liabilities												
Borrowings	3,046	4,480	6,782	11,827	10,514	11,432	12,942	10,912	8,789	6,569	4,708	3,018
Provisions - Employees	479	479	479	479	479	479	479	479	479	479	479	479
Provisions - Tips	9,546	9,546	10,031	10,516	10,981	11,426	11,851	12,284	12,724	13,171	13,626	14,089
Total Non-Current Liabilities	13,071	14,505	17,292	22,822	21,974	23,337	25,272	23,675	21,992	20,219	18,813	17,585
TOTAL LIABILITIES	**45,263**	**43,879**	**47,146**	**53,443**	**51,869**	**52,721**	**54,240**	**52,965**	**51,613**	**50,181**	**48,666**	**47,523**
Net Assets	**992,759**	**991,095**	**1,035,650**	**1,038,916**	**1,038,019**	**1,037,895**	**1,037,291**	**1,037,822**	**1,038,708**	**1,040,852**	**1,045,382**	**1,051,719**
EQUITY												
Retained Earnings	334,348	357,187	358,636	359,346	354,941	351,571	345,434	338,726	332,208	325,456	332,243	355,127
Asset Replacement Reserves	60,950	36,447	38,504	41,058	44,567	47,813	53,346	60,586	67,988	76,885	74,629	58,082
Revaluation Reserves	597,461	597,461	638,511	638,511	638,511	638,511	638,511	638,511	638,511	638,511	638,511	638,511
Council Equity Interest	992,759	991,095	1,035,650	1,038,916	1,038,019	1,037,895	1,037,291	1,037,822	1,038,708	1,040,852	1,045,382	1,051,719
Minority Equity Interest	-	-	-	-	-	-	-	-	-	-	-	-
Total Equity	**992,759**	**991,095**	**1,035,650**	**1,038,916**	**1,038,019**	**1,037,895**	**1,037,291**	**1,037,822**	**1,038,708**	**1,040,852**	**1,045,382**	**1,051,719**

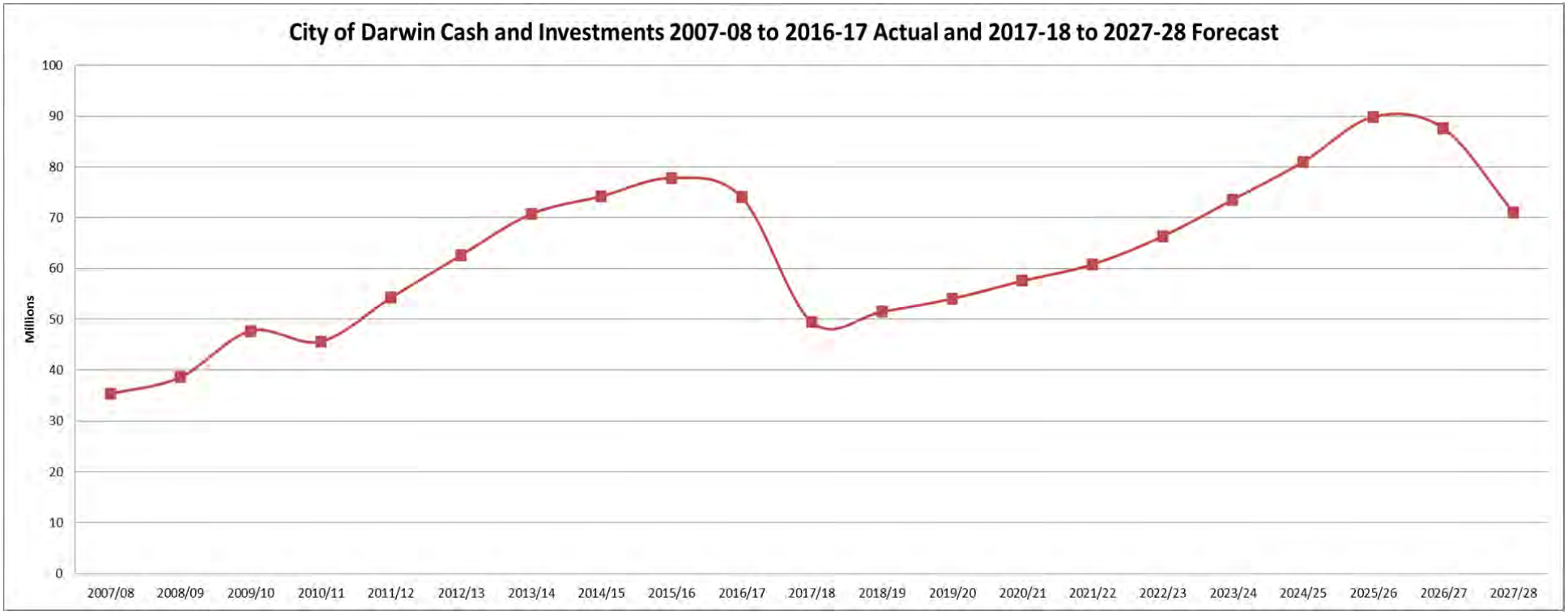
8.4 Budgeted Statement of Changes in Equity

City of Darwin												
10 Year Financial Plan for the Years ending 30 June 2028												
EQUITY STATEMENT - GENERAL FUND	Actuals	Current Year	Projected Years									
Scenario: General rates increase by 3.0% PA	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Opening Balance	1,169,422	992,759	991,095	1,035,650	1,038,916	1,038,019	1,037,895	1,037,291	1,037,822	1,038,708	1,040,852	1,045,382
a. Current Year Income & Expenses Recognised direct to Equity												
- Transfers to/(from) Asset Revaluation Reserve	(174,209)	-	41,050	-	-	-	-	-	-	-	-	-
- Transfers to/(from) Other Reserves	-	24,503	(2,057)	(2,555)	(3,508)	(3,247)	(5,533)	(7,240)	(7,403)	(8,897)	2,256	16,547
Net Income Recognised Directly in Equity	(174,209)	24,503	38,993	(2,555)	(3,508)	(3,247)	(5,533)	(7,240)	(7,403)	(8,897)	2,256	16,547
b. Net Operating Result for the Year	(2,454)	(1,664)	3,505	3,265	(897)	(124)	(604)	532	886	2,144	4,530	6,337
Total Recognised Income & Expenses (c&d)	(176,663)	22,839	42,499	711	(4,405)	(3,370)	(6,137)	(6,708)	(6,517)	(6,752)	6,786	22,884
c. Distributions to/(Contributions from) Minority Interests	-											
d. Transfers between Equity	-	(24,503)	2,057	2,555	3,508	3,247	5,533	7,240	7,403	8,897	(2,256)	(16,547)
Equity - Balance at end of the reporting period	**992,759**	**991,095**	**1,035,650**	**1,038,916**	**1,038,019**	**1,037,895**	**1,037,291**	**1,037,822**	**1,038,708**	**1,040,852**	**1,045,382**	**1,051,719**

8.5 Budgeted Statement of Cash Flows

City of Darwin												
10 Year Financial Plan for the Years ending 30 June 2028												
CASH FLOW STATEMENT - GENERAL FUND	Actuals	Current Year	Projected Years									
Scenario: General rates increase by 3.0% PA	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Cash Flows from Operating Activities												
Receipts:												
Rates & Annual Charges	67,428	69,069	71,278	74,039	76,908	79,889	82,986	86,205	89,549	93,024	96,636	100,388
User Charges & Fees	22,826	24,569	22,837	23,400	23,978	24,570	25,179	25,804	26,446	27,105	27,782	28,477
Interest & Investment Revenue Received	2,645	1,953	1,913	1,968	2,172	2,177	2,182	2,187	1,192	1,397	1,702	1,707
Grants	9,945	5,866	5,319	5,399	5,480	5,562	5,646	5,731	5,817	5,904	5,992	6,082
Contributions		133	190	7,785	2,270	1,991	20	20	20	20	20	20
Bonds & Deposits Received	-	-	-	-	-	-	-	-	-	-	-	-
Other	4,820	1,772	1,549	1,569	1,589	1,610	1,630	1,652	1,673	1,695	1,717	1,740
Payments:												
Employee Benefits & On-Costs	(30,626)	(32,313)	(33,456)	(34,629)	(35,843)	(37,039)	(38,524)	(40,068)	(41,674)	(43,345)	(44,864)	(46,437)
Materials & Contracts	(52,905)	(53,953)	(48,102)	(47,931)	(48,501)	(49,589)	(49,982)	(50,746)	(51,523)	(52,681)	(53,114)	(53,924)
Borrowing Costs	(228)	(291)	(305)	(366)	(585)	(526)	(565)	(632)	(544)	(448)	(351)	(256)
Net Cash provided (or used in) Operating Activities	23,905	16,805	21,223	31,235	27,468	28,645	28,573	30,152	30,956	32,671	35,520	37,797
Cash Flows from Investing Activities												
Receipts:												
Sale of Investment Securities	3,657	23,000	-	-	-	-	-	7,000	30,000	-	1,000	-
Purchase of Investment Securities				(6,000)	(3,500)	(2,500)	(5,000)			(7,000)	(10,000)	(10,000)
Sale of Infrastructure, Property, Plant & Equipment	931	783	801	813	825	837	850	863	876	889	902	916
Grants & Contributions - Capital	2,970	5,068	9,925	85	86	87	89	90	91	93	94	96
Payments:												
Purchase of Infrastructure, Property, Plant & Equipment	(31,352)	(48,855)	(32,470)	(35,179)	(23,617)	(27,510)	(25,847)	(21,926)	(22,491)	(22,633)	(36,552)	(53,494)
Net Cash provided (or used in) Investing Activities	(23,794)	(20,004)	(21,744)	(40,281)	(26,206)	(29,085)	(29,909)	(13,973)	8,477	(28,651)	(44,555)	(62,483)
Cash Flows from Financing Activities												
Receipts:												
Proceeds from Borrowings & Advances	-	2,000	3,000	6,300	-	2,500	3,450	-	-	-	-	-
Payments:												
Repayment of Borrowings & Advances	(226)	(384)	(423)	(699)	(1,254)	(1,313)	(1,582)	(1,940)	(2,030)	(2,123)	(2,221)	(1,861)
Net Cash Flow provided (used in) Financing Activities	(226)	1,616	2,577	5,601	(1,254)	1,187	1,868	(1,940)	(2,030)	(2,123)	(2,221)	(1,861)
Net Increase/(Decrease) in Cash & Cash Equivalents	(115)	(1,583)	2,057	(3,446)	8	746	532	14,240	37,402	1,897	(11,256)	(26,547)
plus: Cash, Cash Equivalents & Investments - beginning of year	3,290	3,175	1,592	3,649	203	211	958	1,490	15,730	53,132	55,029	43,773
Cash & Cash Equivalents - end of the year	**3,175**	**1,592**	**3,649**	**203**	**211**	**958**	**1,490**	**15,730**	**53,132**	**55,029**	**43,773**	**17,227**
Cash & Cash Equivalents - end of the year	3,175	1,592	3,649	203	211	958	1,490	15,730	53,132	55,029	43,773	17,227
Investments - end of the year	70,814	47,814	47,814	53,814	57,314	59,814	64,814	57,814	27,814	34,814	43,814	53,814
Cash, Cash Equivalents & Investments - end of the year	**73,989**	**49,406**	**51,463**	**54,017**	**57,525**	**60,772**	**66,304**	**73,544**	**80,946**	**89,843**	**87,587**	**71,041**
Representing:												
- External Restrictions	31,492	30,352	35,356	37,954	40,433	44,124	49,393	55,570	62,280	70,635	67,946	51,825
- Internal Restricitons	29,458	6,094	3,146	3,103	4,132	3,687	3,951	5,014	5,707	6,249	6,682	6,255
- Unrestricted	13,039	12,960	12,960	12,960	12,960	12,960	12,960	12,959	12,959	12,959	12,960	12,960
	73,989	**49,406**	**51,463**	**54,017**	**57,525**	**60,772**	**66,304**	**73,544**	**80,946**	**89,843**	**87,587**	**71,041**

8.6 Budgeted Chart Cash Flows



8.7 Budgeted Statements of Reserves

City of Darwin
10 Year Financial Plan for the Years ending 30 June 2028
Reserves Summay

10 Year Financial Plan for the Years ending 30 June 2028											
	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing
	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Internal Reserves											
Asset Replacement & Refurbishment	1,313	273	620	967	1,314	1,604	1,951	2,298	2,530	2,761	2,993
DEC Asset Replacement & Refurbishment	-	-	-	-	-	-	-	-	-	-	-
Disaster Contingency	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035	1,035
Election Expenses	10	110	210	310	-	110	220	330	0	120	240
Nightcliff Community Hall	39	53	66	80	94	108	122	137	152	167	182
Plant & Vehicle Replacement	986	745	597	566	1,012	425	567	346	678	466	808
Public Art	291	110	110	110	110	110	110	110	110	110	110
Off & On Street Parking	-	217	400	1,021	100	558	1,008	1,450	1,743	2,023	887
Street Lighting	2,312	517	-	-	-	-	-	-	-	-	-
Tree Risk Management	-	-	-	-	-	-	-	-	-	-	-
Environmental	107	86	65	44	22	0	0	0	0	0	0
Total Internal Reserves	**6,094**	**3,146**	**3,103**	**4,132**	**3,687**	**3,951**	**5,014**	**5,707**	**6,249**	**6,682**	**6,255**

10 Year Financial Plan for the Years ending 30 June 2028											
	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28
	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing
	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
External Reserves											
Developer Contributions	1,614	1,703	7,361	7,754	5,652	2,140	2,237	2,336	2,438	2,542	2,649
Domestic Waste Management	2,337	6,657	1,704	1,832	5,602	12,291	16,208	20,585	27,554	35,101	42,503
Car Parking Shortfall - Developer Contributions	12,726	13,112	13,505	13,909	14,324	14,751	15,190	15,641	15,078	2,828	1,435
Car Parking Shortfall - Rate Levy Income	13,140	13,253	14,659	16,118	17,630	19,198	20,824	22,509	24,255	26,063	3,726
DEC Air Conditioning Replacement - External	60	96	132	168	204	240	276	312	348	384	420
Highway/Commercial Carparking Shortfall	19	19	20	20	21	21	22	22	23	23	24
Market Site Development - External	364	418	473	529	586	644	702	762	822	883	945
Specific purpose Unexpended grants	-	-	-	-	-	-	-	-	-	-	-
Other Carparking Shortfall	93	98	100	103	106	108	111	114	117	120	123
Total External Reserves	**30,352**	**35,356**	**37,954**	**40,433**	**44,124**	**49,393**	**55,570**	**62,280**	**70,635**	**67,946**	**51,825**
Grand Total All Reserves	**36,446**	**38,502**	**41,057**	**44,565**	**47,812**	**53,344**	**60,584**	**67,987**	**76,884**	**74,627**	**58,081**

Note: Any negative balances are considered relatively minor and temporary. There are no concerns in the context of a ten year plan.

8.8 Budgeted Statement of Borrowing (external)

City of Darwin													
10 Year Financial Plan for the Years ending 30 June 2028													
LOANS (EXTERNAL) - GENERAL FUND													
Scenario: General rates increase by 3.0% PA													
	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing	Closing
	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance
	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Loans												
Opening balance	3,287	5,046	7,624	13,225	11,970	13,157	15,025	13,086	11,056	8,933	6,712	4,852
Plus new borrowings	2,000	3,000	6,300	-	2,500	3,450	-	-	-	-	-	-
Less principal repayments	241	423	699	1,254	1,313	1,582	1,940	2,030	2,123	2,221	1,861	1,691
Closing balance	5,046	7,624	13,225	11,970	13,157	15,025	13,086	11,056	8,933	6,712	4,852	3,161
Interest repayments	214	276	366	585	526	565	632	544	448	351	256	182

9.0 Key Ratios

An analysis of the financial plan has been completed utilising a number of key financial ratios, which have been endorsed for use by the Risk Management & Audit Committee.

Financial - Key Performance Indicators

Council has adopted a set of financial key performance indicators in line with the targets set in the 'Evolving Darwin: Towards 2020' Strategic Plan.

Financial KPI	Target	Actual 2016/17	Forecast 2017/18	Budget 2018/19	Budget 2019/20	Budget 2020/21	Budget 2021/22	Budget 2022/23	Budget 2023/24	Budget 2024/25	Budget 2025/26	Budget 2026/27	Budget 2027/28
% of Rate Debtors Outstanding	<5%	3.4%	3.3%	3.8%	3.6%	3.5%	3.4%	3.3%	3.2%	3.0%	2.9%	2.8%	2.7%
This indicator is designed to measure Council's effectiveness in recovering debts legally owed to it.													
Debt Servicing Ratio	<5%	0.9%	0.6%	1.1%	1.4%	2.0%	2.0%	2.2%	2.5%	2.4%	2.3%	2.3%	1.9%
This indicator is designed to show what proportion of revenue is required as a comitment to fund loan repayments.													
Liquidity	>1:1	2.63	1.96	2.01	2.06	2.24	2.40	2.64	2.88	3.11	3.38	3.33	2.79
This indicator is designed to measure whether Council has the ability to pay its debts as they fall due expressed as a factor of one.													
Rates Ratio	60-70%	62.8%	65.2%	63.2%	64.9%	68.5%	69.0%	70.6%	70.9%	71.9%	72.1%	72.2%	72.6%
This indicator is designed to measure Council's ability to cover its own day to day expenses through its own tax revenue.													
Operating Surplus / (-Deficit)	BreakEven	-$5.4M	-$6.9M	-$6.6M	-$4.6M	-$3.3M	-$2.2M	-$0.7M	$0.4M	$0.8M	$2.0M	$4.4M	$6.2M
This indicator is designed to provide information on the result of ordinary operations and does not include capital income. Trend analysis may enable the Council to determine if the current level of operations can be sustained into the future.													
Operating Surplus Before Depreciation	> BreakEven	$21.9M	$22.4M	$30.9M	$31.0M	$27.3M	$28.5M	$28.4M	$30.0M	$30.8M	$32.5M	$35.3M	$37.6M
This indicator is designed to provide information on the result of ordinary operations before depreciation which is a non cash expense. Strong positive fund flows from operations assist capital renewals.													
Asset Sustainability Ratio	>50%	60%	132%	39%	45%	45%	65%	69%	49%	49%	50%	55%	41%
This indicator is designed to indicate the extent to which Council is renewing its assets. A ratio of 100% or more indicates that Council spends at least the amount of depreciation each year on renewing assets.													

Deloitte Access Economics Jan 2018 ratios	Target	Actual 2016/17	Forecast 2017/18	Budget 2018/19	Budget 2019/20	Budget 2020/21	Budget 2021/22	Budget 2022/23	Budget 2023/24	Budget 2024/25	Budget 2025/26	Budget 2026/27	Budget 2027/28
Sustainability Ratio	>0%	-5.6%	-6.8%	-6.4%	-4.3%	-2.9%	-1.9%	-0.6%	0.3%	0.6%	1.6%	3.3%	4.5%
Operating result ratio(operating revenue(excluding capital revenue) minus operating expenses expressed as a percentage of operating revenue													
Net Financial Liabilities Ratio	<+100%	-26.8%	-5.2%	-3.8%	-0.5%	-5.0%	-6.9%	-10.2%	-16.9%	-23.4%	-30.6%	-29.0%	-16.9%
An entity's total liabilities less financial assets expressed as a percentage of operating income.													

Space for notes:

ENCL: YES	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM: 14.1.2

TREES IN THE DARWIN MUNICIPALITY - UPDATE JULY 2018

REPORT No.: 18CO0039 CB:jw COMMON No.: 3777063 DATE: 17/07/2018

Presenter: Acting General Manager City Operations, Nik Kleine

Approved: Acting Chief Executive Officer, Dr Diana Leeder

PURPOSE

The purpose of this report is to inform Council of progress to date on a range of issues associated with the effects of Tropical Cyclone Marcus on City of Darwin tree assets throughout the municipality.

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
2 Vibrant, Flexible and Tropical Lifestyle
Outcome
2.2 A sense of place and community
Key Strategies
2.2.3 Improve the landscaping, streetscape, infrastructure and natural environment

KEY ISSUES

- Council has requested information on a range of issues resulting from Tropical Cyclone Marcus that will take time to fully explore and enact.
- The aspects raised by Council are addressed within this report, with a number of these able to be resolved.
- Collection of information on the species of trees that were uprooted or damaged in the cyclone is complete.
- An expression of interest to survey and identify trees in parks in close proximity to private property and powerlines has been initiated.
- A Tree Re-establishment Advisory Committee (TRAC) has been called for that will make recommendations to Council on the selection of tree species and planting requirements for City of Darwin and the broader community.
- Endorsement of the Committee and its Terms of Reference is sought from Council.
- Formal approaches requesting salvage and reuse of timber will be assessed once clean-up operations are complete.

RECOMMENDATIONS

A. THAT Report Number 18CO0039 CB:jw entitled Trees in the Darwin Municipality - Update July 2018, be received and noted.

B. THAT Council, pursuant to Sections 54 and 55 of the Local Government Act, establish the Tree Re-establishment Advisory Committee.

C. THAT Council endorse the Terms of Reference for the Tree Re-establishment Advisory Committee at **Attachment B** to Report Number 18CO0039 CB:jw entitled Trees in the Darwin Municipality - Update July 2018.

D. THAT a further report be presented to Council to appoint members of the Tree Re-establishment Advisory Committee in accordance with the Local Government Act.

E. THAT Council endorse the level of infrastructure, other than powerlines, considered for risk management purposes in the proposed survey of Council parks for trees located in close proximity to property and powerlines to be the principal residence of a property.

BACKGROUND

DECISION NO. 22\0781 (29/5/18)

Trees in the Darwin Municipality - Update
Report No. 18CO0020 (23/05/18) Common No. 3777063

A. THAT Report Number 18CO0020 NK:jh entitled Trees In The Darwin Municipality - Update, be received and noted.

B. THAT Council commence the survey of trees located in close proximity to property and power lines.

C. THAT Council refer the amount of $160,000 for survey of trees located in close proximity to property and power lines to the fourth quarter budget review for the survey of trees that have the potential to impact on private property and or powerlines as identified in Report Number 18CO0020 NK:jh entitled Trees In The Darwin Municipality - Update.

D. THAT Council endorse the establishment of a panel of experts to recommend future tree species (mainly native to top end areas) selection and planting requirements as identified in Report Number 18CO0020 NK:jh entitled Trees in the Darwin Municipality - Update.

E. THAT Council endorse proceeding with Option 2, being that on completion of the clean-up, Council calls for expressions of interest for parties to collect salvaged timber, within specified timeframes and at no cost to Council as

outlined in Report Number 18CO0020 NK:jh entitled Trees in the Darwin Municipality – Update.

DECISION NO.22\0592 (27/03/18)

Dangerous Trees in the Darwin Municipality
Common No. 3777063

A. *THAT Council considers the issue of potentially dangerous trees that are planted throughout the City of Darwin Municipality, and in particular the trees that have come down during recent significant weather events and develop a plan to manage these trees.*

B. *THAT the report include but not be limited to:*

- *A report to be provided to Council regarding the kind of trees that have been damaged /uprooted in recent events ranked by (generic) species.*
- *Inspection of Council parks to identify trees planted in close proximity to private property and /or powerlines that have the potential to cause damage*
  And /or injury if/when they come down.
- *A plan for the removal and possible costing to be provided to Council regarding specifically these trees.*
- *A review of our parks to identify number and species of trees that may come down in a future weather event as it has happened in the recent past.*
- *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.*
- *A review of the list trees suitable to areas prone to cyclones been undertaken to ensure that all trees that are removed are replaced with suitable trees.*
- *Potential for salvage from fallen trees*
- *The issue of maintaining trees to reduce load so that they remain safe in high winds*

C. *THAT a follow up report from Cyclone Marcus be presented to Council, including consideration of effects on vegetation.*

DISCUSSION

In order to address Council's decision, a number of activities are required. This report provides an update of activities undertaken to date and a plan for future activities subject to funding, as outlined within Council's decision on 27 March 2018.

1. *A report to be provided to Council regarding the kind of trees that have been damaged /uprooted in recent events ranked by (generic) species.*

Collection of information on the species of trees that were uprooted or damaged in the cyclone is complete and the report entitled 'An Assessment of Tree Damage and Resilience in Darwin Parks Following Tropical Cyclone Marcus March 17th 2018' is attached. **(Attachment A)**

The report will be analysed and considered by The Tree Re-establishment Advisory Committee and used to inform future activities and decision making regarding tree re-planting.

2. *Inspection of Council parks to identify trees planted in close proximity to private property and /or powerlines that have the potential to cause damage and /or injury if/when they come down.*

An Expression of Interest for suitably qualified and experienced arborists to undertake this survey work is underway.

Clarification and direction is sought from Council as to what level of private property infrastructure will need to be taken into account for risk management purposes in this survey.

In the majority of Darwin parks, a significant proportion of the remaining trees have the potential to impact on private property. Using a risk management approach that considers the location and the infrastructure that may be impacted, it is recommended to survey only those trees in parks (not road reserve) that have the potential to cause damage/injury if/when they fail to the principal residence, be it a house or unit and powerlines.

It is not recommended for the purposes of this survey to consider trees that may cause damage to private property infrastructure such as fences, garden sheds, swimming pools or such areas where people would not reasonably be expected to be sheltering during a cyclone. Many of the remaining trees within parks, depending on their height and maturity have the potential to fall into this category and as such their inclusion would have an exponential effect on costs and works arising from the survey.

In addition, inclusion of these trees would have a significant impact on the amenity and shading of parks within the municipality.

Following this initial survey, the risk to other infrastructure, including Council assets, will be considered for further survey work based on a risk management approach.

3. *A plan for the removal and possible costing to be provided to Council regarding specifically these trees*

Following clarification on the level of private property infrastructure to be included in the risk assessment methodology for the survey in Item 2, and upon completion of the survey and works in items 1 and 2, the number, species and size of trees for potential removal will be better understood and a cost estimate prepared.

4. *A review of our parks to identify number and species of trees that may come down in a future weather event as it has happened in the recent past.*

Advice received from industry experts is that the intensity and effect of a weather event at a particular location on a particular tree is unpredictable and conditions during and leading up to will be different for each event.

It is impossible to predict which trees may fail at a particular time or location.

5. *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.*

Endorsement is sought for the Terms of Reference (**Attachment B)** for the expert panel, the Tree Re-establishment Advisory Committee (TRAC) that will:

- Recommend a list of trees *not* to be planted by City of Darwin in any future tree establishment programs or landscaping;
- Recommend a preferred resilient tree species planting list to City of Darwin for consideration in any future tree establishment programs or landscaping;
- Advise City of Darwin on best practice methods of tree propagation, planting and protection across the Darwin Municipality;

Expressions of interest for community members are currently being sought and previously approved organisations have been invited to nominate a representative. The Committee will first sit in early August, once members and chair are formally appointed by Council, and deliver recommendations to Council in October 2018

6. *A review of the list of trees suitable to areas prone to cyclones be undertaken to ensure that all trees that are removed are replaced with suitable trees.*

This will be covered by the previous item, Item 5.

7. *Potential for salvage from fallen trees*

In relation to this matter Council DECISION NO.22\0781 was:

THAT Council endorse proceeding with Option 2, being that on completion of the clean-up, Council calls for expressions of interest for parties to collect salvaged Timber, within specified timeframes and at no cost to Council as outlined in Report Number 18CO0020 NK:jh entitled Trees in the Darwin Municipality – Update.

The mechanisms and resourcing to facilitate this salvaging process through an expression of interest will be developed prior to completion of clean-up operations.

8. *The issue of maintaining trees to reduce load so that they remain safe in high winds*

City of Darwin undertakes risk assessments of its tree assets in order to maintain the safety of the community, and at the same time provide the shade, amenity value and biodiversity that the community expects. This approach is consistent with Council's Tree Management Plan and the Visual Tree Risk Assessment methodology endorsed by Council in November 2017.

City of Darwin Policy No. 050 Trees on Verges – Conservation, is under review and will be informed by the outcomes from the work requested by Council, particular item 5 discussed within this report.

Summary

The following table summarises the actions taken to date and the status of elements contained within Councils decision:

Item	Action	Status
1. A report to be provided to Council regarding the type of trees that have been damaged /uprooted in recent events ranked by (generic) species.	Report finalised	Complete
2. Inspection of Council parks to identify trees planted in close proximity to private property and /or powerlines that have the potential to cause damage and /or injury if/when they come down.	Expression of Interest to value of $160,000,	Underway
3. A plan for the removal and possible costing to be provided to Council regarding these specific trees.	Works will be undertaken in conjunction with item 2.	Not started
4. A review of our parks to identify number and species of trees that may come down in a future weather event as it has happened in the recent past.	Review	Not started
5. 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.	Terms Of Reference formulated Structure of Tree Re-establishment Advisory Committee formulated Expression of Interest advertised for community members to serve on	Underway

	Committee	
6. A review of the list of trees suitable to areas prone to cyclones be undertaken to ensure that all trees that are removed are replaced with suitable trees.	To be undertaken in conjunction with item 5.	Not started
7. Potential for salvage from fallen trees.	Council Decision No 22\0781	Underway
8.The issue of maintaining trees to reduce load so that they remain safe in high winds	Council's adopted Tree Management Plan and Visual Tree Risk Assessment methodology addresses the maintenance and management of trees under Council's control.	Complete

CONSULTATION PROCESS

In preparing this report, the following City of Darwin Officers were consulted:

- Acting Manager Infrastructure Maintenance
- Parks and Reserves Coordinator
- Senior Technical Officer Parks and Reserves

In preparing this report, the following External Parties were consulted:

- Australian Vegetation Management Services
- Australian Institute Landscape Architects NT
- Nursery and Garden Industry NT
- Arboreal Association NT
- Greening Australia NT
- Bill Sullivan, Consulting Arborist

POLICY IMPLICATIONS

City of Darwin Policy No. 050 – Trees on Verges – Conservation identifies its policy objective as "*Council has a strongly conservative policy towards the removal of live trees and the intention is to preserve as many trees as possible."* This policy is currently under review and will be informed by the outcomes of the investigations requested by Council.

BUDGET AND RESOURCE IMPLICATIONS

Cost implications for the removal of identified trees in parks that have the potential to cause damage to private property and powerlines or injury to people has not been assessed at this time.

Sitting fees in line with the C2 classification structure of Northern Territory Government bodies for the Chair of the Tree Re-establishment Advisory Committee will be met from within existing operational budgets

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

All trees have a risk of failure in normal weather events and as trees increase in size, mass and maturity, the risk of failure increases. Council's program of Tree Risk Management is designed to protect the public from foreseeable risks, and so reduce the prospect of damages claims being made against Council in these normal weather events. This occurs through normal tree management activities, such as inspections of leased properties.

This report has not considered insurance aspects at this time; however future reports will include consideration of insurance as required.

During cyclonic weather events it is not reasonable to predict whether a tree may fail, causing damage or injury, or remain standing.

ENVIRONMENTAL IMPLICATIONS

Trees provide great environmental benefits to the Darwin community and trees are assessed, within resourcing and budgets, for maintenance or removal with the best long term outcome for the community, including safety and environmental benefits.

If trees are to be considered for removal based purely on species and/or proximity to private property and powerlines there would likely be a further significant reduction in tree canopy cover and biodiversity throughout the Municipality.

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

NIK KLEINE
ACTING GENERAL MANAGER
CITY OPERATIONS

DIANA LEEDER
ACTING CHIEF
EXECUTIVE OFFICER

For enquiries, please contact Nik Kleine on 89300581 or email: n.kleine@darwin.nt.gov.au.

Attachments:

Attachment A: An Assessment of Tree Damage and Resilience in Darwin Parks Following Tropical Cyclone Marcus on 17 March 2018
Attachment B: Advisory Committee Terms of Reference

AUSTRALIAN VEGETATION MANAGEMENT SERVICES

Greening Australia

An assessment of tree damage and resilience in Darwin parks following Tropical Cyclone Marcus March 17th 2018

CITY OF DARWIN

Acknowledgements

The following people and their organisations provided valuable support to the project: Jason Hill, Bart Edmeades and Ross Sinordin from DENR (for providing access to Greater Darwin Land Units spatial data); Sharon Wilson and Paul Munns from the George Brown Botanical Gardens (for palm and exotic species identification); Ian Cowie and Nick Cuff from the Darwin Herbarium (for identification of native plants); Jude Scott and Ian Shepherd from BOM (for supplying TC Marcus information); Chris Bailey and Josh Forner from City of Darwin (project management and provision of Darwin parks maps); and Dr. Greg Calvert for initial survey discussions and review.

Cover Photo: A large uprooted *Khaya senegalensis* (African Mahogany) on the Esplanade in Darwin, March 2018.

This document may be cited as:

Clark, M.J., McGregor, J. & Parsons, B. (2018), *An assessment of tree damage and resilience in Darwin parks following Tropical Cyclone Marcus March 17th 2018.* City of Darwin, Darwin.

FUNDED BY

CITY OF DARWIN

Executive Summary

Trees are an important component of the urban infrastructure. They are often ignored until an event such as a cyclone occurs and then become front and centre of community discussion, decisions, investment and actions. It is hoped that this report provides valuable information for planners, advisors and leaders to make well informed decisions in regards to the future management of vegetation in Darwin.

Tropical Cyclone Marcus passed over Darwin between 9.30 am and 1pm ACST on Saturday the 17th of March 2018. The category 2 cyclone brought with it strong wind gusts of 130km per hour (gale radius of around 100km (BoM 2018)) and brought significant widespread damage to Darwin, Palmerston and the surrounding rural area. It caused major damage to thousands of trees which in turn caused infrastructure damage to houses, vehicles, fences, carports, sheds, footpaths etc. Around 430 powerlines were downed leaving some 26500 customers without power immediately after the cyclone. Fortunately there were no injuries (BoM 2018).

On the 27th March 2018, City of Darwin Council considered dangerous trees in the Darwin municipality, in particular the issue of potentially dangerous trees planted throughout the municipality, the trees that came down during recent significant weather events and the development of a plan to manage these trees (CoD 2018). A decision was carried for amongst other actions, a report to be provided to Council regarding the kind of trees that had been damaged /uprooted in recent events ranked by (generic) species. This report presents the results of the survey and discusses the types and degrees of damage for the different species as well as any trends that relate to the physical environment and management of the trees.

Four weeks after TC Marcus, a survey of parks commenced to record (for all individual trees): damage to trees; tree damage to infrastructure and surrounding landscape information. This was followed by analysis of the 30 plus recorded individual tree parameters and correlations with the degree of cyclone damage to determine and attempt to understand trends in urban tree damage and survival. A data set of individual trees in the surveyed parks was provided to CoD and will be a valuable information layer for Council's GIS.

A total of 2,857 individual trees (all the trees in the parks) from 142 species in 40 parks were surveyed. This represented approximately 20% of the total 200 parks managed by DoC in the municipality. It is important to note that this survey is a snapshot in time of the tree damage in these 40 Darwin parks. The points of discussion and conclusions are based on results with a high sample size (ie high level of confidence) and notable statistics where results varied significantly from the average.

Of the 142 total species, 21 species comprised 68% of the surveyed trees. There were 7 standout dominant species with over 100 surveyed individuals. In order of descending order of tree numbers, they were: African mahogany (*Khaya senegalensis),* Maranthes (*Maranthes corymbosa),* Red gum

(Eucalyptus camaldulensis), Yellow flame tree *(Peltophorum pterocarpum),* Black wattle (*Acacia auriculiformis),* Papua New Guinea rosewood *(Pterocarpus indicus)* and Mimusops (*Mimusops elengi).*

Of the species surveyed, the majority were local provenance natives (50%) along with other NT native species (17%), Australian natives (4%), naturalised (2%) and exotic species (27%). As a proportion of all trees surveyed, the majority were local provenance (51.7%), exotic species made up a nearly a quarter (24.7%), NT natives with the next highest number of indiividuals (17.2%) and the remainder made up of Australian natives and naturalised specimens (3.9% and 2.5% respectively).

15.4% of total trees surveyed were uprooted. 8.3% of trees experienced significant branch damage and 3% large branch damage. A small percentage (3.1%) had trunks snapped or split and only 0.4% had a damaged leader. A high proportion of trees had small branch damage (28.8%). There was very little foliage loss recorded (0.4%). 40.5% of trees received no damage at all, although the author suspects that the foliage on alot of the trees had grown back by the time the survey commenced, and therefore were not recorded for foliage loss.

From the analysis of the 21 most abundant species, for all damage categories including minor foliage loss and small branches broken, *Khaya senegalensis* (88.5%), *Acacia auriculiformis* (88.7%), *Maranthes corymbosa* (78.0%) and *Eucalyptus camaldulensis* (75.9%) had the highest tree damage rates. *Maranthes corymbosa*, however, had a very low rate (12.2%) of major damage. Only 5.6% of Carpentaria acuminata were damaged. Other relatively unscathed tree species were *Ficus virens* (46.5%) and *Leptospermum madidum* (47.7%).

From the analysis of those species with 10 or more surveyed individuals, *Khaya senegalensis* (71.5%), *Acacia auriculiformis* (56.5%), *Eucalyptus camaldulensis* (46.6%) and *Peltophorum pterocarpum* (42.6%) had a significantly high rate of major damage (and a large sample size) compared with the average rate for the survey sample (30.2%). *Khaya senegalensis* had a significantly high proportion of uprooted trees (66%). This is over 4 times higher than the average uprooting rate for all trees. Other species which commonly uprooted were *Pterocarpus indicus* (weeping form) (30.6%) and *Acacia* auriculiformis (29.8%). *Delonix regia* (18.9%) and *Eucalyptus camaldulensis* (15.7%) had significantly higher rates of significant branch damage compared to the sample average (8.3%). *Leptospermum madidum,* with a good sample size, had a significantly high rate (12.3%) of snapped or split trunks.

Carpentaria acuminata (4.2%) and *Latania lodgesii* (2.9%) had low rates of major damage and a good sample size. *Callophyllum inophyllum* and *Carpentaria acuminata had 0% uprooting.*

The project also looked for correlations between park management and tree damage to determine any trends. This included park classification, irrigation types and tree spacings. Green belt parks had a higher rate of uprooting but lower rates of large and small branches being damaged compared with the majority of smaller neighbourhood parks. This could be due to the greater degree of exposure in the larger parks. Tree spacing was not a good predictor of tree damage. Uprooting appeared to be slightly higher in individuals, but this difference may not be statistically significant.

Manually watered trees had the highest rate of damage, the highest rate of significant branches breaking and the highest rate of uprooting. However, they had no recorded incidences of trunk snapping, possibly due to roots giving way more easily. When analysing the 21 most abundant species, irrigation was associated with a higher rate of tree damage in *Maranthes corymbosa* and *Corymbia bella.* No irrigation was associated with a higher rate of tree damage in *Carpentaria acuminata, Corymbia ptychocarpa* and Mimusops elengi. Manual irrigation was associated with a higher rate of tree damage in Khaya senegalensis. Irrigation was associated with a higher rate of large branch damage to Ficus virens and Khaya senegalensis and significant branches being broken in Maranthes corymbosa. Irrigation was associated with a higher rate of uprooting in Khaya senegalensis.

Tree damage by tree size, origin and health was analysed. Australian Native tree species had the lowest rate of tree damage (20.9%) and the the highest rate of no damage (62.7%). Exotic trees had the highest rate of tree damage (39.7%) and the highest rate of uprooting by a large margin (30.8%). The overall rate for exotic trees included two abundant species, *Khaya senegalensis* and *Pterocarpus indicus* (weeping variety) which had significantly high rates of uprooting. Australian Native and Local Provenance tree species had the lowest rates of uprooting (7.3% and 9.0% respectively). Australian Native tree species had the lowest rate of tree damage (20.9%). Exotic trees had the highest rate of tree damage (39.7%).

Large trees were more likely to be damaged than the general population, and specifically had a far higher rate of uprooting. Small trees were less likely to be damaged than the general population, and this was the case for almost every type of damage. Larger trees have more above ground surface area and mass to offer strong winds whereas smaller trees offer less resistance and usually have quite flexible trunks and branches.

Pre-existing weaknesses did not appear to be a good predictor of the tree being damaged by the cyclone, although pre-existing termite damage was more likely to lead to further damage than other factors. Interestingly, trees with termites present were less likely to be uprooted. This could possibly be due to the fact that it was harder to pick up pre-existing termite presence around an uprooted tree. The termites may, however, be doing something in the soil which is beneficial to the trees.

Tree damage by the physical environment was analysed. Where wind direction was determined, uprooted trees were more likely to have been uprooted by south-westerly or westerly winds than other directions. This correlates well with BoM tracking data which recorded the highest wind speeds from the south west and west.

Surveyed parks were found in flat to gently undulating upland surface, gentle side and lower slopes with low gradients. No obvious trends emerged from the analysis possibly due to the relatively uniform landforms found in the parks.

Leptic Rudosols (shallow gravelly lithosols) had lower rates of major tree damage, and specifically, lower rates of significant branches broken. This is a surprising result as shallow soils underlaid with unweathered rock are often blamed for tree uprooting. Brown kandosol soils (deep gravelly yellow massive earths with minor lithosols) and red kandosols (shallow-moderately deep red massive earths

with minor yellow massive earths) had high rates of uprooting. This could be a result of these deeper soils being more saturated following heavy monsoonal rains previous to the cyclone.

Slope and waterlogging didn't appear to be a significant driver of damage, or any particular type of damage.

Trees were examined for their damage to infrastructure. Of all the trees surveyed 3.3% caused damage to infrastructure. Of all the damaged trees surveyed 5.6% caused damage to infrastructure. Of all the *Khaya senegalensis* surveyed 19.1% caused infrastructure damage. This is far higher than other tree species which were significantly sampled. Of all the uprooted trees, 19.3% caused infrastructure damage (i.e. a falling tree had a 19.3% chance of causing damage), but this accounted for 89.5% of all infrastructure damage (i.e. 89.5% of infrastructure damage was caused by fallen trees). Other types of tree damage were far less likely to result in damage.

Of the 40 surveyed parks tree damage for 6 individual parks with the most individual trees was analysed. Bike Fun Park had high rates of small branch damage compared to the population total percentage (52.1% vs 28.8%) and very low rates of uprooted trees. This was insignificantly biased as approximately 6 trees were removed prior to survey.

Bayfield Park had lower rates of tree damage than the general tree population (50.1% vs 40.5%). It also had lower rates of small branches being damaged than the general tree population (15.0% vs 28.8%). *Khaya senegalensis* at Bayfield Park had a higher rate of uprooting than for its general population (77.2% vs 66.0%). It also had twice the rate of significant branch breaking than for the general population (7.6% vs 3.8%).

In summary and conclusion, a large exotic tree growing in an irrigated Darwin park in saturated deep massive earths with minimal management would have a high chance of being uprooted in a category 2 cyclone. Tropical Cyclone Marcus was an arboreal cleansing process, clearing the parks of many unstable tree species. It was a big wake up call for Darwin and provided an opportunity to develop more climate resilient plantings in parks, streetscapes and other landscaped areas in the municipality. Many of the surveyed parks are now quite open and require well planned plantings of suitable cyclone stable amenity species.

Darwin suffered major damage to thousands of trees in what was only a category 2 cyclone. A large proportion of these trees were made up of a small number of species of which the majority showed susceptibility to major damage in the cyclone. These particular species need to be looked at more thoroughly for future planning and management purposes. For example it would not be recommended to plant a low diversity of these unstable species in the future. Thankfully there were a couple of these abundant species that showed stable traits during the course of TC Marcus. Overall just over 40% of all trees suffered no damage at all (apart from some foliage loss). These are the specimens that require further scrutinization for potential use in the future urban revegetation of Darwin.

To progress from the results and discussion of this survey, the valuable information could be combined with results of previous post cyclone surveys for comprehensive recommended lists of suitable species

list for planting in Darwin and other cyclone prone regions of Australia. It could also be used to come up with species lists of unstable species that should be avoided in these areas. Where physical environment and management trends have emerged both in the positive and negative sense it should warrant further studies for more confident results for further planning and management of future tree planting in Darwin and other cyclone prone areas.

The mapping of individual trees and associated data will be a valuable management tool for the City of Darwin park managers. This could be expanded to include all the CoD parks so that the whole management chain includes valuable information for all trees. This includes information on individuals that are categorised as unstable and are potentially a risk for humans and infrastructure. For future plantings this chain could start at the genetic source, through to propagation, cultivation and eventually the death or end of shelf life and removal of trees. There is iTree software used by municipal councils in South Australia that could be explored for this 'life of the tree' chain (Mr. J. McGregor 2018, pers comm. 12th June).

Recommendations of this report:

- Use results of this survey in conjunction with previous reports to establish a list of preferred species, and a list of plants to be discouraged for use around public infrastructure.
- For species that had high rates of major tree damage, determine where the cut off line is in regard to what is an acceptable level of risk (risk appetite). This process is a precursor to above and will determine the relative level of risk between species.
- Digitise through survey and mapping, all trees in Darwin parks, streetscapes and other landscaped areas. From this determine which species are deemed to be a risk to infrastructure and human safety.
- Consider the gradual phasing out of unstable species and replacement with resilient species. This could occur in stages over a ten year period, giving the newly planted trees time to establish shade cover before removing the next tranche of redundant species.
- Undertake further study of irrigated and non-irrigated plantings to determine the merits of non-irrigated plantings for future revegetation activities.
- Investigate further damage trends of pre-existing weaknesses of trees as a result of genetics, propagation and cultivation.
- Dertermine best practice methods for propagation and cultivation of resilient trees and shrubs.
- Develop a protocol for the planting and maintenance of trees in public areas, including policies, procedures, guidelines and specifications.

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Abbreviations

AVMS	Australian Vegetation Management Services
BoM	Bureau of Meteorology
CoD	City of Darwin
GA	Greening Australia
DENR	Department of Environment and Natural Resources
GIS	Geographic Information System
NT	Northern Territory
TC	Tropical Cyclone
TIO	Territory Insurance Office

1 Introduction

At the Twelfth Meeting of the Twenty-Second Council on Tuesday, 27 March 2018 (ORD03/36) under General Business, the council considered Dangerous Trees in the Darwin Municipality (Common No. 3777063). The Council considered the issue of potentially dangerous trees planted throughout the City of Darwin Municipality, and in particular the trees that came down during recent significant weather events and develop a plan to manage these trees.

They also agreed that the report include but not be limited to:

- A report to be provided to Council regarding the kind of trees that have been damaged /uprooted in recent events ranked by species.
- Inspection of Council parks to identify trees planted in close proximity to private property and /or powerlines that have the potential to cause damage and /or injury if/when they come down.
- A plan for the removal and possible costing to be provided to Council regarding specifically these trees.
- A review of our parks to identify number and species of trees that may come down in a future weather event as it has happened in the recent past.
- 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.
- A review of the list trees suitable to areas prone to cyclones been undertaken to ensure that all trees that are removed are replaced with suitable trees.
- Potential for salvage from fallen trees
- The issue of maintaining trees to reduce load so that they remain safe in high winds.

They also agree that a follow up report from Cyclone Marcus be presented to Council, including consideration of effects on vegetation. A decision was then carried (NO.22\0592).

This report address the first dot point above.

2 Project Aims

The project objectives are to: undertake a survey of parks in the Darwin municipality to record damage to trees, tree damage to infrastructure, surrounding landscape information and resilient trees; and determine trends following analysis of individual tree parameters recorded and correlations with the degree of cyclone damage.

The project goals are to:

- understand trends in urban tree damage and survival following a Category 2 tropical cyclone; determine tree species that suffered major damage in TC Marcus; determine tree species that were resilient to TC Marcus; and understand all the variables that effected trees during TC Marcus.

The project solutions are to provide a comprehensive report presented to City of Council that includes the following:

- an analysis of survey data which includes proportions of tree species and the degree of damage in Darwin parks
- a presentation of tree response trends following analysis of survey data collected
- a presentation of results for use in informed decision making for future vegetation management actions in Darwin.

A data set of individual trees in the surveyed municipality parks will also be provided to CoD, providing a valuable information layer for Council's GIS.

3 Background

3.1 Cyclone Marcus

The following is an extract from the TC Marcus report on the BoM website.

“Tropical Cyclone Marcus was the strongest tropical cyclone to affect Darwin since Tropical Cyclone Tracy (category 4) in December 1974.
The centre of Tropical Cyclone Marcus made landfall as a category 2 cyclone near Cape Hotham at 9 am ACST on 17 March, then maintained its category 2 strength as it passed directly over Darwin City, Palmerston and surrounding suburbs between 10 am and 11 am ACST. The cyclone crossed Darwin Harbour to pass over Belyuen on the Cox Peninsula between 12 pm and 1 pm ACST and crossed Bynoe Harbour to pass over Dundee Beach between 2 pm to 3 pm ACST. Tropical Cyclone Marcus was downgraded to category 1 at 3 pm ACST about 20 km south of Dundee Beach.
Although Tropical Cyclone Marcus was a small sized cyclone as it passed the Northern Territory, with a gale radius of around 100km, the impacts on Darwin were widespread and significant. Thousands of trees were damaged or brought down. Many trees fell on buildings and cars. Around 430 powerlines were downed leaving some 26500 customers without power immediately after the cyclone. Fortunately there were no injuries. Gales were observed at Darwin Airport between 9:30 am and 1 pm ACST. Initially from the south, gales turned southwest to west then northwest as the destructive core of the tropical cyclone passed. The strongest wind gusts observed were 126 km/h (westerly) at Darwin Airport at 11:00 am ACST and 130 km/h (west-northwesterly) at Darwin Harbour at 11:30 am ACST. The heaviest rainfall was confined to the coasts with 136.4 mm at Gunn Point, 60.0 mm at Darwin Airport and 31.4 mm at The Chase (Palmerston) in the 24 hours to 9 am ACST 18 March. A 90 cm storm surge was recorded at the Darwin tidal gauge as the cyclone passed, although coinciding with low tide, the Highest Astronomical Tide was not exceeded.”

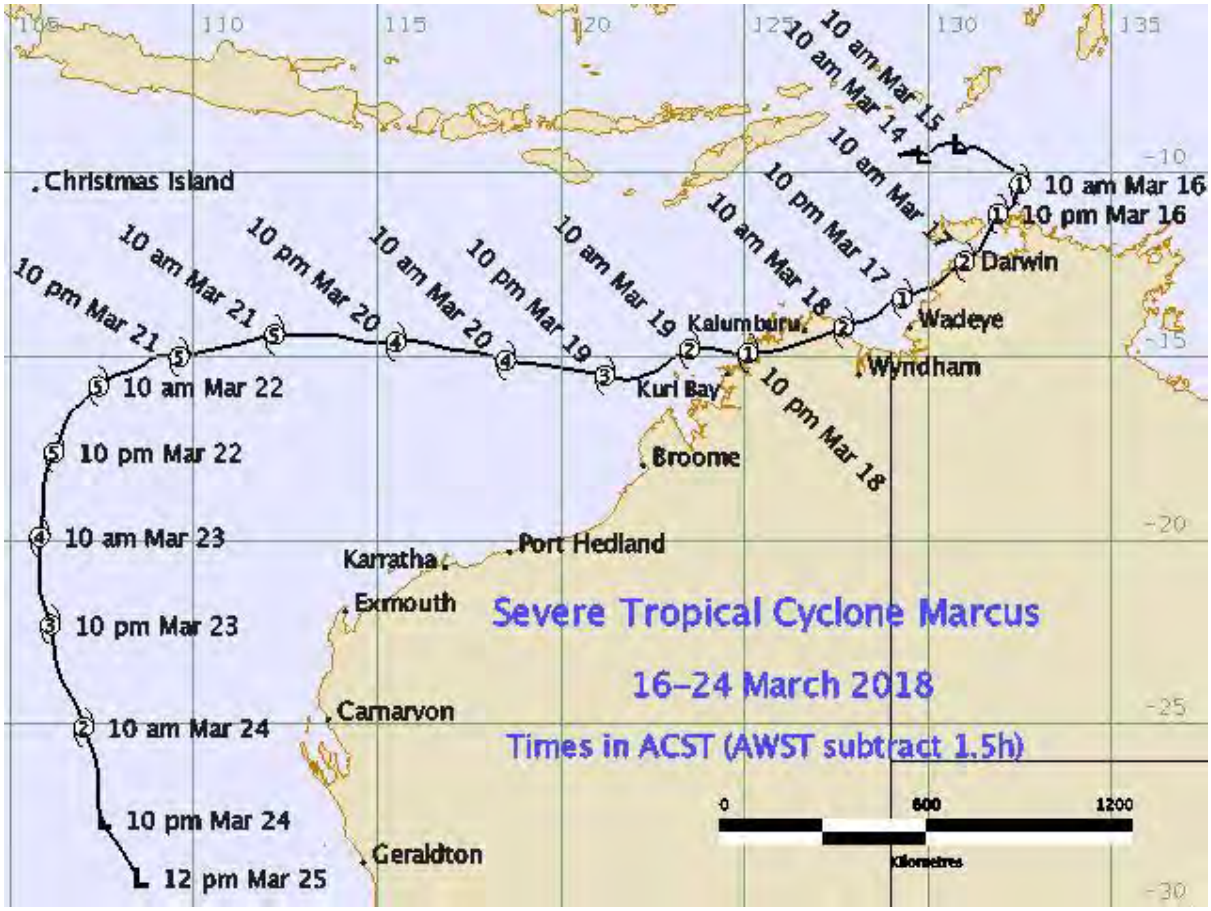


Figure 1 BoM weather map showing tracking history of TC Marcus

4 Methodology

4.1 Limitations

Cyclone Marcus hit Darwin on Saturday 17th March 2018 and the survey commenced a month later on the 17th April 2018. By this time the clearing crews, comprising City of Darwin staff, their contractors and TIO Insurance contractors, were working at an industrial scale to clean up damaged trees in the streets and parks of Darwin and surrounding suburbs. At the time of the survey commencement, all the main roads had been cleared of damaged trees.

In consultation with Council managers and the TIO Insurance contractor supervisor the remaining parks were prioritised for surveying so as to keep in front of the clearing crews and record tree damage as it was immediate post cyclone. This obviously restricted the sample size and timing for the survey. An electronic data collection form using Fulcrum had to be developed and included pre-loaded data and provision for photographs and GPs coordinates. This took a further week and could not be used in the field until the 22nd of April. During the previous week the data was recorded manually using the same Fulcrum categories. The time delay also biased recording of foliage damage which was difficult to determine 4 weeks after the cyclone had passed.

4.2 Assumptions

According to TC Marcus data from BoM there were variations in wind speed and direction as well as amounts of rainfall throughout the sample sites. Soil types and landform also varied between and within the surveyed parks. It is also assumed that all the trees surveyed varied in size, shape, health, propagation and cultivation (eg watering regimes, pests and diseases tree maintenance etc) regimes.

4.3 Data collection and analysis

This report is based on field observations of all trees in 40 Darwin parks in the aftermath of TC Marcus. Through the recording of these observations, data from an array of 30 parameters for all the trees was collected and then analysed to determine general trends. This was further amended with other datasets such as the Land Units and BoM data to identify further correlations. For example trees surveyed using Fulcrum (1,716 in total) were mapped with soil types derived from the Greater Darwin Land Units (DENR 2000).

4.3.1 Data collection

The Survey generated a substantial amount of field data, including an abundance of digital photographs and field data. The data was collected and collated using an electronic in-field data capture method using Greening Australia's Fulcrum database. Data collection tools featured automatic upload to a cloud-based website, which allowed for real time data collation, review, analysis and interpretation in the office. This functionality was of key importance in the timely and accurate reporting for the Project Area.

At each location, the following data was collected: street address; soil type; landscape description (including irrigated/non-irrigated); tree species; tree size; individual/group of trees; major damage type; less damaged type; infrastructure damage; trees posing a future threat to infrastructure; GPS coordinates; wind direction; and photographs. Wind direction was mainly measured by the direction the tree fell as it was uprooted. All data collected on Fulcrum will be linked with CoD Arc Info GIS to provide an information layer.

The majority of species were identified in the field by the author and samples taken for any unidentified specimens. Where possible these were identified by staff at the Darwin Herbarium and the George Brown Botanical Gardens.

City of Darwin provided copies of digital maps of municipal parks, streets and infrastructure for the survey.

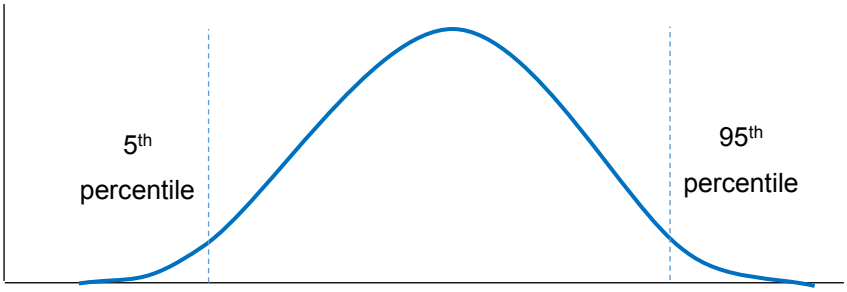
4.3.2 The analysis of tree statistics

All individual tree species were analysed for the degree of cyclone damage. The species with the greatest abundance provided a larger sample size for more confident analysis.

In the following tables, particularly notable statistics are highlighted in green (positive) or red (negative). These are results vary significantly from the average and have a comparatively large sample size.

The use of red (performed poorly for that indicator) and green (performed well for that indicator) highlight in cells is intended to highlight potentially significant and notable data. Although a full statistical analysis was not performed this threshold was roughly based around data that:

- May lie in the 5^{th} or 95^{th} percentile for that indicator, and



- There is a large sample size and therefore probably a large confidence margin.

Using the made-up example below:

Species \ Damage Type	Nil		Total
	number	%	
Khaya senegalensis	27	11.5%	235
Peltophorum pterocarpum	1	10.0%	10
Pterocarpus indicus	61	50.0%	122
Mimusops elengi	10	62.5%	16
All Trees	**1157**	**40.5%**	**2857**

Khaya senegalensis had a very low rate of "Nil" damage (11.5% vs a survey average of 40.5%). Furthermore it had a very large sample size so we can be reasonably confident that the 11.5% is a good reflection of the entire population. This indicates an undesirable result (i.e. we prefer trees with higher levels of Nil damage), therefore the cell is highlighted red. Contrast this with *Peltophorum pterocarpum,* which had a lower rate of "Nil" damage -10%. However, this was only based on a survey of 10 plants so there is very low confidence that the 10% figure accurately reflects the entire population, even though it would be inside the 5th percentile. Therefore it was not highlighted.

Pterocarpus indicus had a very high rate of "Nil" damage (50% vs a survey average of 40.5%). Furthermore it had a very large sample size so we can be reasonably confident that the 50% is a good reflection of the entire population. This indicates a desirable result (i.e. we prefer trees with higher levels of Nil damage), therefore the cell is highlighted green. Contrast this with *Mimusops elengi* which had a higher rate of "Nil" damage - 62.5%. However, this was only based on a survey of 16 plants so there is very low confidence that the 62.5% figure accurately reflects the entire population, even though it would be inside the 95th percentile. Therefore it was not highlighted.

4.4 Proportions of individual tree species damaged

Proportions of individual tree species damaged was determined by surveying all individual trees in as many parks in the municipality as was possible during the remaining timeframe of the clean up program. By surveying prior to any clean up activities, the sites provided a snapshot of the tree damage immediately following a cyclone.

The following damage categories were recorded for each tree: major damage type (uprooted, trunk/leader snapped/split, significant branch broken); less damaged type (good (no visible damage to the tree apart from loss of foliage); small branches (subjective, but generally a branch comprising only a small proportion of the tree); leaning (plant is laying over but roots are not necessarily exposed) and damage from another tree. The survey used similar damage classifications as previous post cyclone surveys, so that the data base on tree response can build in cyclone prone areas of Australia.

Plate 1: Examples of tree damage categories. Clockwise from top left corner: uprooted; trunk split; trunk snapped, significant branch broken; small branches broken; tree leaning; tree damaged by other tree; and tree damaged infrastructure.

Figure 2: Fulcrum survey sample template

5 Results and Discussion

5.1 Survey Locations

During the project period 40 parks from 13 suburbs in the Darwin Municipality were surveyed. This represents close to 20% of the total 200 parks managed by DoC in the municipality (DoC also manages over 70 other landscaped areas). The majority of parks surveyed were in the northern suburbs. By the time the survey commenced, all the parks in Darwin CBD and surrounding 'southern' suburbs had either been cleared or were in the process of being cleared of damaged trees. Chrisp Street and Nakara Ovals included irrigated and non-irrigated sections and Mueller Park was manually irrigated. The surveyed sites included a range of small and large urban parks, greenbelts and ovals, most irrigated and some not. The majority of parks surveyed were neighbourhood parks

Table 1: Darwin parks surveyed

Suburb	Park	Irrigation	Park type	CoD classification
Alawa	Bald Park	yes	Small urban	Neighbourhood
	Britomart Park	yes	Small urban	Neighbourhood
	Stedcombe Park	yes	Small urban	Neighbourhood
	Stobo Park	yes	Small urban	Neighbourhood
Coconut Grove	Easther Park	yes	Small urban	Neighbourhood
	Old Macmillan's Park	yes	Large urban	District
Malak	Abbot Park	yes	Small urban	Neighbourhood
	Bayfield Park	no	Greenbelt	Neighbourhood
	Malak G/belt	no	Greenbelt	District
	Malak Oval	yes	Large urban	Sporting Ground
	Mueller Park	yes - manually	Large urban	Neighbourhood
	Holzerland Green Belt	no	Greenbelt	Neighbourhood
Millner	Stokes Park	yes	Small urban	Neighbourhood
Moil	Butters Park	yes	Small urban	Neighbourhood
	Byrne Park	yes	Small urban	Neighbourhood
	Greenwood Park	no	Small urban	Neighbourhood
Nakara	Harwood Park	yes	Small urban	Neighbourhood
	Kilfoyle Park	yes	Small urban	Neighbourhood
	Nakara Oval Park	no	Large urban	Sporting Ground
		yes	Large urban	Sporting Ground
Nightcliff	Bill Bell Park	yes	Large urban	Neighbourhood
	Grevillea Park	yes	Small urban	Neighbourhood
Parap	Worgan Park	yes	Small urban	Neighbourhood
Rapid Creek	Bike Fun Park	no	Large urban	Neighbourhood
	Chrisp Street Oval Park	no	Large urban	Sporting Ground
		yes	Large urban	Sporting Ground
Wagaman	Amsterdam Park	yes	Small urban	Neighbourhood
	Colster Park	yes	Small urban	Neighbourhood
	Groote Park	yes	Small urban	Neighbourhood
	Tasman Park	yes	Small urban	Neighbourhood
Wanguri	Kailis Park	yes	Small urban	Neighbourhood
	Mazlin Park	yes	Small urban	Neighbourhood
	Strele Park	yes	Small urban	Neighbourhood
	Wanguri Oval Irrigated	yes	Large urban	Sporting Ground
Wulagi	Curlew Park	yes	Small urban	Neighbourhood
	Jabiru Park	yes	Small urban	Neighbourhood
	Plover Park	yes	Small urban	Neighbourhood
	Wulagi Greenbelt	yes	Greenbelt	District
Karama	Eaton Park	yes	Small urban	Neighbourhood
	Freycinet Park	yes	Small urban	Neighbourhood
	Mahogany Park	yes	Large urban	Neighbourhood
	Peron Park	yes	Small urban	Neighbourhood

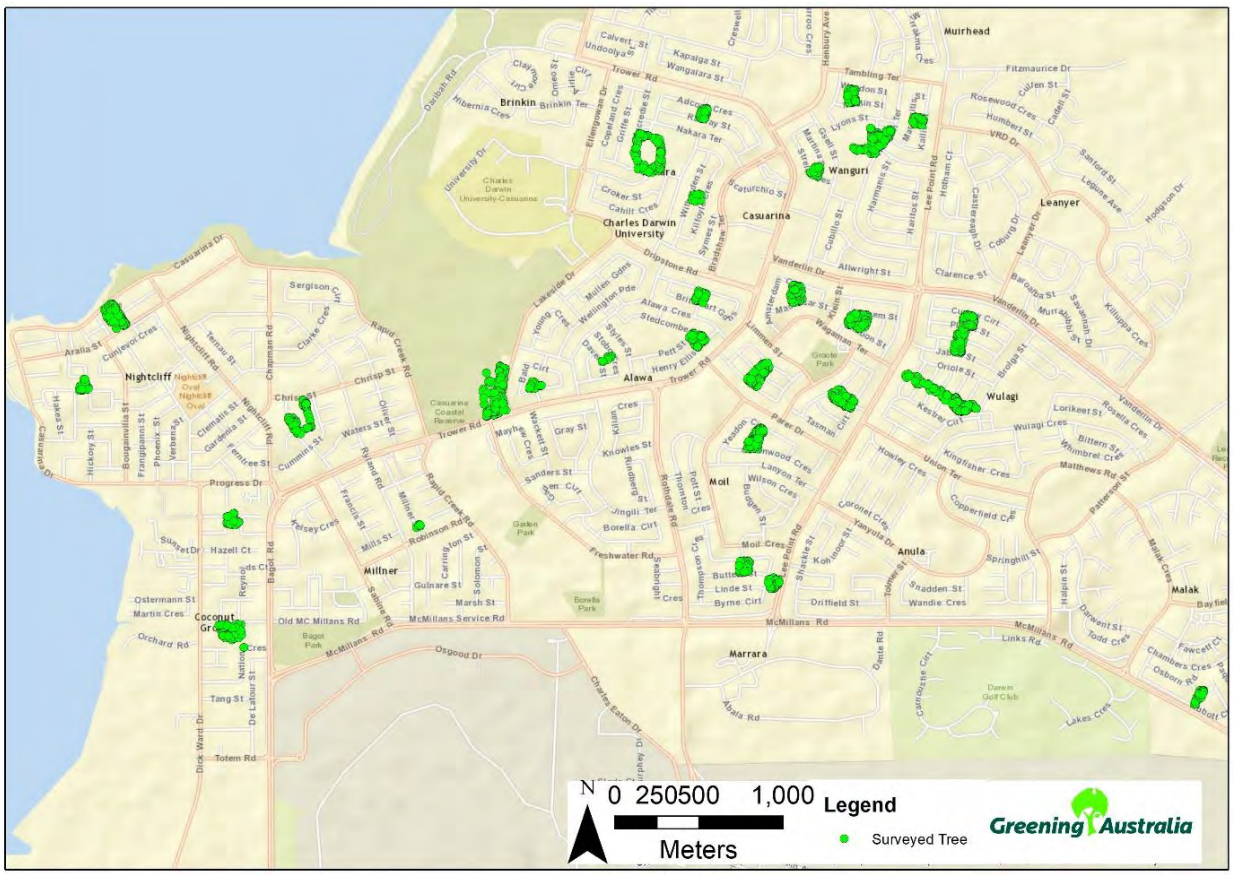


Figure 3 Map showing locations of surveyed trees in Darwin parks

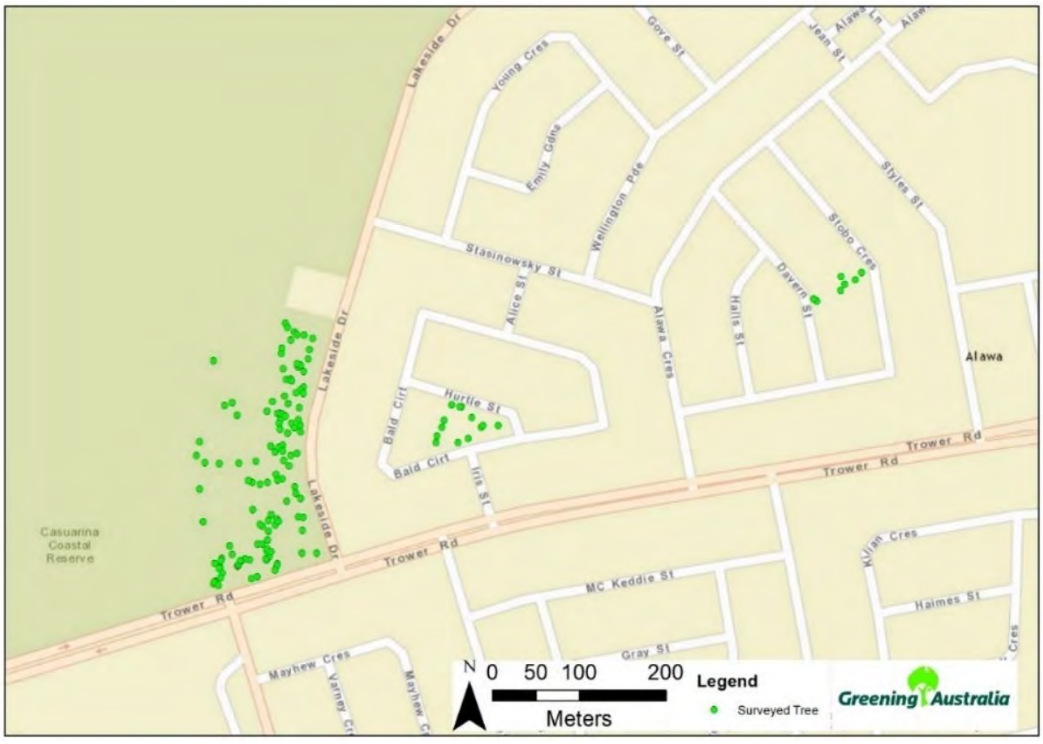


Figure 4: An example of a close-up map with tree locations in 3 surveyed parks.

Figure 5: Example close-up map of the same 3 surveyed parks with aerial image

5.2 Description of park land units, landforms, soils, trees and associated infrastructure

5.2.1 Land units

Surveyed parks were found in the following land units as defined by DENR (2000).

Rises

2b1: Gentle side-slopes; gradient 2-5%; moderately deep gravelly yellow massive earths, minor lithosols: Eucalypt Open Woodland to Woodland.

3a: Flat to gently undulating upland surface; gradient 0-2%; deep red massive earths, minor yellow massive earths: Eucalypt Open Forest.

3b: Flat to gently undulating upland surface; gradient 0-2.5%; moderately deep gravelly yellow massive earths, minor red massive earths: Eucalypt Woodland to Open Forest.

3c: Flat to gently undulating upland surface; gradient 1-3%; shallow, gravelly yellow massive earths, minor lateritic lithosols: Eucalypt Woodland, minor Open Woodland.

3d: Flat to gently undulating upland surface; gradient 1-3%; shallow gravelly lithosols: Eucalypt Open Woodland, minor Woodland.

3e: Flat to gently undulating upland surface; gradient 0.5-2%; wet-season water table; hard-setting deep mottled yellow massive earths: Variable Woodland, minor Open Forest.

4c: Gentle lower slopes; gradient 0.5-1.5%; wet-season water table; hard-setting deep mottled yellow massive earths: Mixed species Open Forest, minor Woodland.

9b: Estuarine fringes; gradient negligible, <0.5%; intertidal inundation; saline muds and clays: Low Closed Forest of Mangrove spp.

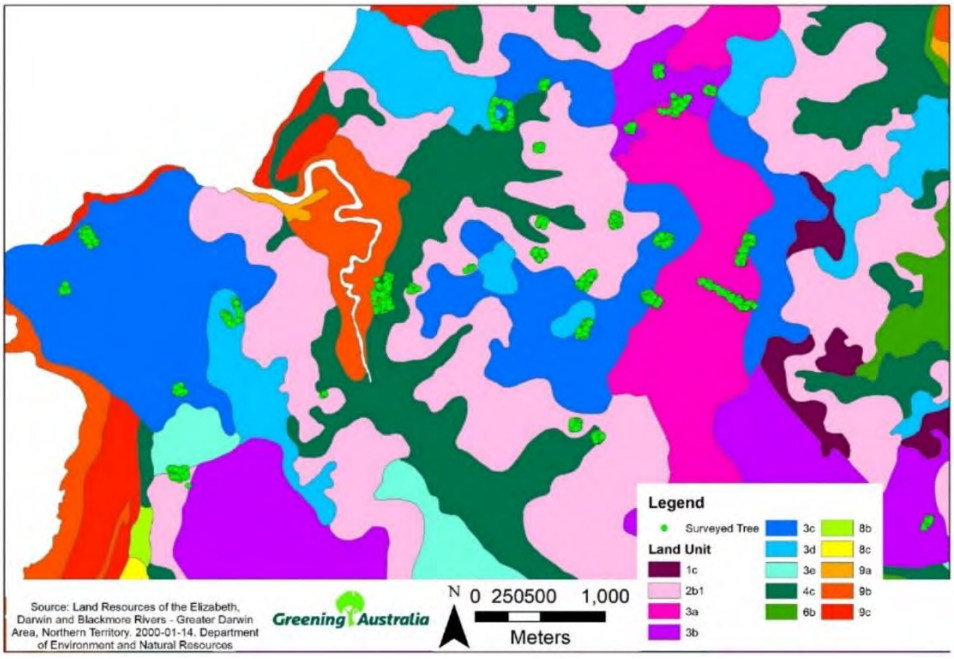


Figure 6: Map showing trees surveyed using Fulcrum and land units as described by DENR (2000).

5.2.2 Landforms

Surveyed parks were found in the following landforms as defined by DENR (2000) flat to gently undulating upland surface with a gradient ranging from 0-3%; gentle side-slopes with a gradient of 2-5%; and gentle lower slopes with a gradient of 0.5-1.5%.

5.2.3 Soils

The 1,716 trees surveyed with Fulcrum occurred in the following soil types: brown kandosol soil (deep gravelly yellow massive earths with minor lithosols), red kandosols (shallow -moderately deep red massive earths with minor yellow massive earths), kandosolic redoxic hydrosols (hardsetting deep mottled yellow massive earths), leptic rudosols (shallow gravelly lithosols). The latter soil type has a shallow (within 0.5m) underlaying of unweathered lateritic rock (CSIRO 2018). Lithosols are any of a group of shallow azonal soils consisting of imperfectly weathered rock fragments (Miriam-Webster 2018).

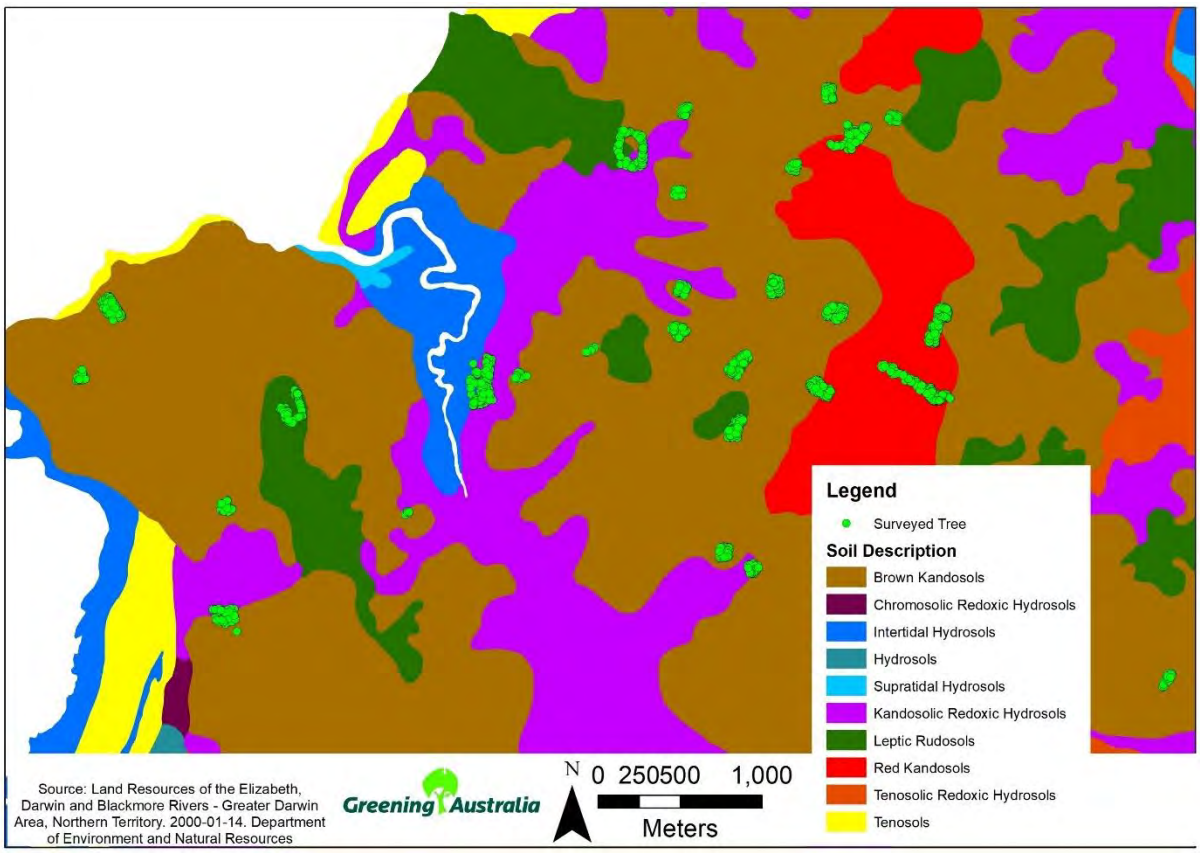


Figure 7: Map showing trees surveyed using Fulcrum and soil types as described by DENR (2000).

5.2.4 Trees

The majority of the surveyed trees had been cultivated but occasional remnant trees did exist. Many of the larger trees in the surveyed parks were planted post TC Tracy in the late 1970's and early 1980's. A great majority of these trees were grown by the then Conservation Commission of the NT nursery at Berrimah Farm as well as some of the larger nurseries around Darwin. They were planted out by Parks and Gardens crews working for the Forestry Unit. These included a mixture of exotic timber/shade trees such as African mahogany (*Khaya senegalensis*) and local native species such as Black wattle (*Acacia auriculiformis*) and Red gum (*Eucalyptus camaldulensis*). Following on from these original plantings CoD have managed the parks and planted a mixture of local native species, including *Mimusops elengi* and *Maranthes corymbosa* as well as a variety of exotic palms.

5.2.5 Associated infrastructure

The small urban (neighbourhood) parks were typically surrounded by housing and associated gardens, and bounded by urban roads on one, two, three or four sides. The larger urban parks and greenbelts (regional, district, sporting ground and neighbourhood parks) were also bounded by housing, roads, schools and shopping centres. All parks had fencing and hard coated pathways. Irrigated parks had piping, meters and solenoids. Some parks had playgrounds, lighting, seating and drinking fountains.

5.3 Proportions of tree species

A total of 2,857 individual trees from 142 species in 40 parks were surveyed. Of the species surveyed, the majority were local provenance natives (50%) along with other NT native species (17%), Australian natives (4%), naturalised (2%) and exotic species (27%). As a proportion of all trees surveyed, the majority were local provenance (51.7%), exotic species made up a nearly a quarter (24.7%), NT natives with the next highest number of indiividuals (17.2%) and the remainder made up of Australian Natives and Naturalised specimens (3.9% and 2.5% respectively). There were 7 standout dominant species with over 100 surveyed individuals. They were in order of tree numbers: African mahogany (*Khaya senegalensis),* Maranthes (*Maranthes corymbosa),* Red gum *(Eucalyptus camaldulensis),* Yellow flame tree *(Peltophorum pterocarpum),* Black wattle (*Acacia auriculiformis),* Papua New Guinea rosewood *(Pterocarpus indicus)* and Mimusops (*Mimusops elengi).* Of the 142 species surveyed, 21 species comprised 68% of the surveyed trees.

Table 2: Tree species surveyed and origin

Tree Species	Common Name	Provenance	Total Number
Khaya senegalensis	African mahogany	Exotic	235
Maranthes corymbosa	Maranthes	Local provenance	205
Eucalyptus camaldulensis	River red gum	NT Native	191
Peltophorum pterocarpum	Yellow flame tree	Local provenance	162
Acacia auriculiformis	Black wattle	Local provenance	124
Pterocarpus indicus	Papua New Guinea rosewood	Exotic	122
Mimusops elengi	Mimusops	Local provenance	107
Ficus virens	Banyan	Local provenance	99
Allosyncarpia ternata	Allosyncarpia	NT Native	86
Eucalyptus bigalerita	Northern salmon gum	NT Native	73
Carpentaria acuminata	Carpentaria palm	Local provenance	71
Corymbia bella	Ghost gum	Local provenance	65
Leptospermum madidum	Weeping ti-tree	Local provenance	65
Pterocarpus indicus (weeping form)	Weeping rosewood	Exotic	62
Corymbia ptychocarpa	Swamp bloodwood	Local provenance	55
Delonix regia	Poinciana	Naturalised	48
Calophyllum inophyllum	Beauty leaf	Local provenance	43
Eucalyptus tetrodonta	Darwin stringy bark	Local provenance	36
Latania lodgesii	Blue Latan palm	Exotic	35
Melaleuca leucadendra	Weeping paperbark	Local provenance	32
Syzygium forte	Bush apple	Local provenance	32
Corymbia polycarpa	Long-fruited bloodwood	Local provenance	30
Callistemon viminalis	Red bottlebrush	NT Native	29
Alstonia actinophylla	Mikwood	Local provenance	28
Tabebuia aurea	Caribbean trumpet tree	Exotic	27
Plumeria obtusa	Evergreen frangipani	Exotic	26

Albizia lebbeck	Albizia	Local provenance	25
Carallia brachiata	Freshwater mangrove	Local provenance	25
Ficus macrocarpa var. hillii	Hills weeping fig	Australian Native	25
Tamarindus indica	Tamarind	Naturalised	24
Arfuillea arborescens	Hop tree	Exotic	23
Ptychosperma macarthurii	Macarthur palm	Australian Native	22
Eucalyptus miniata	Darwin woolybutt	Local provenance	21
Murraya paniculata	Murraya	NT Native	21
Millettia pinnata	Millettia	Local provenance	21
Alstonia scholaris	Cheesewood	Australian Native	20
Eucalyptus tintinanns	Salmon gum	NT Native	20
Wodyetia bifurcata	Fox tail palm	Australian Native	20
Eucalyptus herbertiana	Yellow barked mallee	NT Native	19
Syzygium armstrongii	White bush apple	Local provenance	19
Myristica insipida	Native nutmeg	NT Native	18
Terminalia melanocarpa	Black Damson	Australian Native	16
Ficus benjamina	Weeping fig	Local provenance	15
Albizia saman	Raintree	Exotic	15
Ficus longifolia	Narrow leaf fig	Exotic	14
Melaleuca bracteata	Black tea-tree	NT Native	14
Terminalia microcarpa	Terminalia	Local provenance	14
Livistona muelleri	Northern cabbage palm	Exotic	14
Livistona benthamii	Benthams fan palm	Local provenance	13
Dypsis lutescens	Golden cane	Exotic	13
Cycas media	Cycad	Exotic	13
Ficus racemosa	Cluster fig	Local provenance	12
Caryota mitis	Fishtail palm	Exotic	12
Mangifera indica	Mango	Exotic	11
Tabebuia pallida	Pink trumpet tree	Exotic	11
Terminalia platyphylla	Wild plum	Local provenance	11
Ganophyllum falcatum	Ganophyllum	Local provenance	10
Melaleuca argentea	Silver-leaved paperbark	Local provenance	10
Cocos nucifera	Coconut	Exotic	9
Corymbia bleeseri	Smooth - stemmed bloodwood	Local provenance	9
Alphitonia excelsa	Soap-leaf tree	Local provenance	8
Azadirachta indica	Neem tree	Local provenance	8
Brachychiton diversifolius	Northern kurrajong	Local provenance	8
Lagerstroemia indica	Pride of India	Exotic	8
Nauclea orientalis	Leichardt pine	Local provenance	8
Polyalthia longifolia	Indian mast tree	Exotic	7
Corymbia jacobsiana	Stringybark bloodwood	NT Native	6
Dodonea platyptera	Dodonea	Local provenance	6
Eucalyptus apodophylla	White bark	Local provenance	6
Livistona humilis	Sand palm	Local provenance	6

Cassia fistula	Golden shower tree	Exotic	5
Gmelina arborea	Gmelina	Exotic	5
Timonius timon	Timonius	Local provenance	5
Syzygium suborbiculare	Red bush apple	Local provenance	5
Monoon australe	Polyalthia	Local provenance	5
Breynia cernua	Breynia	Local provenance	4
Callitris intratropica	Northern cypress pine	Local provenance	4
Eucalyptus phoenicea	Scarlet gum	NT Native	4
Eucalyptus tectifica	Darwin box	Local provenance	4
Schleichera oleosa	Ceylon oak	Exotic	4
Syzygium nervosum	Syzygium	Local provenance	4
Sterculia sp.	Sterculia sp.	NT Native	4
Melaleuca dealbata	Melaleuca	Local provenance	3
Roystonea regia	Cuban royal palm	Exotic	3
Schefflera actinophylla	Umbrella tree	Local provenance	3
Xanthostemon chrysanthus	Golden penda	Australian Native	3
Pterocarpus sp.	Rosewood	Exotic	3
Cascabela thevetia	Yellow oleander	Exotic	3
Citharexylum spinosum	Fiddlewood tree	Exotic	2
Corymbia confertiflora	Broad-leaf carbeen	Local provenance	2
Exocarpus latifolius	Native cherry	Local provenance	2
Ficus opposita	Sandpaper fig	Local provenance	2
Lophostemon lactifluus	Lophostemon	Local provenance	2
Planchonia careya	Cocky apple	Local provenance	2
Bauhinia purpurea	Purple Bauhinia	Exotic	2
Miliusa brahei	Miliusa	Local provenance	2
Elaeis guineensis	African oil palm	Exotic	2
Caesalpiniacea sp.		Exotic	2
Asteromyrtus magnifica	Asteromyrtus	NT Native	2
Hyphorbe verschaffeltii	Spindle palm	Exotic	2
Terminalia bellirica	Bahera	Exotic	2
Melaleuca sp.	Melaleuca	NT Native	2
Adenanthera pavonina	Red bead tree	Local provenance	1
Artocarpus heterophylla	Jackfruit	Exotic	1
Barringtonia asiatica	Fish poison tree	Exotic	1
Berrya cordifolia	Berrya	Local provenance	1
Buchanania obovata	Green plum	Local provenance	1
Cyclophyllum schultzii	Cyclophyllum	Local provenance	1
Cassia siamea	Siamese cassia	Exotic	1
Casuarina equisetifolia	Coastal sheoak	Local provenance	1
Citrus latifolia	Lime tree	Exotic	1
Corymbia latifolia - check	Round-leaf bloodwood	Local provenance	1
Corymbia porrecta	Grey bloodwood	Local provenance	1
Croton sp.	Croton	Exotic	1

Cupaniopsis anacardioides	Beach tamarind	Local provenance	1
Cycas armstrongii	Cycad	Local provenance	1
Diospyros sp.	Native ebony	Local provenance	1
Erythrophleum chlorostachys	Ironwood	Local provenance	1
Hibbertia sp.	Hibbertia	Exotic	1
Lyrata pandurata	Fiddle leaf fig	Exotic	1
Tree with 7 leaflets		NT Native	1
Wrightia pubescens	Wrightia	Local provenance	1
Wrightia saligna	Milk bush	Local provenance	1
Melaleuca nervosa	Fibrebark	Local provenance	1
Pleiogynium timoriense	Burdekin plum	Australian Native	1
Psidium guajava	Guava	Exotic	1
Syzygium jambos	Rose apple	Exotic	1
Morinda citrifolia	Rotten cheesefruit	Local provenance	1
Guazuma ulmifolia	West Indian elm	Exotic	1
Veitchia merillii	Christmas palm	Exotic	1
Apocynacea sp.		Local provenance	1
Bougainvillea spectabilis	Bougainvillea	Exotic	1
Arecacea sp.	Palm	Exotic	1
Horsfieldia australiana	Horsfieldia	Local provenance	1
Syzygium sp. 2		Australian Native	1
Livistona ramsayii	Queensland fan palm	Australian Native	1
Tabebuia rosea		Exotic	1
Eucalyptus oligantha	Broad-leaved box	NT Native	1
Syzygium sp.		Australian Native	1
Diospyros nigra	Black sapote	Exotic	1
Coelospermum reticulatum	Coelospermum	Local provenance	1
Unidentified monsoon forest sp.		NT Native	1
		Total	**2,857**

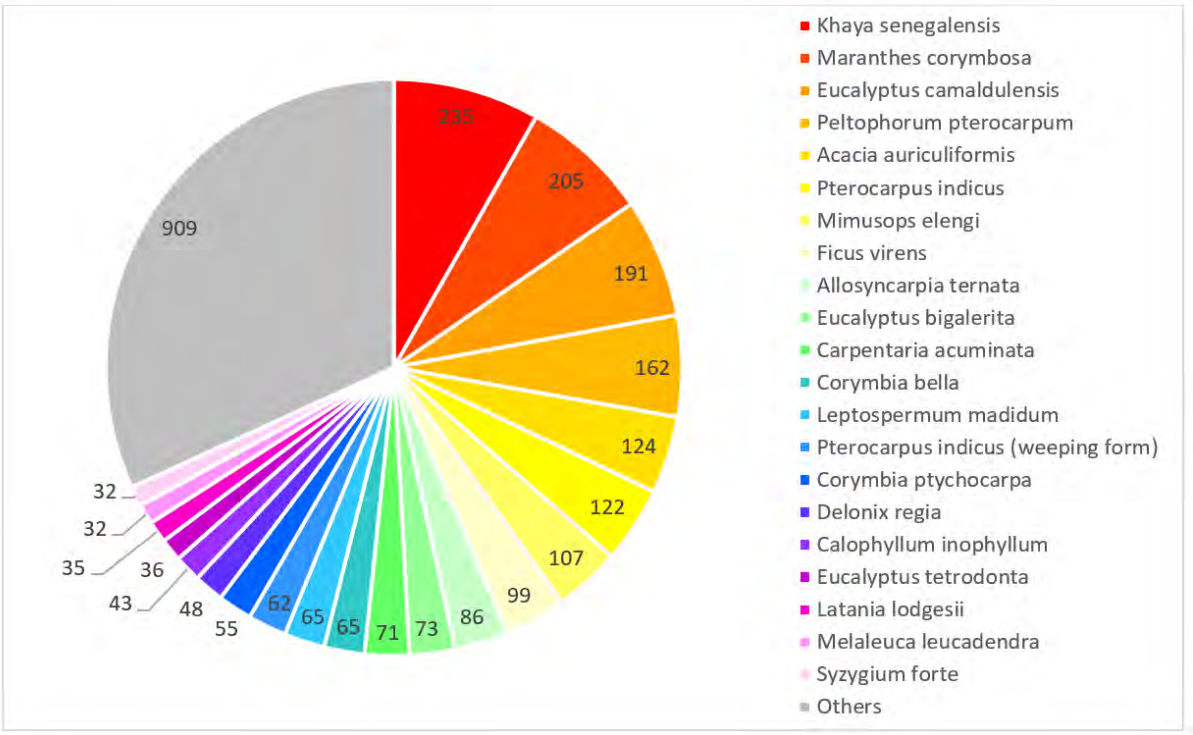


Figure 8: Top 21 most commonly species represented as a proportion of all sampled species

Table 3: Proportion of individual trees surveyed by origin

Origin	Survey Proportion
Local provenance	51.7%
NT Native	17.2%
Australian Native	3.9%
Naturalised	2.5%
Exotic	24.7%

5.4 Tree damage type statistics

5.4.1 Tree damage statistics of the top 21 most abundant species.

From the analysis of the 21 most abundant species, for all damage categories including minor foliage loss and small branches broken, *Khaya senegalensis* (88.5%), *Acacia auriculiformis* (88.7%),

Maranthes corymbosa (78.0%) and *Eucalyptus camaldulensis* (75.9%) had the highest tree damage rates. It is interesting to note that from the above species *Maranthes corymbosa* had a very low rate (12.2%) of major damage.

66% of all surveyed *Khaya senegalensis* were uprooted. Other species which commonly uprooted were *Pterocarpus indicus* (weeping form) (30.6%) and *Acacia auriculiformis* (29.8%).

Only 5.6% of *Carpentaria acuminata* were damaged. Other relatively unscathed tree species were *Ficus virens* (46.5%) and *Leptospermum madidum* (47.7%).

Delonix regia had the highest rate of significant branch breaks (18.8%). However, it had no trunk snapping or splitting.

Leptospermum madidum) had the highest rate of trunk snapping or splitting (12.3%).

Plate 2: Two specimens of *Alstonia actinophylla*, a local provenance native species.

Table 4: Top 21 most surveyed tree species stratified by tree damage.

Top 21 most surveyed tree species stratified by tree damage.

Species \ Damage Type	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Khaya senegalensis	27	11.5%	0	0.0%	40	17.0%	67	28.5%	168	71.5%	4	1.7%	9	3.8%	0	0.0%	0	0.0%	155	66.0%	235
Maranthes corymbosa	45	22.0%	0	0.0%	135	65.9%	180	87.8%	25	12.2%	4	2.0%	15	7.3%	0	0.0%	2	1.0%	4	2.0%	205
Eucalyptus camaldulensis	46	24.1%	2	1.0%	54	28.3%	102	53.4%	89	46.6%	6	3.1%	30	15.7%	1	0.5%	12	6.3%	40	20.9%	191
Peltophorum pterocarpum	46	28.4%	2	1.2%	45	27.8%	93	57.4%	69	42.6%	10	6.2%	23	14.2%	1	0.6%	2	1.2%	33	20.4%	162
Acacia auriculiformis	14	11.3%	0	0.0%	40	32.3%	54	43.5%	70	56.5%	7	5.6%	16	12.9%	1	0.8%	9	7.3%	37	29.8%	124
Pterocarpus indicus	61	50.0%	0	0.0%	30	24.6%	91	74.6%	31	25.4%	5	4.1%	7	5.7%	0	0.0%	2	1.6%	17	13.9%	122
Mimusops elengi	52	48.6%	0	0.0%	35	32.7%	87	81.3%	20	18.7%	1	0.9%	9	8.4%	0	0.0%	2	1.9%	8	7.5%	107
Ficus virens	53	53.5%	2	2.0%	22	22.2%	77	77.8%	22	22.2%	7	7.1%	13	13.1%	0	0.0%	0	0.0%	2	2.0%	99
Allosyncarpia ternata	31	36.0%	0	0.0%	37	43.0%	68	79.1%	18	20.9%	1	1.2%	1	1.2%	0	0.0%	4	4.7%	12	14.0%	86
Carpentaria acuminata	67	94.4%	0	0.0%	1	1.4%	68	95.8%	3	4.2%	0	0.0%	0	0.0%	0	0.0%	3	4.2%	0	0.0%	71
Eucalyptus bigalerita	29	39.7%	0	0.0%	24	32.9%	53	72.6%	20	27.4%	3	4.1%	3	4.1%	0	0.0%	2	2.7%	12	16.4%	73
Leptospermum madidum	34	52.3%	0	0.0%	6	9.2%	40	61.5%	25	38.5%	1	1.5%	7	10.8%	0	0.0%	8	12.3%	9	13.8%	65
Corymbia bella	19	29.2%	0	0.0%	31	47.7%	50	76.9%	15	23.1%	9	13.8%	2	3.1%	0	0.0%	3	4.6%	1	1.5%	65
Pterocarpus indicus (weeping form)	27	43.5%	0	0.0%	13	21.0%	40	64.5%	22	35.5%	0	0.0%	1	1.6%	0	0.0%	2	3.2%	19	30.6%	62
Corymbia ptychocarpa	17	30.9%	0	0.0%	24	43.6%	41	74.5%	14	25.5%	3	5.5%	5	9.1%	0	0.0%	2	3.6%	4	7.3%	55
Delonix regia	13	27.1%	0	0.0%	16	33.3%	29	60.4%	19	39.6%	2	4.2%	9	18.8%	0	0.0%	0	0.0%	8	16.7%	48
Calophyllum inophyllum	8	18.6%	0	0.0%	25	58.1%	33	76.7%	10	23.3%	1	2.3%	6	14.0%	0	0.0%	3	7.0%	0	0.0%	43
Eucalyptus tetrodonta	6	16.7%	0	0.0%	15	41.7%	21	58.3%	15	41.7%	4	11.1%	4	11.1%	0	0.0%	4	11.1%	3	8.3%	36
Latania lodgesii	33	94.3%	0	0.0%	1	2.9%	34	97.1%	1	2.9%	0	0.0%	0	0.0%	0	0.0%	1	2.9%	0	0.0%	35
Melaleuca leucadendra	16	50.0%	0	0.0%	11	34.4%	27	84.4%	5	15.6%	1	3.1%	1	3.1%	0	0.0%	2	6.3%	1	3.1%	32
Syzygium forte	15	46.9%	0	0.0%	12	37.5%	27	84.4%	5	15.6%	0	0.0%	1	3.1%	0	0.0%	1	3.1%	3	9.4%	32
Grand Total	**659**	**33.8%**	**6**	**0.3%**	**617**	**31.7%**	**1282**	**65.8%**	**666**	**34.2%**	**69**	**3.5%**	**162**	**8.3%**	**3**	**0.2%**	**64**	**3.3%**	**368**	**18.9%**	**1948**
All Trees	**1157**	**40.5%**	**12**	**0.4%**	**824**	**28.8%**	**1993**	**69.8%**	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

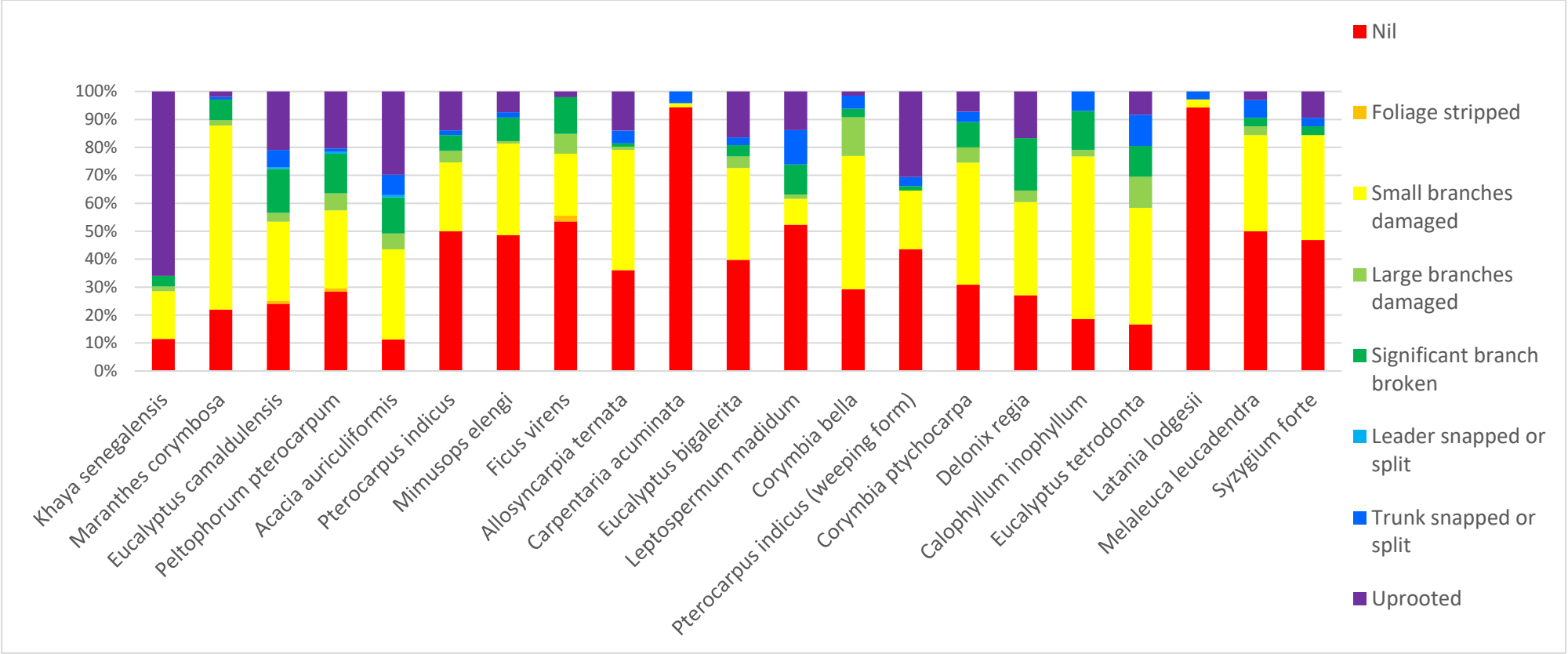


Figure 9: All tree damage to the top 21 surveyed trees

5.4.2 Tree damage statistics of tree species with 10 or more surveyed individuals

5.4.2.1 Tree species with the lowest rate of major tree damage

Carpentaria acuminata (4.2%) and *Latania lodgesii* (2.9%) had low rates of major damage and a good sample size. *Murraya paniculata, Melaleuca bracteata, Livistona muelleri, Dypsis lutescens, Cycas media* and *Melaleuca argentea* all had 0% major damage, but the sample size was small.

Table 5: Tree species with 10 or more samples in order of lowest rate of major tree damage

Damage Type / Species	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Murraya paniculata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	21
Melaleuca bracteata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Livistona muelleri	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Livistona benthamii	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Dypsis lutescens	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Cycas media	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Melaleuca argentea	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
Latania lodgesii	1	2.9%	0	0.0%	0	0.0%	0	0.0%	1	2.9%	0	0.0%	35
Carpentaria acuminata	3	4.2%	0	0.0%	0	0.0%	0	0.0%	3	4.2%	0	0.0%	71
Ptychosperma macarthurii	1	4.5%	0	0.0%	0	0.0%	0	0.0%	1	4.5%	0	0.0%	22
Eucalyptus tintinanns	1	5.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	5.0%	20
Plumeria obtusa	2	7.7%	0	0.0%	1	3.8%	0	0.0%	0	0.0%	1	3.8%	26
Corymbia polycarpa	3	10.0%	1	3.3%	1	3.3%	1	3.3%	0	0.0%	0	0.0%	30
Alstonia scholaris	2	10.0%	0	0.0%	2	10.0%	0	0.0%	0	0.0%	0	0.0%	20
Ganophyllum falcatum	1	10.0%	1	10.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
Callistemon viminalis	3	10.3%	0	0.0%	2	6.9%	0	0.0%	0	0.0%	1	3.4%	29
Eucalyptus herbertiana	2	10.5%	1	5.3%	1	5.3%	0	0.0%	0	0.0%	0	0.0%	19
Maranthes corymbosa	25	12.2%	4	2.0%	15	7.3%	0	0.0%	2	1.0%	4	2.0%	205
Tamarindus indica	3	12.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	12.5%	24
Arfuillea arborescens	3	13.0%	0	0.0%	2	8.7%	0	0.0%	0	0.0%	1	4.3%	23
Wodyetia bifurcata	3	15.0%	0	0.0%	0	0.0%	0	0.0%	3	15.0%	0	0.0%	20
Melaleuca leucadendra	5	15.6%	1	3.1%	1	3.1%	0	0.0%	2	6.3%	1	3.1%	32
Syzygium forte	5	15.6%	0	0.0%	1	3.1%	0	0.0%	1	3.1%	3	9.4%	32
Myristica insipida	3	16.7%	0	0.0%	0	0.0%	2	11.1%	0	0.0%	1	5.6%	18
Alstonia actinophylla	5	17.9%	1	3.6%	3	10.7%	0	0.0%	1	3.6%	0	0.0%	28
Terminalia platyphylla	2	18.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	11
Mimusops elengi	20	18.7%	1	0.9%	9	8.4%	0	0.0%	2	1.9%	8	7.5%	107
Allosyncarpia ternata	18	20.9%	1	1.2%	1	1.2%	0	0.0%	4	4.7%	12	14.0%	86
Ficus virens	22	22.2%	7	7.1%	13	13.1%	0	0.0%	0	0.0%	2	2.0%	99
Corymbia bella	15	23.1%	9	13.8%	2	3.1%	0	0.0%	3	4.6%	1	1.5%	65
Calophyllum inophyllum	10	23.3%	1	2.3%	6	14.0%	0	0.0%	3	7.0%	0	0.0%	43
Millettia pinnata	5	23.8%	0	0.0%	3	14.3%	1	4.8%	0	0.0%	1	4.8%	21
Pterocarpus indicus	31	25.4%	5	4.1%	7	5.7%	0	0.0%	2	1.6%	17	13.9%	122
Corymbia ptychocarpa	14	25.5%	3	5.5%	5	9.1%	0	0.0%	2	3.6%	4	7.3%	55
Syzygium armstrongii	5	26.3%	1	5.3%	2	10.5%	0	0.0%	1	5.3%	1	5.3%	19
Ficus benjamina	4	26.7%	1	6.7%	3	20.0%	0	0.0%	0	0.0%	0	0.0%	15
Eucalyptus bigalerita	20	27.4%	3	4.1%	3	4.1%	0	0.0%	2	2.7%	12	16.4%	73
Ficus macrocarpa var. hillii	7	28.0%	2	8.0%	3	12.0%	0	0.0%	0	0.0%	2	8.0%	25
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.2 Tree species with the highest rate of major tree damage

Khaya senegalensis (71.5%), *Acacia auriculiformis* (56.5%), *Eucalyptus camaldulensis* (46.6%) and *Peltophorum pterocarpum* (42.6%) having a significantly high rate of major damage (and a large sample size) compared with the average rate for all trees (30.2%).

The following species had over 30 individuals sampled and less than 10% uprooting: *Callophyllum inophyllum* (0%), *Carpentaria acuminata* (0%), *Corymbia bella* (1.5%), *Corymbia polycarpa* (0%), *Corymbia ptychocarpa (7.3%), Ficus virens* (2%), *Latania lodgesii* (0%), *Maranthes corymbosa* (2%) , *Melaleuca leucadendra* (3.1%), *Mimusops elengi* (7.5%) and *Syzygium forte* (9.4%).

Table 6: Tree species with 10 or more samples in order of highest rate of major tree damage

Damage Type / Species	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Khaya senegalensis	27	11.5%	0	0.0%	40	17.0%	67	28.5%	168	71.5%	4	1.7%	9	3.8%	0	0.0%	0	0.0%	155	66.0%	235
Tabebuia pallida	2	18.2%	0	0.0%	2	18.2%	4	36.4%	7	63.6%	2	18.2%	3	27.3%	0	0.0%	1	9.1%	1	9.1%	11
Terminalia melanocarpa	1	6.3%	0	0.0%	5	31.3%	6	37.5%	10	62.5%	0	0.0%	1	6.3%	1	6.3%	2	12.5%	6	37.5%	16
Ficus longifolia	2	14.3%	0	0.0%	4	28.6%	6	42.9%	8	57.1%	0	0.0%	1	7.1%	0	0.0%	0	0.0%	7	50.0%	14
Acacia auriculiformis	14	11.3%	0	0.0%	40	32.3%	54	43.5%	70	56.5%	7	5.6%	16	12.9%	1	0.8%	9	7.3%	37	29.8%	124
Carallia brachiata	7	28.0%	0	0.0%	4	16.0%	11	44.0%	14	56.0%	0	0.0%	6	24.0%	3	12.0%	1	4.0%	4	16.0%	25
Terminalia microcarpa	3	21.4%	0	0.0%	4	28.6%	7	50.0%	7	50.0%	1	7.1%	3	21.4%	0	0.0%	0	0.0%	3	21.4%	14
Samanea saman	5	33.3%	0	0.0%	3	20.0%	8	53.3%	7	46.7%	1	6.7%	4	26.7%	0	0.0%	0	0.0%	2	13.3%	15
Eucalyptus camaldulensis	46	24.1%	2	1.0%	54	28.3%	102	53.4%	89	46.6%	6	3.1%	30	15.7%	1	0.5%	12	6.3%	40	20.9%	191
Albizia lebbeck	9	36.0%	0	0.0%	5	20.0%	14	56.0%	11	44.0%	0	0.0%	5	20.0%	0	0.0%	0	0.0%	6	24.0%	25
Eucalyptus miniata	5	23.8%	0	0.0%	7	33.3%	12	57.1%	9	42.9%	2	9.5%	5	23.8%	0	0.0%	1	4.8%	1	4.8%	21
Peltophorum pterocarpum	46	28.4%	2	1.2%	45	27.8%	93	57.4%	69	42.6%	10	6.2%	23	14.2%	1	0.6%	2	1.2%	33	20.4%	162
Eucalyptus tetrodonta	6	16.7%	0	0.0%	15	41.7%	21	58.3%	15	41.7%	4	11.1%	4	11.1%	0	0.0%	4	11.1%	3	8.3%	36
Ficus racemosa	2	16.7%	0	0.0%	5	41.7%	7	58.3%	5	41.7%	0	0.0%	3	25.0%	0	0.0%	0	0.0%	2	16.7%	12
Tabebuia aurea	10	37.0%	0	0.0%	6	22.2%	16	59.3%	11	40.7%	0	0.0%	6	22.2%	0	0.0%	1	3.7%	4	14.8%	27
Delonix regia	13	27.1%	0	0.0%	16	33.3%	29	60.4%	19	39.6%	2	4.2%	9	18.8%	0	0.0%	0	0.0%	8	16.7%	48
Leptospermum madidum	34	52.3%	0	0.0%	6	9.2%	40	61.5%	25	38.5%	1	1.5%	7	10.8%	0	0.0%	8	12.3%	9	13.9%	65
Mangifera indica	6	54.5%	0	0.0%	1	9.1%	7	63.6%	4	36.4%	0	0.0%	1	9.1%	0	0.0%	0	0.0%	3	27.3%	11
Pterocarpus indicus (weeping form)	27	43.5%	0	0.0%	13	21.0%	40	64.5%	22	35.5%	0	0.0%	1	1.6%	0	0.0%	2	3.2%	19	30.6%	62
Caryota mitis	8	66.7%	0	0.0%	0	0.0%	8	66.7%	4	33.3%	0	0.0%	0	0.0%	0	0.0%	2	16.7%	2	16.7%	12
Ficus macrocarpa var. hillii	15	60.0%	0	0.0%	3	12.0%	18	72.0%	7	28.0%	2	8.0%	3	12.0%	0	0.0%	0	0.0%	2	8.0%	25
Eucalyptus bigalerita	29	39.7%	0	0.0%	24	32.9%	53	72.6%	20	27.4%	3	4.1%	3	4.1%	0	0.0%	2	2.7%	12	16.4%	73
Ficus benjamina	9	60.0%	0	0.0%	2	13.3%	11	73.3%	4	26.7%	1	6.7%	3	20.0%	0	0.0%	0	0.0%	0	0.0%	15
Syzygium armstrongii	8	42.1%	0	0.0%	6	31.6%	14	73.7%	5	26.3%	1	5.3%	2	10.5%	0	0.0%	1	5.3%	1	5.3%	19
Corymbia ptychocarpa	17	30.9%	0	0.0%	24	43.6%	41	74.5%	14	25.5%	3	5.5%	5	9.1%	0	0.0%	2	3.6%	4	7.3%	55
Pterocarpus indicus	61	50.0%	0	0.0%	30	24.6%	91	74.6%	31	25.4%	5	4.1%	7	5.7%	0	0.0%	2	1.6%	17	13.9%	122
Millettia pinnata	5	23.8%	0	0.0%	11	52.4%	16	76.2%	5	23.8%	0	0.0%	3	14.3%	1	4.8%	0	0.0%	1	4.8%	21
Calophyllum inophyllum	8	18.6%	0	0.0%	25	58.1%	33	76.7%	10	23.3%	1	2.3%	6	14.0%	0	0.0%	3	7.0%	0	0.0%	43
Corymbia bella	19	29.2%	0	0.0%	31	47.7%	50	76.9%	15	23.1%	9	13.8%	2	3.1%	0	0.0%	3	4.6%	1	1.5%	65
Ficus virens	53	53.5%	2	2.0%	22	22.2%	77	77.8%	22	22.2%	7	7.1%	13	13.1%	0	0.0%	0	0.0%	2	2.0%	99
Alloxylocarpia ternata	31	36.0%	0	0.0%	37	43.0%	68	79.1%	18	20.9%	1	1.2%	1	1.2%	0	0.0%	4	4.7%	12	14.0%	86
Mimusops elengi	52	48.6%	0	0.0%	35	32.7%	87	81.3%	20	18.7%	1	0.9%	9	8.4%	0	0.0%	2	1.9%	8	7.5%	107
Terminalia platyphylla	6	54.5%	0	0.0%	3	27.3%	9	81.8%	2	18.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	11
Alstonia echinophylla	17	60.7%	0	0.0%	6	21.4%	23	82.1%	5	17.9%	1	3.6%	3	10.7%	0	0.0%	1	3.6%	0	0.0%	28
Myristica insipida	9	50.0%	0	0.0%	6	33.3%	15	83.3%	3	16.7%	0	0.0%	0	0.0%	2	11.1%	0	0.0%	1	5.6%	18
Melaleuca leucadendra	16	50.0%	0	0.0%	11	34.4%	27	84.4%	5	15.6%	1	3.1%	1	3.1%	0	0.0%	2	6.3%	1	3.1%	32
Syzygium forte	15	46.9%	0	0.0%	12	37.5%	27	84.4%	5	15.6%	0	0.0%	1	3.1%	0	0.0%	1	3.1%	3	9.4%	32
Wodyetia bifurcata	15	75.0%	0	0.0%	2	10.0%	17	85.0%	3	15.0%	0	0.0%	0	0.0%	0	0.0%	3	15.0%	0	0.0%	20
All Trees	**1157**	**40.5%**	**12**	**0.4%**	**824**	**28.8%**	**1993**	**69.8%**	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.3 Trees with species with more than 10% rate of uprooting.

Khaya senegalensis had a significantly high proportion of uprooted trees (66%). This is over 4 times higher than the overall uprooting rate of 15.4% for all 440 trees that were uprooted.

Plate 3 : An uprooted Khaya senegalensis

Table 7: Tree species with 10 or more samples with more than 10% rate of uprooting.

Damage Type / Species	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Khaya senegalensis	168	71.5%	4	1.7%	9	3.8%	0	0.0%	0	0.0%	155	66.0%	235
Ficus longifolia	8	57.1%	0	0.0%	1	7.1%	0	0.0%	0	0.0%	7	50.0%	14
Terminalia melanocarpa	10	62.5%	0	0.0%	1	6.3%	1	6.3%	2	12.5%	6	37.5%	16
Pterocarpus indicus (weeping form)	22	35.5%	0	0.0%	1	1.6%	0	0.0%	2	3.2%	19	30.6%	62
Acacia auriculiformis	70	56.5%	7	5.6%	16	12.9%	1	0.8%	9	7.3%	37	29.8%	124
Mangifera indica	4	36.4%	0	0.0%	1	9.1%	0	0.0%	0	0.0%	3	27.3%	11
Albizia lebbeck	11	44.0%	0	0.0%	5	20.0%	0	0.0%	0	0.0%	6	24.0%	25
Terminalia microcarpa	7	50.0%	1	7.1%	3	21.4%	0	0.0%	0	0.0%	3	21.4%	14
Eucalyptus camaldulensis	89	46.6%	6	3.1%	30	15.7%	1	0.5%	12	6.3%	40	20.9%	191
Peltophorum pterocarpum	69	42.6%	10	6.2%	23	14.2%	1	0.6%	2	1.2%	33	20.4%	162
Terminalia platyphylla	2	18.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	11
Ficus racemosa	5	41.7%	0	0.0%	3	25.0%	0	0.0%	0	0.0%	2	16.7%	12
Delonix regia	19	39.6%	2	4.2%	9	18.8%	0	0.0%	0	0.0%	8	16.7%	48
Caryota mitis	4	33.3%	0	0.0%	0	0.0%	0	0.0%	2	16.7%	2	16.7%	12
Eucalyptus bigalerita	20	27.4%	3	4.1%	3	4.1%	0	0.0%	2	2.7%	12	16.4%	73
Carallia brachiata	14	56.0%	0	0.0%	6	24.0%	3	12.0%	1	4.0%	4	16.0%	25
Tabebuia aurea	11	40.7%	0	0.0%	6	22.2%	0	0.0%	1	3.7%	4	14.8%	27
Allosyncarpia ternata	18	20.9%	1	1.2%	1	1.2%	0	0.0%	4	4.7%	12	14.0%	86
Pterocarpus indicus	31	25.4%	5	4.1%	7	5.7%	0	0.0%	2	1.6%	17	13.9%	122
Leptospermum madidum	25	38.5%	1	1.5%	7	10.8%	0	0.0%	8	12.3%	9	13.8%	65
Samanea saman	7	46.7%	1	6.7%	4	26.7%	0	0.0%	0	0.0%	2	13.3%	15
Tamarindus indica	3	12.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	12.5%	24
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.4 Tree species with a 0% rate of uprooting

Out of the species with 0% uprooting, *Callophyllum inophyllum* and *Carpentaria acuminata* were represented by a good sample size. 18 species recorded nil uprooting compared with the overall uprooting rate of 15.4% for all trees.

Table 8: Tree species with 10 or more samples with a 0% rate of uprooting.

Species \ Damage Type	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Ficus benjamina	4	26.7%	1	6.7%	3	20.0%	0	0.0%	0	0.0%	0	0.0%	15
Calophyllum inophyllum	10	23.3%	1	2.3%	6	14.0%	0	0.0%	3	7.0%	0	0.0%	43
Alstonia actinophylla	5	17.9%	1	3.6%	3	10.7%	0	0.0%	1	3.6%	0	0.0%	28
Wodyetia bifurcata	3	15.0%	0	0.0%	0	0.0%	0	0.0%	3	15.0%	0	0.0%	20
Eucalyptus herbertiana	2	10.5%	1	5.3%	1	5.3%	0	0.0%	0	0.0%	0	0.0%	19
Corymbia polycarpa	3	10.0%	1	3.3%	1	3.3%	1	3.3%	0	0.0%	0	0.0%	30
Alstonia scholaris	2	10.0%	0	0.0%	2	10.0%	0	0.0%	0	0.0%	0	0.0%	20
Ganophyllum falcatum	1	10.0%	1	10.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
Ptychosperma macarthurii	1	4.5%	0	0.0%	0	0.0%	0	0.0%	1	4.5%	0	0.0%	22
Carpentaria acuminata	3	4.2%	0	0.0%	0	0.0%	0	0.0%	3	4.2%	0	0.0%	71
Latania lodgesii	1	2.9%	0	0.0%	0	0.0%	0	0.0%	1	2.9%	0	0.0%	35
Murraya paniculata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	21
Melaleuca bracteata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Livistona muelleri	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Livistona benthamii	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Dypsis lutescens	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Cycas media	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Melaleuca argentea	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.5 Tree species with more than 5% rate of snapped or split trunks

Leptospermum madidum, with a good sample size, had a significantly high rate (12.3%) of snapped or split trunks, 4 times higher than the average of 3.1% for all trees surveyed.

Table 9: Tree species with 10 or more samples with more than 5% rate of snapped or split trunks.

Species \ Damage Type	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Caryota mitis	4	33.3%	0	0.0%	0	0.0%	0	0.0%	2	16.7%	2	16.7%	12
Wodyetia bifurcata	3	15.0%	0	0.0%	0	0.0%	0	0.0%	3	15.0%	0	0.0%	20
Terminalia melanocarpa	10	62.5%	0	0.0%	1	6.3%	1	6.3%	2	12.5%	6	37.5%	16
Leptospermum madidum	25	38.5%	1	1.5%	7	10.8%	0	0.0%	8	12.3%	9	13.8%	65
Eucalyptus tetrodonta	15	41.7%	4	11.1%	4	11.1%	0	0.0%	4	11.1%	3	8.3%	36
Tabebuia pallida	7	63.6%	2	18.2%	3	27.3%	0	0.0%	1	9.1%	1	9.1%	11
Acacia auriculiformis	70	56.5%	7	5.6%	16	12.9%	1	0.8%	9	7.3%	37	29.8%	124
Calophyllum inophyllum	10	23.3%	1	2.3%	6	14.0%	0	0.0%	3	7.0%	0	0.0%	43
Eucalyptus camaldulensis	89	46.6%	6	3.1%	30	15.7%	1	0.5%	12	6.3%	40	20.9%	191
Melaleuca leucadendra	5	15.6%	1	3.1%	1	3.1%	0	0.0%	2	6.3%	1	3.1%	32
Syzygium armstrongii	5	26.3%	1	5.3%	2	10.5%	0	0.0%	1	5.3%	1	5.3%	19
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.6 Tree species with a 0% rate of snapped or split trunks

Delonix regia, Ficus virens and *Khaya senegalensis* all had a large sample size and 0% snapped or split trunks. It is worthy to note that these species did experience other types of major damage, for example *K. senegalensis* with 66% uprooting.

Plate 4: Some species with strong trunks were damaged in other ways

Table 10: Tree species with 10 or more samples with a 0% rate of snapped or split trunks.

Damage Type / Species	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Albizia lebbeck	11	44.0%	0	0.0%	5	20.0%	0	0.0%	0	0.0%	6	24.0%	25
Alstonia scholaris	2	10.0%	0	0.0%	2	10.0%	0	0.0%	0	0.0%	0	0.0%	20
Arfuillea arborescens	3	13.0%	0	0.0%	2	8.7%	0	0.0%	0	0.0%	1	4.3%	23
Callistemon viminalis	3	10.3%	0	0.0%	2	6.9%	0	0.0%	0	0.0%	1	3.4%	29
Cycas media	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Delonix regia	19	39.6%	2	4.2%	9	18.8%	0	0.0%	0	0.0%	8	16.7%	48
Dypsis lutescens	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Eucalyptus herbertiana	2	10.5%	1	5.3%	1	5.3%	0	0.0%	0	0.0%	0	0.0%	19
Eucalyptus tintinanns	1	5.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	5.0%	20
Ficus benjamina	4	26.7%	1	6.7%	3	20.0%	0	0.0%	0	0.0%	0	0.0%	15
Ficus longifolia	8	57.1%	0	0.0%	1	7.1%	0	0.0%	0	0.0%	7	50.0%	14
Ficus macrocarpa var. hillii	7	28.0%	2	8.0%	3	12.0%	0	0.0%	0	0.0%	2	8.0%	25
Ficus racemosa	5	41.7%	0	0.0%	3	25.0%	0	0.0%	0	0.0%	2	16.7%	12
Ficus virens	22	22.2%	7	7.1%	13	13.1%	0	0.0%	0	0.0%	2	2.0%	99
Myristica insipida	3	16.7%	0	0.0%	0	0.0%	2	11.1%	0	0.0%	1	5.6%	18
Ganophyllum falcatum	1	10.0%	1	10.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
Khaya senegalensis	168	71.5%	4	1.7%	9	3.8%	0	0.0%	0	0.0%	155	66.0%	235
Millettia pinnata	5	23.8%	0	0.0%	3	14.3%	1	4.8%	0	0.0%	1	4.8%	21
Livistona benthamii	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Livistona muelleri	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Mangifera indica	4	36.4%	0	0.0%	1	9.1%	0	0.0%	0	0.0%	3	27.3%	11
Melaleuca argentea	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
Melaleuca bracteata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Murraya paniculata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	21
Plumeria obtusa	2	7.7%	0	0.0%	1	3.8%	0	0.0%	0	0.0%	1	3.8%	26
Corymbia polycarpa	3	10.0%	1	3.3%	1	3.3%	1	3.3%	0	0.0%	0	0.0%	30
Samanea saman	7	46.7%	1	6.7%	4	26.7%	0	0.0%	0	0.0%	2	13.3%	15
Tamarindus indica	3	12.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	12.5%	24
Terminalia microcarpa	7	50.0%	1	7.1%	3	21.4%	0	0.0%	0	0.0%	3	21.4%	14
Terminalia platyphylla	2	18.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	11
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.7 *Tree species with leader snapped or split*

Overall trees had a very low rate of snapped or split leaders (0.4%). *Carallia brachiata* (12%) and *Myristica insipida* (11.1%) had higher rates of damaged leaders but the sample size was relatively small. The author notes that he has observed this type of damage for these species outside of the survey area.

Table 11: Tree species with 10 or more samples with a leader snapped or split.

Damage Type / Species	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Acacia auriculiformis	70	56.5%	7	5.6%	16	12.9%	1	0.8%	9	7.3%	37	29.8%	124
Carallia brachiata	14	56.0%	0	0.0%	6	24.0%	3	12.0%	1	4.0%	4	16.0%	25
Corymbia polycarpa	3	10.0%	1	3.3%	1	3.3%	1	3.3%	0	0.0%	0	0.0%	30
Eucalyptus camaldulensis	89	46.6%	6	3.1%	30	15.7%	1	0.5%	12	6.3%	40	20.9%	191
Millettia pinnata	5	23.8%	0	0.0%	3	14.3%	1	4.8%	0	0.0%	1	4.8%	21
Myristica insipida	3	16.7%	0	0.0%	0	0.0%	2	11.1%	0	0.0%	1	5.6%	18
Peltophorum pterocarpum	69	42.6%	10	6.2%	23	14.2%	1	0.6%	2	1.2%	33	20.4%	162
Terminalia melanocarpa	10	62.5%	0	0.0%	1	6.3%	1	6.3%	2	12.5%	6	37.5%	16
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.8 *Tree species with more than 10% rate of significant branches broken*

Delonix regia (18.9%) and *Eucalyptus camaldulensis* (15.7%) had a significantly higher rates of significant branch damage compared to the sample average (8.3%).

Table 12: Tree species with 10 or more samples with more than 10% rate of significant branches broken.

Damage Type / Species	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Tabebuia pallida	7	63.6%	2	18.2%	3	27.3%	0	0.0%	1	9.1%	1	9.1%	11
Samanea saman	7	46.7%	1	6.7%	4	26.7%	0	0.0%	0	0.0%	2	13.3%	15
Ficus racemosa	5	41.7%	0	0.0%	3	25.0%	0	0.0%	0	0.0%	2	16.7%	12
Carallia brachiata	14	56.0%	0	0.0%	6	24.0%	3	12.0%	1	4.0%	4	16.0%	25
Eucalyptus miniata	9	42.9%	2	9.5%	5	23.8%	0	0.0%	1	4.8%	1	4.8%	21
Tabebuia aurea	11	40.7%	0	0.0%	6	22.2%	0	0.0%	1	3.7%	4	14.8%	27
Terminalia microcarpa	7	50.0%	1	7.1%	3	21.4%	0	0.0%	0	0.0%	3	21.4%	14
Albizia lebbeck	11	44.0%	0	0.0%	5	20.0%	0	0.0%	0	0.0%	6	24.0%	25
Ficus benjamina	4	26.7%	1	6.7%	3	20.0%	0	0.0%	0	0.0%	0	0.0%	15
Delonix regia	19	39.6%	2	4.2%	9	18.9%	0	0.0%	0	0.0%	8	16.7%	48
Eucalyptus camaldulensis	89	46.6%	6	3.1%	30	15.7%	1	0.5%	12	6.3%	40	20.9%	191
Millettia pinnata	5	23.8%	0	0.0%	3	14.3%	1	4.8%	0	0.0%	1	4.8%	21
Peltophorum pterocarpum	69	42.6%	10	6.2%	23	14.2%	1	0.6%	2	1.2%	33	20.4%	162
Calophyllum inophyllum	10	23.3%	1	2.3%	6	14.0%	0	0.0%	3	7.0%	0	0.0%	43
Ficus virens	22	22.2%	7	7.1%	13	13.1%	0	0.0%	0	0.0%	2	2.0%	99
Acacia auriculiformis	70	56.5%	7	5.6%	16	12.9%	1	0.8%	9	7.3%	37	29.8%	124
Ficus macrocarpa var. hillii	7	28.0%	2	8.0%	3	12.0%	0	0.0%	0	0.0%	2	8.0%	25
Eucalyptus tetrodonta	15	41.7%	4	11.1%	4	11.1%	0	0.0%	4	11.1%	3	8.3%	36
Leptospermum madidum	25	38.5%	1	1.5%	7	10.8%	0	0.0%	8	12.3%	9	13.8%	65
Alstonia actinophylla	5	17.9%	1	3.6%	3	10.7%	0	0.0%	1	3.6%	0	0.0%	28
Syzygium armstrongii	5	26.3%	1	5.3%	2	10.5%	0	0.0%	1	5.3%	1	5.3%	19
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.4.2.9 *Tree species with a 0% rate of significant branches broken*

Carpentaria acuminata and several other species of palms and a cycad were amongst the group that had no significant branch damage. These species do not have branches so the result is biased. *Eucalyptus tintinnans*, *Murraya paniculata* and *Tamarindus indica* also had 0% significant branch damage but a smaller sample size than *Carpentaria acuminata.*

Table 13: Tree species with 10 or more samples with a 0% rate of significant branches broken.

Damage Type / Species	Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	
Carpentaria acuminata	3	4.2%	0	0.0%	0	0.0%	0	0.0%	3	4.2%	0	0.0%	71
Caryota mitis	4	33.3%	0	0.0%	0	0.0%	0	0.0%	2	16.7%	2	16.7%	12
Cycas media	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Dypsis lutescens	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Eucalyptus tintinanns	1	5.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	5.0%	20
Ganophyllum falcatum	1	10.0%	1	10.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
Latania lodgesii	1	2.9%	0	0.0%	0	0.0%	0	0.0%	1	2.9%	0	0.0%	35
Livistona benthamii	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	13
Livistona muelleri	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Melaleuca argentea	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10
Melaleuca bracteata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	14
Murraya paniculata	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	21
Myristica insipida	3	16.7%	0	0.0%	0	0.0%	2	11.1%	0	0.0%	1	5.6%	18
Ptychosperma macarthurii	1	4.5%	0	0.0%	0	0.0%	0	0.0%	1	4.5%	0	0.0%	22
Tamarindus indica	3	12.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	12.5%	24
Terminalia platyphylla	2	18.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	11
Wodyetia bifurcata	3	15.0%	0	0.0%	0	0.0%	0	0.0%	3	15.0%	0	0.0%	20
All Trees	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

Plate 5: An example of a tree with significant branch damage

5.4.2.10 Root movement by species

Khaya senegalensis (62.1%), *Acacia auriculiformis* (32.3%) and *Pterocarpus indicus* - weeping form (27.4%) had significantly high rates of root movement with the majority haven fallen.

Maranthes corymbosa (96.6%) and *Ficus virens* (97%) had significantly high rates of no root movement.

Table 14: Root movement by species with more than 10 samples

Lean Category / Species	No Lean or Natural Lean		Root Movement (see right)		Lean		Fallen		Total
	number	%	number	%	number	%	number	%	
Khaya senegalensis	89	37.9%	146	62.1%	6	2.6%	140	59.6%	235
Terminalia melanocarpa	9	56.3%	7	43.8%	0	0.0%	7	43.8%	16
Ficus longifolia	9	64.3%	5	35.7%	2	14.3%	3	21.4%	14
Acacia auriculiformis	84	67.7%	40	32.3%	3	2.4%	37	29.8%	124
Albizia lebbeck	18	72.0%	7	28.0%	1	4.0%	6	24.0%	25
Pterocarpus indicus (weeping form)	45	72.6%	17	27.4%	1	1.6%	16	25.8%	62
Mangifera indica	8	72.7%	3	27.3%	0	0.0%	3	27.3%	11
Tabebuia aurea	20	74.1%	7	25.9%	3	11.1%	4	14.8%	27
Terminalia microcarpa	11	78.6%	3	21.4%	0	0.0%	3	21.4%	14
Eucalyptus camaldulensis	153	80.1%	38	19.9%	2	1.0%	36	18.8%	191
Peltophorum pterocarpum	130	80.2%	32	19.8%	3	1.9%	29	17.9%	162
Eucalyptus bigalerita	59	80.8%	14	19.2%	2	2.7%	12	16.4%	73
Terminalia platyphylla	9	81.8%	2	18.2%	0	0.0%	2	18.2%	11
Allosyncarpia ternata	71	82.6%	15	17.4%	2	2.3%	13	15.1%	86
Tamarindus indica	20	83.3%	4	16.7%	2	8.3%	2	8.3%	24
Caryota mitis	10	83.3%	2	16.7%	1	8.3%	1	8.3%	12
Carallia brachiata	21	84.0%	4	16.0%	0	0.0%	4	16.0%	25
Leptospermum madidum	55	84.6%	10	15.4%	1	1.5%	9	13.8%	65
Delonix regia	41	85.4%	7	14.6%	0	0.0%	7	14.6%	48
Samanea saman	13	86.7%	2	13.3%	1	6.7%	1	6.7%	15
Eucalyptus tetrodonta	32	88.9%	4	11.1%	0	0.0%	4	11.1%	36
Pterocarpus indicus	109	89.3%	13	10.7%	0	0.0%	13	10.7%	122
Eucalyptus miniata	19	90.5%	2	9.5%	1	4.8%	1	4.8%	21
Syzygium forte	29	90.6%	3	9.4%	0	0.0%	3	9.4%	32
Tabebuia pallida	10	90.9%	1	9.1%	0	0.0%	1	9.1%	11
Mimusops elengi	98	91.6%	9	8.4%	2	1.9%	7	6.5%	107
Ficus racemosa	11	91.7%	1	8.3%	0	0.0%	1	8.3%	12
Ficus macrocarpa var. hillii	23	92.0%	2	8.0%	0	0.0%	2	8.0%	25
Dypsis lutescens	12	92.3%	1	7.7%	1	7.7%	0	0.0%	13
Livistona benthamii	12	92.3%	1	7.7%	1	7.7%	0	0.0%	13
Corymbia ptychocarpa	51	92.7%	4	7.3%	0	0.0%	4	7.3%	55
Callistemon viminalis	27	93.1%	2	6.9%	2	6.9%	0	0.0%	29
Melaleuca leucadendra	30	93.8%	2	6.3%	0	0.0%	2	6.3%	32
Milletia pinnata	17	94.4%	1	5.6%	0	0.0%	1	5.6%	18
Myristica insipida	17	94.4%	1	5.6%	0	0.0%	1	5.6%	18
Syzygium armstrongii	18	94.7%	1	5.3%	0	0.0%	1	5.3%	19
Eucalyptus tintinanns	19	95.0%	1	5.0%	0	0.0%	1	5.0%	20
Arfuillea arborescens	22	95.7%	1	4.3%	0	0.0%	1	4.3%	23
Plumeria obtusa	25	96.2%	1	3.8%	0	0.0%	1	3.8%	26
Maranthes corymbosa	198	96.6%	7	3.4%	4	2.0%	3	1.5%	205
Ficus virens	96	97.0%	3	3.0%	2	2.0%	1	1.0%	99
Latania lodgesii	33	97.1%	1	2.9%	0	0.0%	1	2.9%	34
Corymbia hella	64	98.5%	1	1.5%	0	0.0%	1	1.5%	65
Carpentaria acuminata	70	98.6%	1	1.4%	1	1.4%	0	0.0%	71
Alstonia actinophylla	28	100.0%	0	0.0%	0	0.0%	0	0.0%	28
Alstonia scholaris	20	100.0%	0	0.0%	0	0.0%	0	0.0%	20
Calophyllum inophyllum	43	100.0%	0	0.0%	0	0.0%	0	0.0%	43
Corymbia polycarpa	30	100.0%	0	0.0%	0	0.0%	0	0.0%	30
Cycas media	13	100.0%	0	0.0%	0	0.0%	0	0.0%	13
Eucalyptus herbertiana	19	100.0%	0	0.0%	0	0.0%	0	0.0%	19
Ficus benjamina	15	100.0%	0	0.0%	0	0.0%	0	0.0%	15
Ganophyllum falcatum	10	100.0%	0	0.0%	0	0.0%	0	0.0%	10
Livistona muelleri	14	100.0%	0	0.0%	0	0.0%	0	0.0%	14
Melaleuca argentea	10	100.0%	0	0.0%	0	0.0%	0	0.0%	10
Melaleuca bracteata	14	100.0%	0	0.0%	0	0.0%	0	0.0%	14
Murraya paniculata	21	100.0%	0	0.0%	0	0.0%	0	0.0%	21
Ptychosperma macarthurii	22	100.0%	0	0.0%	0	0.0%	0	0.0%	22
Wodyetia bifurcata	20	100.0%	0	0.0%	0	0.0%	0	0.0%	20
All Trees	**2411**	**84.4%**	**446**	**15.6%**	**47**	**1.6%**	**399**	**14.0%**	**2857**

Plate 6: Examples of root movement in trees – leaning and fallen

5.5 Damage to trees by management.

5.5.1 Damage to trees by park classification

Green belt parks had a higher rate of uprooting but lower rates of large and small branches being damaged.

Smaller urban (neighbourhood) parks could have a higher degree of protection from surrounding housing and associated gardens. These parks are bounded by urban roads on one, two, three or four sides, where a degree of exposure may have an effect on tree response to the cyclone. The larger urban parks (neighbourhood, regional or district) could have greater exposure due to the larger lengths of road boundaries and in some cases associated ovals. Narrower shaped parks could also have a greater degree of protection from surrounding urban infrastructure.

Table 15: Tree damage by park classification

Damage Type / Park Category	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Green belt	456	47.6%	0	0.0%	190	19.9%	646	67.5%	311	32.5%	3	0.3%	75	7.8%	1	0.1%	45	4.7%	187	19.5%	957
Large urban	290	34.5%	9	1.1%	307	36.5%	606	72.1%	235	27.9%	31	3.7%	70	8.3%	4	0.5%	15	1.8%	115	13.7%	841
Small urban	411	38.8%	3	0.3%	327	30.9%	741	70.0%	318	30.0%	52	4.9%	92	8.7%	7	0.7%	29	2.7%	138	13.0%	1059
Grand Total	**1157**	**40.5%**	**12**	**0.4%**	**824**	**28.8%**	**1993**	**69.8%**	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.5.2 Damage to trees by density

Density was not a good predictor of tree damage.

Uprooting appears to be slightly higher in individuals, but this difference may not be statistically significant.

Table 16: Damage to trees by tree density

Damage Type / Grouping	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Group	850	40.5%	8	0.4%	644	30.7%	1502	71.6%	596	28.4%	80	3.8%	160	7.6%	11	0.5%	64	3.1%	281	13.4%	2098
Individual	197	49.1%	4	1.0%	76	19.0%	277	69.1%	124	30.9%	6	1.5%	27	6.7%	1	0.2%	12	3.0%	78	19.5%	401
Not Recorded	110	30.7%	0	0.0%	104	29.1%	214	59.8%	144	40.2%	0	0.0%	50	14.0%	0	0.0%	13	3.6%	81	22.6%	358
Grand Total	**1157**	**40.5%**	**12**	**0.4%**	**824**	**28.8%**	**1993**	**69.8%**	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

5.5.3 Damage to trees by irrigation type

When analysing all the tree species, manually watered trees had the highest rate of damage, the highest rate of significant branches breaking and the highest rate of uprooting. However, they had no recorded incidences of trunk snapping, possibly due to roots giving way more easily.

When analysing the 21 most abundant species, irrigation was associated with a higher rate of tree damage in *Maranthes corymbosa* and *Corymbia bella.* No irrigation was associated with a higher rate of tree damage in *Carpentaria acuminata, Corymbia ptychocarpa* and *Mimusops elengi.* Manual irrigation was associated with a higher rate of tree damage in *Khaya senegalensis*.

Irrigation was associated with a higher rate of large branch damage to *Ficus virens* and *Khaya senegalensis.*

Irrigation was associated with a higher rate of significant branches being broken in *Maranthes corymbosa.*

Irrigation was associated with a higher rate of uprooting in *Khaya senegalensis.*

Table 17: Damage to trees by irrigation type.

Damage Type / Irrigation Regime	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
no	478	43.5%	6	0.6%	269	24.7%	748	68.8%	340	31.3%	14	1.3%	85	7.8%	4	0.4%	45	4.1%	192	17.6%	1088
yes - manually	20	[illegible]	0	0.0%	20	22.5%	40	44.9%	49	[illegible]	0	0.0%	11	[illegible]	0	0.0%	0	0.0%	38	[illegible]	89
yes	664	39.5%	6	0.4%	535	31.8%	1205	71.7%	475	28.3%	72	4.3%	141	8.4%	8	0.5%	44	2.6%	210	12.5%	1680
Grand Total	1157	40.5%	12	0.4%	824	28.8%	1993	69.6%	864	30.2%	86	3.0%	237	8.3%	12	0.4%	89	3.1%	440	15.4%	2857

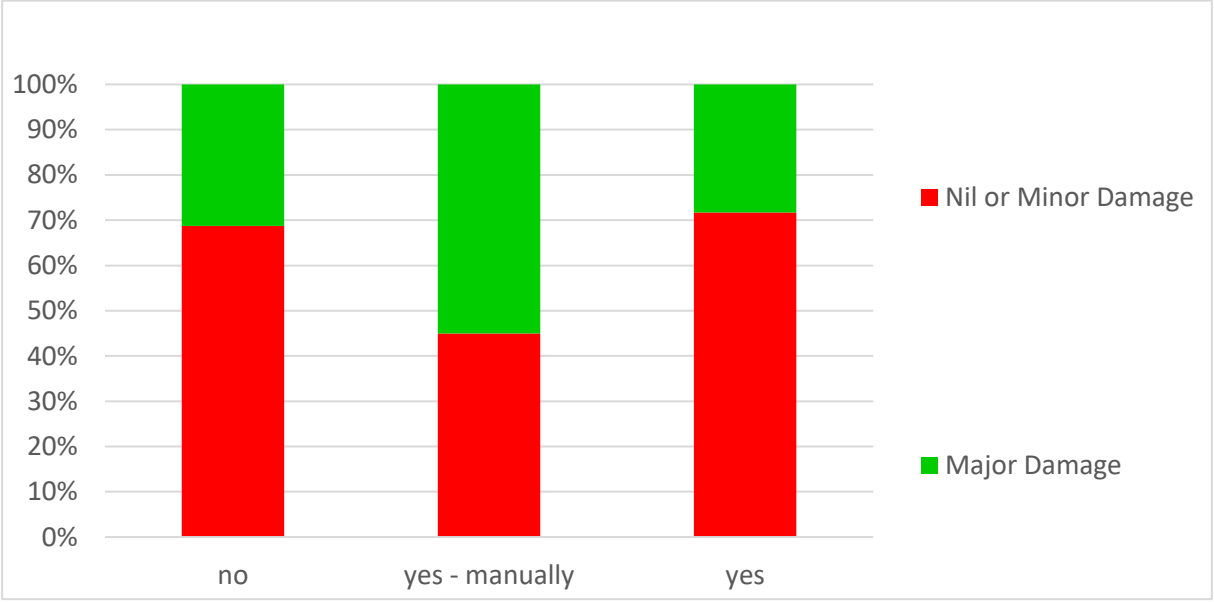


Figure 10: Tree damage by irrigation type

Table 18: Top 21 recorded tree species by irrigation type and damage.

Species	Irrigation	Nil number	Nil %	Foliage stripped number	Foliage stripped %	Small branches damaged number	Small branches damaged %	Nil or Minor Damage (as per left) number	Nil or Minor Damage (as per left) %	Major Damage (as per right) number	Major Damage (as per right) %	Large branches damaged number	Large branches damaged %	Significant branch broken number	Significant branch broken %	Leader snapped or split number	Leader snapped or split %	Trunk snapped or split number	Trunk snapped or split %	Uprooted number	Uprooted %	Total number
Acacia auriculiformis	no	7	11.1%	0	0.0%	24	38.1%	31	49.2%	32	50.8%	2	3.2%	8	12.7%	0	0.0%	5	7.9%	17	27.0%	63
	yes	7	11.9%	0	0.0%	16	26.2%	23	37.7%	38	62.3%	5	8.2%	8	13.1%	1	1.6%	4	6.6%	20	32.8%	61
Allosyncarpia ternata	no	4	33.3%	0	0.0%	5	41.7%	9	75.0%	3	25.0%	0	0.0%	0	0.0%	0	0.0%	1	8.3%	2	16.7%	12
	yes	27	37.0%	0	0.0%	32	43.8%	59	80.8%	14	19.2%	1	1.4%	1	1.4%	0	0.0%	3	4.1%	9	12.3%	73
	yes - manually	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	1
Calophyllum inophyllum	no	4	50.0%	0	0.0%	2	25.0%	6	75.0%	2	25.0%	0	0.0%	0	0.0%	0	0.0%	2	25.0%	2	0.0%	8
	yes	4	11.4%	0	0.0%	23	65.7%	27	77.1%	8	22.9%	1	2.9%	6	17.1%	0	0.0%	1	2.9%	0	0.0%	35
Carpentaria acuminata	no	22	84.6%	0	0.0%	1	3.8%	23	88.5%	3	11.5%	0	0.0%	0	0.0%	0	0.0%	3	11.5%	0	0.0%	26
	yes	41	100.0%	0	0.0%	0	0.0%	41	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	41
	yes - manually	4	100.0%	0	0.0%	0	0.0%	4	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	4
Corymbia bella	no	8	31.6%	0	0.0%	12	63.2%	18	94.7%	1	5.3%	0	0.0%	0	0.0%	0	0.0%	1	5.3%	0	0.0%	19
	yes	13	28.3%	0	0.0%	19	41.3%	32	69.6%	14	30.4%	3	15.0%	2	8.2%	0	0.0%	2	4.3%	1	2.2%	46
Corymbia plychocarpa	no	13	50.0%	0	0.0%	4	15.4%	17	65.4%	9	34.6%	1	3.8%	3	11.5%	0	0.0%	2	7.7%	3	11.5%	26
	yes	4	13.8%	0	0.0%	20	69.0%	24	82.8%	5	17.2%	2	6.9%	2	6.9%	0	0.0%	0	0.0%	1	3.4%	29
Delonix regia	no	7	50.0%	0	0.0%	4	28.6%	11	78.6%	3	21.4%	2	14.3%	1	7.1%	0	0.0%	0	0.0%	0	0.0%	14
	yes	6	20.0%	0	0.0%	11	36.7%	17	56.7%	13	43.3%	0	0.0%	6	20.0%	0	0.0%	0	0.0%	7	23.3%	30
	yes - manually	0	0.0%	0	0.0%	1	25.0%	1	25.0%	3	75.0%	0	0.0%	2	50.0%	0	0.0%	0	0.0%	1	25.0%	4
Eucalyptus tigalensis	no	3	50.0%	0	0.0%	2	33.3%	5	83.3%	1	16.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	16.7%	6
	yes	25	37.9%	0	0.0%	22	33.3%	47	71.2%	19	28.8%	3	4.5%	3	4.5%	0	0.0%	2	3.0%	11	16.7%	66
	yes - manually	1	100.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1
Eucalyptus camaldulensis	no	27	26.0%	2	1.9%	28	26.9%	57	54.8%	47	45.2%	2	1.9%	17	16.3%	1	1.0%	5	4.8%	22	21.2%	104
	yes	19	22.4%	0	0.0%	25	29.4%	44	51.8%	41	48.2%	4	4.7%	11	12.9%	0	0.0%	7	8.2%	17	20.0%	85
	yes - manually	0	0.0%	0	0.0%	1	50.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	2
Eucalyptus tetrodonta	no	2	14.3%	0	0.0%	5	35.7%	7	50.0%	7	50.0%	0	0.0%	2	14.3%	0	0.0%	3	21.4%	2	14.3%	14
	yes	4	18.2%	0	0.0%	10	45.5%	14	63.6%	8	36.4%	4	18.2%	2	9.1%	0	0.0%	1	4.5%	1	4.5%	22
Ficus drees	no	20	54.1%	1	2.7%	8	21.6%	29	78.4%	8	21.6%	1	2.7%	7	18.9%	0	0.0%	0	0.0%	0	0.0%	37
	yes	33	54.1%	1	1.6%	13	21.3%	47	77.0%	14	23.0%	6	9.8%	6	9.8%	0	0.0%	0	0.0%	2	3.3%	61
	yes - manually	0	0.0%	0	0.0%	1	100.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1
Khaya senegalensis	no	18	14.3%	0	0.0%	19	15.1%	37	29.4%	89	70.6%	0	0.0%	7	5.6%	0	0.0%	0	0.0%	82	65.1%	126
	yes	9	11.4%	0	0.0%	19	24.1%	28	35.4%	51	64.6%	4	5.1%	1	1.3%	0	0.0%	0	0.0%	46	58.2%	79
	yes - manually	0	0.0%	0	0.0%	2	6.7%	2	6.7%	28	93.3%	0	0.0%	1	3.3%	0	0.0%	0	0.0%	27	90.0%	30
Lagerstroemia loudonii	no	21	95.5%	0	0.0%	1	4.5%	22	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	22
	yes	12	92.3%	0	0.0%	0	0.0%	12	92.3%	1	7.7%	0	0.0%	0	0.0%	0	0.0%	1	7.7%	0	0.0%	13
Leptospermum madidum	no	1	33.3%	0	0.0%	1	33.3%	2	66.7%	1	33.3%	0	0.0%	1	33.3%	0	0.0%	0	0.0%	0	0.0%	3
	yes	33	53.2%	0	0.0%	5	8.1%	38	61.3%	24	38.7%	1	1.6%	6	9.7%	0	0.0%	8	12.9%	9	14.5%	62
Melaleuca viridiflora	no	18	31.7%	0	0.0%	28	10.4%	39	95.1%	2	4.9%	0	0.0%	0	0.0%	0	0.0%	1	2.4%	1	2.4%	41
	yes	30	19.2%	0	0.0%	104	66.7%	134	85.9%	22	14.1%	4	2.6%	14	9.0%	0	0.0%	1	0.6%	3	1.9%	156
Melaleuca viridiflora (weeping form)	yes - manually	2	25.0%	0	0.0%	5	62.5%	7	87.5%	1	12.5%	0	0.0%	1	12.5%	0	0.0%	0	0.0%	0	0.0%	8
	no	11	73.3%	0	0.0%	2	13.3%	13	86.7%	2	13.3%	0	0.0%	0	0.0%	0	0.0%	1	6.7%	1	6.7%	15
Melaleuca viridiflora (weeping form)	yes	5	29.4%	0	0.0%	9	52.9%	14	82.4%	3	17.6%	1	5.9%	1	5.9%	0	0.0%	1	5.9%	0	0.0%	17
	no	17	50.0%	0	0.0%	8	23.5%	25	73.5%	9	26.5%	0	0.0%	4	11.8%	0	0.0%	1	2.9%	4	11.8%	34
Nitmospo glengi	yes	33	50.0%	0	0.0%	25	37.9%	58	87.9%	8	12.1%	1	1.5%	4	6.1%	0	0.0%	1	1.5%	2	3.0%	66
	yes - manually	2	28.6%	0	0.0%	2	28.6%	4	57.1%	3	42.9%	0	0.0%	1	14.3%	0	0.0%	0	0.0%	2	28.6%	7
Pittosporum pterocarpum	no	24	34.3%	1	1.4%	15	21.4%	40	57.1%	30	42.9%	4	5.7%	8	11.4%	0	0.0%	1	1.4%	17	24.3%	70
	yes	22	25.3%	1	1.1%	29	33.3%	52	59.8%	35	40.2%	6	6.9%	13	14.9%	1	1.1%	1	1.1%	14	16.1%	87
Pterocarpus indicus	yes - manually	0	0.0%	0	0.0%	1	20.0%	1	20.0%	4	80.0%	0	0.0%	2	40.0%	0	0.0%	0	0.0%	2	40.0%	5
	no	8	50.0%	0	0.0%	5	31.3%	13	81.3%	3	18.8%	1	6.3%	0	0.0%	0	0.0%	2	12.5%	0	0.0%	16
Pterocarpus indicus (weeping form)	yes	53	50.0%	0	0.0%	25	23.6%	78	73.6%	28	26.4%	4	3.8%	7	6.6%	0	0.0%	0	0.0%	17	16.0%	106
	no	3	11.1%	0	0.0%	2	22.2%	3	33.3%	6	66.7%	0	0.0%	1	11.1%	0	0.0%	0	0.0%	5	55.6%	9
Syzygium forte	yes	26	49.1%	0	0.0%	11	20.8%	37	69.8%	16	30.2%	0	0.0%	0	0.0%	0	0.0%	2	3.8%	14	26.4%	53
	no	4	40.0%	0	0.0%	5	50.0%	9	90.0%	1	10.0%	0	0.0%	0	0.0%	0	0.0%	3	10.0%	0	0.0%	10
	yes	9	53.9%	0	0.0%	5	29.4%	14	82.4%	3	17.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	17.6%	17
	yes - manually	3	40.0%	0	0.0%	3	40.0%	4	80.0%	1	20.0%	0	0.0%	1	20.0%	0	0.0%	0	0.0%	0	0.0%	5

5.6 Damage to trees by size, origin and condition of trees

5.6.1 Damage to trees by tree size

Large trees were more likely to be damaged than the general population, and specifically had a far higher rate of uprooting.

Small trees were less likely to be damaged than the general population, and this was the case for almost every type of damage.

Table 19: Damage to trees by tree size

Tree Size	Nil number	Nil %	Foliage stripped number	Foliage stripped %	Small branches damaged number	Small branches damaged %	Nil or Minor Damage (as per left) number	Nil or Minor Damage (as per left) %	Major Damage (as per right) number	Major Damage (as per right) %	Large branches damaged number	Large branches damaged %	Significant branch broken number	Significant branch broken %	Leader snapped or split number	Leader snapped or split %	Trunk snapped or split number	Trunk snapped or split %	Uprooted number	Uprooted %	Total
Large (> 10 m)	383	27.6%	4	0.3%	471	34.5%	858	62.8%	508	37.2%	68	5.0%	106	7.8%	4	0.3%	31	2.3%	299	21.9%	1366
Medium (4- 10 m)	451	50.3%	6	0.7%	238	26.5%	695	77.5%	202	22.5%	18	2.0%	76	8.5%	8	0.9%	39	4.3%	61	6.8%	897
Small (< 4 m)	224	85.5%	2	0.8%	19	7.3%	245	93.5%	17	6.5%	0	0.0%	8	3.1%	0	0.0%	7	2.7%	2	0.8%	262
Not Recorded	99	29.8%	0	0.0%	96	28.9%	195	58.7%	137	41.3%	0	0.0%	47	14.2%	0	0.0%	12	3.6%	78	23.5%	332
Grand Total	1157	40.5%	12	0.4%	824	28.8%	1993	69.8%	864	30.2%	86	3.0%	237	8.3%	12	0.4%	89	3.1%	440	15.4%	2857

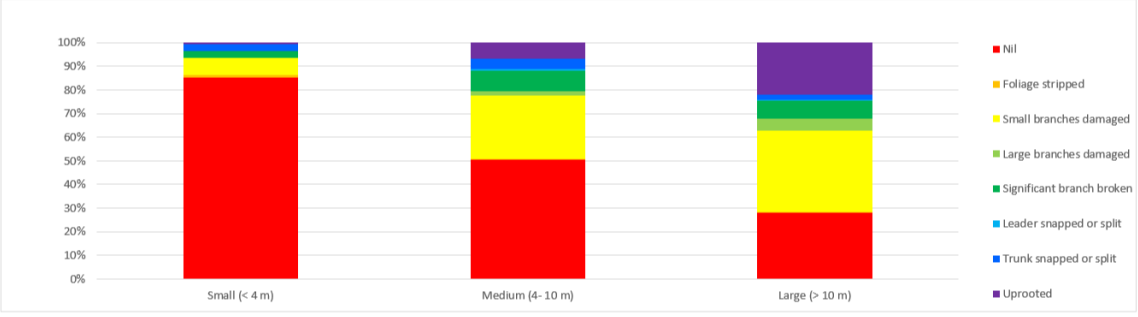


Figure 11: Damage to trees by tree size

5.6.2 Damage to trees by their origin

Australian Native tree species had the lowest rate of tree damage (20.9%). Exotic trees had the highest rate of tree damage (39.7%).

Australian Native and Local Provenance tree species had the lowest rates of uprooting (7.3% and 9.0% respectively). Exotic tree species had the highest rate of uprooting by a large margin (30.8%). The overall rate for exotic trees included two abundant species, *Khaya senegalensis* and *Pterocarpus indicus* (weeping variety) which had significantly high rates of uprooting.

Australian Natives had the highest rate of no damage (62.7%).

Table 20: Damage to trees by tree origin.

Damage Type / Provenance	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Local provenance	556	37.7%	8	0.5%	514	34.8%	1078	73.0%	398	27.0%	58	3.9%	147	10.0%	7	0.5%	53	3.6%	133	9.0%	1476
NT Native	203	41.3%	2	0.4%	147	29.9%	352	71.5%	140	28.5%	11	2.2%	37	7.5%	3	0.6%	19	3.9%	70	14.2%	492
Australian Native	69	62.7%	1	0.9%	17	15.5%	87	79.1%	23	20.9%	2	1.8%	6	5.5%	1	0.9%	6	5.5%	8	7.3%	110
Naturalised	33	45.8%	0	0.0%	17	23.6%	50	69.4%	22	30.6%	2	2.8%	9	12.5%	0	0.0%	0	0.0%	11	15.3%	72
Exotic	296	41.9%	1	0.1%	129	18.2%	426	60.3%	281	39.7%	13	1.8%	38	5.4%	1	0.1%	11	1.6%	218	30.8%	707
Grand Total	**1157**	**40.5%**	**12**	**0.4%**	**824**	**28.8%**	**1993**	**69.8%**	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

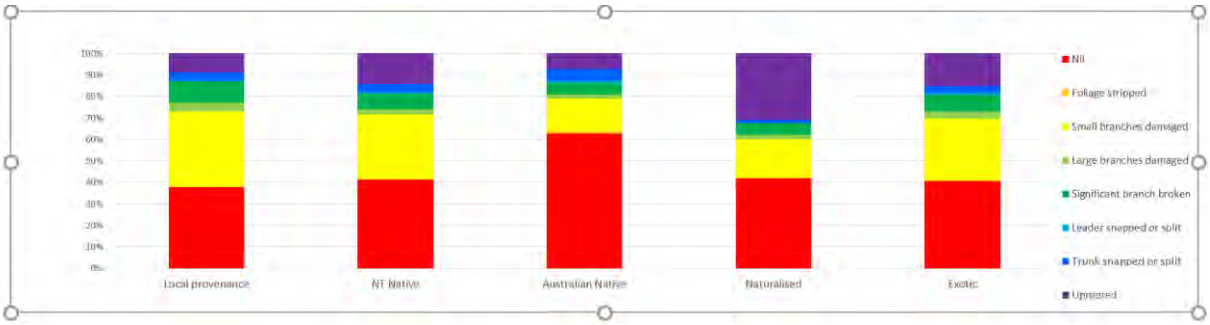


Figure 12: Tree damage by tree origin

5.6.3 Damage to trees by pre-exisiting weaknesses

Pre-existing weaknesses did not appear to be a good predictor of the tree being damaged by the cyclone. Although pre-existing termite damage was more likely to lead to further damage than other factors.

Trees with termites present were more likely to have small branches damaged.

Trees with termites present were less likely to be uprooted. Note - it was possibly just harder to pick up pre-existing termite presence around an uprooted tree. Although they may be doing something in the soil which is beneficial.

Although not commonly observed, there was evidence of root curl in some of the uprooted trees. This was in the form of either a large curled root or the remains of the curled roots in the original pot shape (see Plate 5 below).

Plate 7: An uprooted tree with curled roots in the shape of the original planting pot

Table 21: Damage to trees by pre-existing weaknesses

Damage Type / Weakness	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Already Weakened	73	39.9%	3	1.6%	66	36.1%	142	77.6%	41	22.4%	10	5.5%	11	6.0%	0	0.0%	7	3.8%	13	7.1%	183
...by Termites	52	36.9%	2	1.4%	58	41.1%	112	79.4%	29	20.6%	10	7.1%	9	6.4%	0	0.0%	5	3.5%	5	3.5%	141
...by other factor	21	50.0%	1	2.4%	8	19.0%	30	71.4%	12	28.6%	0	0.0%	2	4.8%	0	0.0%	2	4.8%	8	19.0%	42
Not Weakened	1084	40.5%	9	0.3%	758	28.3%	1851	69.2%	823	30.8%	76	2.8%	226	8.5%	12	0.4%	82	3.1%	427	16.0%	2674
Grand Total	**1157**	**40.5%**	**12**	**0.4%**	**824**	**28.8%**	**1993**	**69.8%**	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

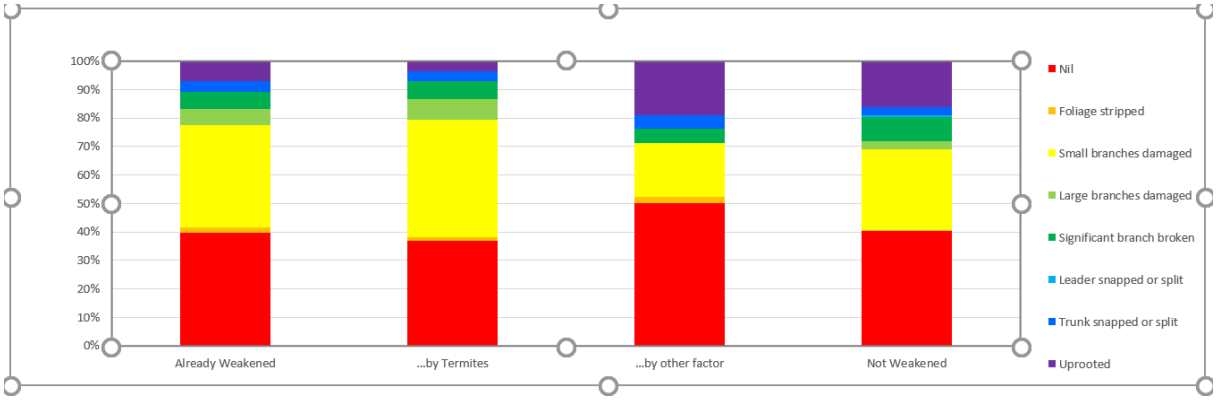


Figure 13: Tree damage by pre-existing weaknesses

5.7 Tree damage by the physical environment

5.7.1 Tree damage by wind direction

Wind direction was mainly measured by the direction the tree fell as it was uprooted, so most trees with a wind direction were uprooted (biased data).

Where wind direction was determined, uprooted trees were more likely to have been pushed by south-westerly or westerly winds than other directions. This correlates well with BoM tracking data (see Table 23 & 24 below) which recorded the highest wind speeds when the winds were coming from the south west and west.

Table 22: Uprooting by wind direction

	Uprooted	
Wind Orientation	number	%
Indeterminate	160	36.4%
South-westerly	119	27.0%
Westerly	111	25.2%
Southerly	43	9.8%
South-easterly	5	1.1%
South South-easterly	1	0.2%
Easterly	1	0.2%
Grand Total	**440**	**100.0%**

Table 23: Wind orientation by uprooting

	Uprooted	
Wind Orientation	number	%
Indeterminate	160	6.3%
South-westerly	119	96.7%
Westerly	111	93.3%
Southerly	43	86.0%
South-easterly	5	100.0%
South South-easterly	1	100.0%
Easterly	1	100.0%
Grand Total	**440**	**15.4%**

Plate 8: Many trees were uprooted along the Esplanade, near where wind gusts reached 130kph

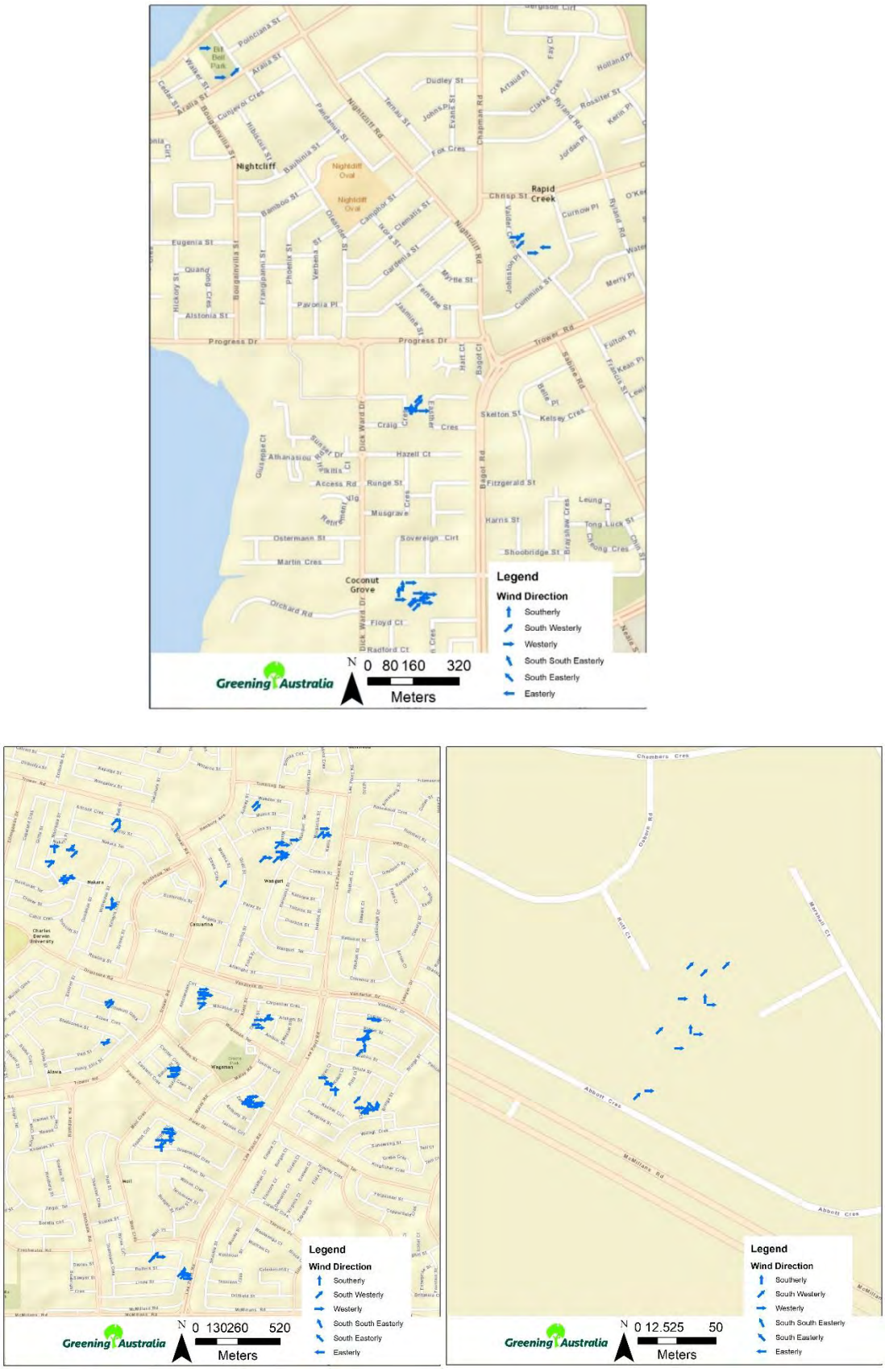


Figure 14 : Three maps showing direction that uprooted trees had fallen

The following is a summary of wind speed and direction of TC Marcus provided by Bom specifically for this report:

“The attached track of the centre of the cyclone shows that the northern suburbs and Darwin city were affected by the western side of the cyclone with strongest winds blowing from SSW to WNW as the core of the cyclone passed further inland during the late morning on 17 March 2018. This is consistent with the direction of fallen trees in much of your survey area. As we discussed, areas (including Palmerston) located to the east of the path of the cyclone centre appeared to experience weaker winds and less damage due to the asymmetric rainfall distribution and the longer distance that the wind had to travel overland.

The Bureau's automatic weather stations at Darwin Airport and at Stokes Hill Wharf provide a useful record of the damaging wind gusts during the cyclone which would have caused much of the tree damage. The strongest winds from each location on 17 March are listed below – there are three quantities listed, the wind direction (the direction from which the wind blows), the 10-minute average wind and the 3-second wind gust at each time. These measurements are taken at 10 metre height above ground level at the airport and near that height above water at the wharf, depending on the tide level” .

Figure 15: BoM track of TC Marcus centre over Darwin and surrounds

Table 24: TC Marcus wind direction and speed for Darwin Airport (highest recordings highlighted)

Time (CST)	Direction	10-min average (km/h)	3-sec gust (km/h)
0819	S	42	52
0919	S	63	72
0931	S	61	93
0943	SSW	76	104
1002	SSW	83	122
1012	SSW	89	111
1033	SW	85	115
1051	W	98	126
1110	WNW	89	120
1126	WNW	91	109
1158	WNW	81	102
1216	NW	85	85

Table 25: TC Marcus wind direction and speed for Stokes Hill Wharf (highest recordings highlighted)

Time (CST)	Direction	10-min average (km/h)	3-sec gust (km/h)
0838	S	65	76
0914	SSW	68	92
0937	SSW	75	94
1001	SSW	88	112
1016	SSW	102	120
1033	SSW	98	125

1051	SSW	103	130
1115	W	99	121
1124	WNW	92	130
1142	WNW	69	104
1158	WNW	64	89
1230	NW	56	92

5.7.2 Damage to trees by other tree(s)

Trees damaged by other tree(s) were almost twice as likely as those not damaged by other tree(s) to have major damage and were around 5 times more likely to have a significant broken branch and 6 times more likely to suffer a snapped or split trunk.

On the face of it trees not damaged by other tree(s) were more likely to be uprooted, however, this could partly be a result of a sampling error, where uprooted trees laying flat on the ground were less obvious to damage from other trees (damage other than uprooting). Obviously this was not the case if another tree was laying on top of the tree being surveyed.

Table 26: Damage to trees by other tree(s).

Damage Type / Damaged by Other Tree(s)	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
No	1149	43.5%	12	0.5%	730	27.6%	1891	71.6%	750	28.4%	73	2.8%	171	6.5%	10	0.4%	62	2.3%	434	16.4%	2641
Yes	8	3.7%	0	0.0%	94	43.5%	102	47.2%	114	52.8%	13	6.0%	66	30.6%	2	0.9%	27	12.5%	6	2.8%	216
Grand Total	1157	40.5%	12	0.4%	824	28.8%	1993	69.8%	864	30.2%	86	3.0%	237	8.3%	12	0.4%	89	3.1%	440	15.4%	2857

5.7.3 Damage to trees by soil type

Leptic Rudosols (shallow gravelly lithosols) had lower rates of major tree damage, and specifically, lower rates of significant branches broken. This is a surprising result as shallow soils with an underlay of unweathered rock is often blamed for uprooting of trees.

Brown kandosol soils (deep gravelly yellow massive earths with minor lithosols) and red kandosols (shallow -moderately deep red massive earths with minor yellow massive earths) had high rates of uprooting. This could be a result of these deeper soils being saturated following heavy monsoonal rains previous to the cyclone.

Table 27: Damage to trees by soil type

Damage Type / Soil Type	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Brown Kandosols	415	39.3%	6	0.6%	348	33.0%	769	72.8%	287	27.2%	58	5.5%	80	7.6%	9	0.9%	20	1.9%	120	11.4%	1056
Intertidal Hydrosols	4	44.4%	0	0.0%	5	55.6%	9	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9
Kandosolic Redosolic Hydrosols	62	31.2%	4	2.0%	87	43.7%	153	76.9%	46	23.1%	13	6.5%	13	6.5%	2	1.0%	2	1.0%	16	8.0%	198
Leptic Rudosols	64	49.2%	2	1.5%	41	31.5%	107	82.3%	23	17.7%	5	3.8%	4	3.1%	0	0.0%	3	2.3%	11	8.5%	130
Red Kandosols	147	45.7%	0	0.0%	86	26.7%	233	72.4%	89	27.6%	10	3.1%	25	7.8%	1	0.3%	11	3.4%	42	13.0%	322
Grand Total	**692**	**40.3%**	**12**	**0.7%**	**567**	**33.0%**	**1271**	**74.1%**	**445**	**25.9%**	**86**	**5.0%**	**122**	**7.1%**	**12**	**0.7%**	**36**	**2.1%**	**189**	**11.0%**	**1716**

5.7.4 Damage to trees by slope

Slope didn't appear to be a significant driver of damage, or any particular type of damage.

Table 28: Damage to trees by slope (as per land resources layer)

Damage Type / Slope	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
<0.5%	4	44.4%	0	0.0%	5	55.6%	9	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9
0.5 - 1.5%	53	31.0%	3	1.8%	79	46.2%	135	78.9%	36	21.1%	10	5.8%	11	6.4%	2	1.2%	2	1.2%	11	6.4%	171
0.5 - 2%	156	44.6%	1	0.3%	94	26.9%	251	71.7%	99	28.3%	13	3.7%	27	7.7%	1	0.3%	11	3.1%	47	13.4%	350
0.5 - 2.5%	80	39.4%	1	0.5%	66	32.5%	147	72.4%	56	27.6%	16	7.9%	10	4.9%	2	1.0%	6	3.0%	22	10.8%	203
1 - 3%	252	42.6%	3	0.5%	190	32.1%	445	75.3%	146	24.7%	30	5.1%	44	7.4%	3	0.5%	10	1.7%	59	10.0%	591
2 - 5%	147	37.5%	4	1.0%	133	33.9%	284	72.4%	108	27.6%	17	4.3%	30	7.7%	4	1.0%	7	1.8%	50	12.8%	392
Grand Total	**692**	**40.3%**	**12**	**0.7%**	**567**	**33.0%**	**1271**	**74.1%**	**445**	**25.9%**	**86**	**5.0%**	**122**	**7.1%**	**12**	**0.7%**	**36**	**2.1%**	**189**	**11.0%**	**1716**

5.7.5 Damage to trees by waterlogging

Waterlogging didn't appear to be a significant driver of damage, or any particular type of damage.

Table 29: Damage to trees by waterlogging (as per land resources layer)

Damage Type / Waterlogging	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
Moderate to High Level of Seasonal Soil Waterlogging	62	31.2%	4	2.0%	87	43.7%	153	76.9%	46	23.1%	13	6.5%	13	6.5%	2	1.0%	2	1.0%	16	8.0%	199
Nil to Low Level of Seasonal Soil Waterlogging	626	41.5%	8	0.5%	475	31.5%	1109	73.5%	399	26.5%	73	4.8%	109	7.2%	10	0.7%	34	2.3%	173	11.5%	1508
Severe Level of Seasonal Soil Waterlogging or Inundation for Extended Periods	4	44.4%	0	0.0%	5	55.6%	9	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9
Grand Total	**692**	**40.3%**	**12**	**0.7%**	**567**	**33.0%**	**1271**	**74.1%**	**445**	**25.9%**	**86**	**5.0%**	**122**	**7.1%**	**12**	**0.7%**	**36**	**2.1%**	**189**	**11.0%**	**1716**

5.7.6 Damage to trees by land unit

Trees were less frequently uprooted in 9b than other land units. The author suspects this could be a land unit mapping accuracy issue related to scale, as the only 9b land unit observed in the survey was on the periphery of Bike Fun Park. No trees were recorded in the 9b land unit during the survey.

Trees were less likely to have broken branches in 3d than other land units.

Surveyed parks were found in flat to gently undulating upland surface, gentle side and lower slopes with low gradients. No obvious trends emerged from the analysis possibly due to the relatively uniform landforms found in the parks.

Table 30: Damage to trees by land unit (as per land resources layer)

Damage Type / Land Unit	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
2b1	147	37.5%	4	1.0%	133	33.9%	284	72.4%	108	27.6%	17	4.3%	30	7.7%	4	1.0%	7	1.8%	50	12.8%	392
3a	147	45.7%	0	0.0%	86	26.7%	233	72.4%	89	27.6%	10	3.1%	25	7.8%	1	0.3%	11	3.4%	42	13.0%	322
3b	80	39.4%	1	0.5%	66	32.5%	147	72.4%	56	27.6%	16	7.9%	10	4.9%	2	1.0%	6	3.0%	22	10.8%	203
3c	188	40.8%	1	0.2%	149	32.3%	338	73.3%	123	26.7%	25	5.4%	40	8.7%	3	0.7%	7	1.5%	48	10.4%	461
3d	64	49.2%	2	1.5%	41	31.5%	107	82.3%	23	17.7%	5	3.8%	4	3.1%	0	0.0%	3	2.3%	11	8.5%	130
3e	9	32.1%	1	3.6%	8	28.6%	18	64.3%	10	35.7%	3	10.7%	2	7.1%	0	0.0%	0	0.0%	5	17.9%	28
4c	53	31.0%	3	1.8%	79	46.2%	135	78.9%	36	21.1%	10	5.8%	11	6.4%	2	1.2%	2	1.2%	11	6.4%	171
9b	4	44.4%	0	0.0%	5	55.6%	9	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9
Grand Total	**692**	**40.3%**	**12**	**0.7%**	**567**	**33.0%**	**1271**	**74.1%**	**445**	**25.9%**	**86**	**5.0%**	**122**	**7.1%**	**12**	**0.7%**	**36**	**2.1%**	**189**	**11.0%**	**1716**

5.7.7 Tree root movement by soil type

Red Kandosols had a very high rate of fallen trees (13%)

Table 31: Root movement by species with more than 10 samples and more than 10% movement.

Lean Category / Species	No Lean or Natural Lean		Root Movement (see right)		Lean		Fallen		Total
	number	%	number	%	number	%	number	%	
Brown Kandosols	942	89.2%	119	11.3%	22	2.1%	97	9.2%	1056
Intertidal Hydrosols	9	100.0%	0	0.0%	0	0.0%	0	0.0%	9
Kandosolic Redoxic Hydrosols	182	91.5%	17	8.5%	4	2.0%	13	6.5%	199
Leptic Rudosols	120	92.3%	10	7.7%	4	3.1%	6	4.6%	130
Red Kandosols	277	86.0%	45	14.0%	3	0.9%	42	13.0%	322
Grand Total	**1525**	**88.9%**	**191**	**11.1%**	**33**	**1.9%**	**158**	**9.2%**	**1716**

5.8 Infrastructure Damage Statistics

Of all the trees surveyed 3.3% caused damage to infrastructure.

Of all the damaged trees surveyed 5.6% caused damage to infrastructure.

Of all the *Khaya senegalensis* surveyed 19.1% caused infrastructure damage. This is far higher than other tree species which were significantly sampled.

Of the uprooted trees surveyed, 19.3% caused infrastructure damage (i.e. a falling tree had a 19.3% chance of causing damage), but this accounted for 89.5% of all infrastructure damage (i.e. 89.5% of infrastructure damage was caused by falling trees). Other types of tree damage were far less likely to result in damage.

Table 32: Infrastructure damage rates for all trees

	All Trees	
	number	%
Caused damage	95	3.3%
Didn't cause damage	2762	96.7%

Table 33: Infrastructure damage rates of damaged trees

	Damaged Trees	
	number	%
Caused damage	95	5.6%
Didn't cause damage	1605	94.4%

Table 34: Infrastructure damaging tree species

	Infrastructure Damaged				**Total**
	No		**Yes**		
Tree Species	number	%	number	%	
Cascabela thevetia	2	66.7%	1	33.3%	3
Terminalia melanocarpa	12	75.0%	4	25.0%	16
Khaya senegalensis	190	80.9%	45	19.1%	235
Mangifera indica	9	81.8%	2	18.2%	11
Eucalyptus apodophylla	5	83.3%	1	16.7%	6
Albizia lebbeck	22	88.0%	3	12.0%	25
Tabebuia pallida	10	90.9%	1	9.1%	11
Peltophorum pterocarpum	150	92.6%	12	7.4%	162
Ficus benjamina	14	93.3%	1	6.7%	15
Samanea saman	14	93.3%	1	6.7%	15
Eucalyptus tetrodonta	34	94.4%	2	5.6%	36
Eucalyptus camaldulensis	181	94.8%	10	5.2%	191
Eucalyptus miniata	20	95.2%	1	4.8%	21
Calophyllum inophyllum	41	95.3%	2	4.7%	43

Ficus macrocarpa var. hillii	24	96.0%	1	4.0%	25
Pterocarpus indicus	119	97.5%	3	2.5%	122
Acacia auriculiformis	121	97.6%	3	2.4%	124
Leptospermum madidum	64	98.5%	1	1.5%	65
Maranthes corymbosa	204	99.5%	1	0.5%	205
All Trees	**2762**	**96.7%**	**95**	**3.3%**	**2857**

Plate 9: A fence badly damaged by a fallen *Eucalyptus camaldulensis*

Table 35: Infrastructure damage by tree damage type

	Infrastructure Damaged				Total
	No		Yes		
Tree Damage	number	%	number	%	
Nil	1157	100.0%	0	0.0%	1157
Foliage stripped	12	100.0%	0	0.0%	12
Small branches damaged	823	99.9%	1	0.1%	824
Large branches damaged	86	100.0%	0	0.0%	86
Significant branch broken	231	97.5%	6	2.5%	237
Leader snapped or split	12	100.0%	0	0.0%	12
Trunk snapped or split	86	96.6%	3	3.4%	89
Uprooted	355	80.7%	85	19.3%	440
All trees	**2762**	**96.7%**	**95**	**3.3%**	**2857**

Table 36: Infrastructure damage by tree damage type

Damage Type / Infrastructure Damage	Nil		Foliage stripped		Small branches damaged		Nil or Minor Damage (as per left)		Major Damage (as per right)		Large branches damaged		Significant branch broken		Leader snapped or split		Trunk snapped or split		Uprooted		Total
	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	number	%	
no	1157	41.9%	12	0.4%	823	29.8%	1992	72.1%	770	27.9%	86	3.1%	231	8.4%	12	0.4%	86	3.1%	355	12.9%	2762
yes	0	0.0%	0	0.0%	1	1.1%	1	1.1%	94	98.9%	0	0.0%	6	6.3%	0	0.0%	3	3.2%	85	89.5%	95
All trees	**1157**	**40.5%**	**12**	**0.4%**	**824**	**28.8%**	**1993**	**69.8%**	**864**	**30.2%**	**86**	**3.0%**	**237**	**8.3%**	**12**	**0.4%**	**89**	**3.1%**	**440**	**15.4%**	**2857**

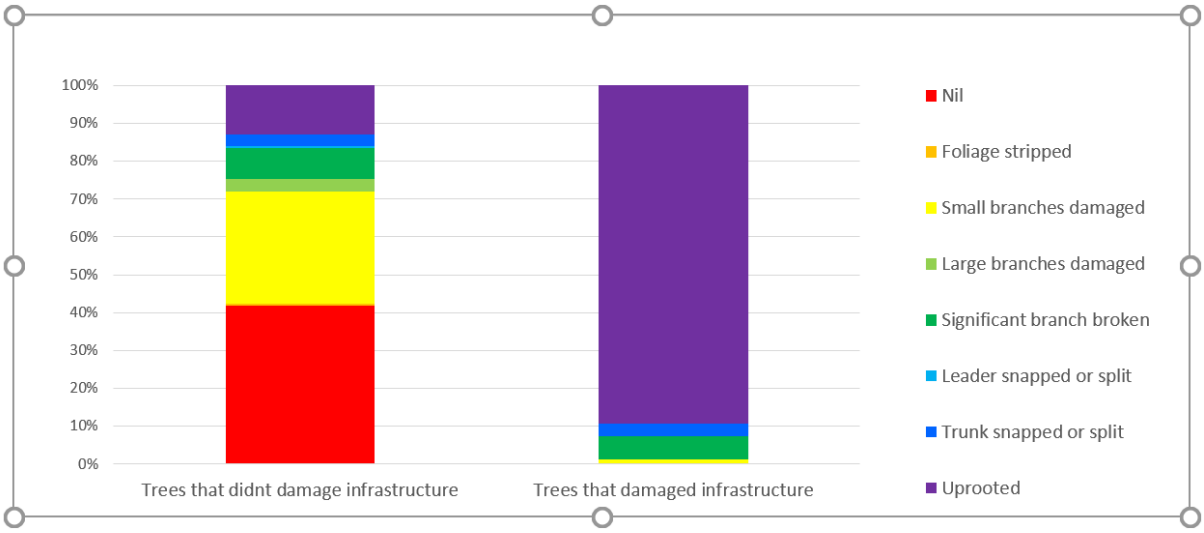


Figure 16: Tree damage to infrastructure by damage type

5.9 Park statistics

Of the 40 surveyed parks tree damage for 6 individual parks with the most individual trees was analysed. Bike Fun Park had high rates of small branch damage compared to the population total percentage (52.1% vs 28.8%).

Bike Fun Park had very low rates of uprooted trees. 4-6 trees were removed prior to survey.

Bayfield Park had lower rates of tree damage than the general tree population (50.1% vs 40.5%). It also had lower rates of small branches being damaged than the general tree population (15.0% vs 28.8%).

Khaya senegalensis at Bayfield Park had a higher rate of uprooting than for its general population (77.2% vs 66.0%). It also had twice the rate of significant branch breaking than for the general population (7.6% vs 3.8%).

Plate 10: Bayfield Park with fallen specimens of *Khaya sengalensis*

Table 37: Mahogany Park Tree Damage (for species with more than 10 trees)

Damage Type / Species	Nil			Foliage stripped			Small branches damaged			Major Damage (as per right)			Large branches damaged			Significant branch broken			Leader snapped or split			Trunk snapped or split			Uprooted			Total	
	number	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	park #	total #
Acacia auriculiformis	1	6.3%	11.3%	0	0.0%	0.0%	5	31.3%	32.3%	10	62.5%	56.5%	0	0.0%	5.8%	2	12.5%	12.9%	0	0.0%	0.8%	0	0.0%	7.3%	8	50.0%	29.8%	16	124
Peltophorum pterocarpum	3	21.4%	28.4%	1	7.1%	1.2%	5	35.7%	27.8%	5	35.7%	42.6%	4	28.6%	6.2%	0	0.0%	14.2%	0	0.0%	0.6%	0	0.0%	1.2%	1	7.1%	20.4%	14	162
Ficus virens	7	63.6%	53.5%	0	0.0%	2.0%	3	27.3%	22.2%	1	9.1%	22.2%	1	9.1%	7.1%	0	0.0%	13.1%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	2.0%	11	99
Maranthes corymbosa	3	27.3%	22.0%	0	0.0%	0.0%	8	72.7%	65.9%	0	0.0%	12.2%	0	0.0%	2.0%	0	0.0%	7.3%	0	0.0%	0.0%	0	0.0%	3.0%	0	0.0%	2.0%	11	205
Grand Total	**40**	**33.6%**	**40.5%**	**1**	**0.8%**	**0.4%**	**44**	**37.0%**	**28.8%**	**34**	**28.6%**	**30.2%**	**11**	**9.2%**	**3.0%**	**5**	**4.2%**	**8.3%**	**2**	**1.7%**	**0.4%**	**4**	**3.4%**	**3.1%**	**12**	**10.1%**	**15.4%**	**119**	**2857**

Table 38: Wanguri Oval Tree Damage (for species with more than 10 trees)

Damage Type / Species	Nil			Foliage stripped			Small branches damaged			Major Damage (as per right)			Large branches damaged			Significant branch broken			Leader snapped or split			Trunk snapped or split			Uprooted			Total	
	number	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	park #	total #
Acacia auriculiformis	1	6.3%	11.3%	0	0.0%	0.0%	5	31.3%	32.3%	10	62.5%	56.5%	0	0.0%	5.8%	2	12.5%	12.9%	0	0.0%	0.8%	0	0.0%	7.3%	8	50.0%	29.8%	16	124
Peltophorum pterocarpum	3	21.4%	28.4%	1	7.1%	1.2%	5	35.7%	27.8%	5	35.7%	42.6%	4	28.6%	6.2%	0	0.0%	14.2%	0	0.0%	0.6%	0	0.0%	1.2%	1	7.1%	20.4%	14	162
Maranthes corymbosa	3	27.3%	22.0%	0	0.0%	0.0%	8	72.7%	65.9%	0	0.0%	12.2%	0	0.0%	2.0%	0	0.0%	7.3%	0	0.0%	0.0%	0	0.0%	3.0%	0	0.0%	2.0%	11	205
Ficus virens	7	63.6%	53.5%	0	0.0%	2.0%	3	27.3%	22.2%	1	9.1%	22.2%	1	9.1%	7.1%	0	0.0%	13.1%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	2.0%	11	99
Grand Total	40	33.6%	40.5%	1	0.8%	0.4%	44	37.0%	28.8%	34	28.6%	30.2%	11	9.2%	3.0%	5	4.2%	8.3%	2	1.7%	0.4%	4	3.4%	3.1%	12	10.1%	15.4%	119	2857

Table 39: Bike Fun Park Tree Damage (for species with more than 10 trees)

Damage Type / Species	Nil			Foliage stripped			Small branches damaged			Major Damage (as per right)			Large branches damaged			Significant branch broken			Leader snapped or split			Trunk snapped or split			Uprooted			Total	
	number	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	park #	total #
Eucalyptus bigalerita	17	30.4%	39.7%	0	0.0%	0.0%	22	39.3%	32.9%	17	30.4%	27.4%	2	3.6%	4.1%	3	5.4%	4.1%	0	0.0%	0.0%	2	3.6%	2.7%	10	17.9%	16.4%	56	73
Carpentaria acuminata	22	100.0%	94.4%	0	0.0%	0.0%	0	0.0%	1.4%	0	0.0%	4.2%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	4.2%	0	0.0%	0.0%	22	71
Eypsis lutescens	11	100.0%	92.3%	0	0.0%	0.0%	0	0.0%	7.7%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	11	13
Ptychosperma macarthurii	11	100.0%	95.5%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	4.5%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	4.5%	0	0.0%	0.0%	11	22
Cerpota mitis	8	66.0%	66.7%	0	0.0%	0.0%	0	0.0%	0.0%	4	40.0%	33.3%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	2	20.0%	16.7%	2	20.0%	16.7%	10	12
Grand Total	110	58.8%	40.5%	0	0.0%	0.4%	40	21.4%	28.8%	37	19.8%	30.2%	3	1.6%	3.0%	10	5.3%	8.3%	1	0.5%	0.4%	6	3.2%	3.1%	17	9.1%	15.4%	187	2857

Table 40: Holzerland Park Tree Damage (for species with more than 10 trees)

Damage Type / Species	Nil			Foliage stripped			Small branches damaged			Major Damage (as per right)			Large branches damaged			Significant branch broken			Leader snapped or split			Trunk snapped or split			Uprooted			Total	
	number	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	park #	total #
Eucalyptus camaldulensis	7	11.8%	24.1%	0	0.0%	1.0%	5	29.4%	28.3%	10	58.8%	46.6%	0	0.0%	3.1%	5	29.4%	15.7%	0	0.0%	0.5%	0	0.0%	6.3%	5	29.4%	20.9%	17	191
Maranthes corymbosa	1	9.1%	22.0%	0	0.0%	0.0%	9	81.8%	65.9%	1	9.1%	12.2%	0	0.0%	2.0%	0	0.0%	7.3%	0	0.0%	0.0%	1	9.1%	1.0%	0	0.0%	2.0%	11	205
Peltophorum pterocarpum	1	9.1%	28.4%	0	0.0%	1.2%	2	18.2%	27.8%	8	72.7%	42.6%	0	0.0%	6.2%	2	18.2%	14.2%	0	0.0%	0.6%	0	0.0%	1.2%	6	54.5%	20.4%	11	161
Alitzia lebbeck	4	40.0%	36.0%	0	0.0%	0.0%	2	20.0%	20.0%	4	40.0%	44.0%	0	0.0%	0.0%	1	10.0%	20.0%	0	0.0%	0.0%	0	0.0%	0.0%	3	30.0%	24.0%	10	25
Grand Total	51	32.7%	40.5%	0	0.0%	0.4%	48	30.8%	28.8%	57	36.5%	30.2%	0	0.0%	3.0%	16	10.3%	8.3%	0	0.0%	0.4%	8	5.1%	3.1%	33	21.2%	15.4%	156	2857

Table 41: Wulagi Green Belt Tree Damage (for species with more than 10 trees)

Damage Type / Species	Nil			Foliage stripped			Small branches damaged			Major Damage (as per right)			Large branches damaged			Significant branch broken			Leader snapped or split			Trunk snapped or split			Uprooted			Total	
	number	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	park #	total #
Ficus virens	14	66.7%	53.5%	1	4.8%	2.0%	2	9.5%	22.2%	4	19.0%	22.2%	1	4.8%	7.1%	3	14.3%	13.1%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	2.0%	21	99
Corymbia bella	4	23.5%	29.2%	0	0.0%	0.0%	12	70.6%	47.7%	1	5.9%	23.1%	0	0.0%	13.8%	0	0.0%	3.1%	0	0.0%	0.0%	1	5.9%	4.6%	0	0.0%	1.5%	17	65
Corymbia polycarpa	3	17.6%	16.7%	0	0.0%	0.0%	13	76.5%	73.3%	1	5.9%	10.0%	0	0.0%	3.3%	0	0.0%	3.3%	1	5.9%	3.3%	0	0.0%	0.0%	0	0.0%	0.0%	17	30
Eucalyptus herbertiana	8	47.1%	52.6%	0	0.0%	0.0%	7	41.2%	36.8%	2	11.8%	10.5%	1	5.9%	5.3%	1	5.9%	5.3%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	17	19
Eucalyptus camaldulensis	3	20.0%	24.1%	1	6.7%	1.0%	7	46.7%	28.3%	4	26.7%	46.6%	1	6.7%	3.1%	3	20.0%	15.7%	0	0.0%	0.5%	0	0.0%	6.3%	0	0.0%	20.9%	15	191
Grand Total	39	32.2%	40.5%	3	2.5%	0.4%	63	52.1%	28.8%	16	13.2%	30.2%	6	5.0%	3.0%	8	6.6%	8.3%	1	0.8%	0.4%	1	0.8%	3.1%	0	0.0%	15.4%	121	2857

Table 42: Bayfield Park Tree Damage (for species with more than 10 trees)

Damage Type / Species	Nil			Foliage stripped			Small branches damaged			Major Damage (as per right)			Large branches damaged			Significant branch broken			Leader snapped or split			Trunk snapped or split			Uprooted			Total	
	number	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	#	park %	total %	park #	total #
Khaya senegalensis	9	9.8%	11.5%	0	0.0%	0.0%	5	5.4%	17.0%	78	84.8%	71.5%	0	0.0%	1.7%	7	9.8%	3.8%	0	0.0%	0.0%	0	0.0%	0.0%	71	77.2%	66.0%	92	235
Acacia auriculiformis	6	15.4%	11.3%	0	0.0%	0.0%	12	30.8%	32.3%	21	53.8%	56.5%	0	0.0%	5.6%	3	7.7%	12.9%	0	0.0%	0.8%	3	7.7%	7.3%	15	38.5%	29.8%	39	124
Eucalyptus camaldulensis	11	30.6%	24.1%	0	0.0%	1.0%	4	11.1%	28.3%	21	58.3%	46.6%	0	0.0%	3.1%	6	16.7%	15.7%	0	0.0%	0.5%	4	11.1%	6.3%	11	30.6%	20.9%	36	191
Callistemon viminalis	22	75.9%	75.9%	0	0.0%	0.0%	4	13.8%	13.8%	3	10.3%	10.3%	0	0.0%	0.0%	2	6.9%	6.9%	0	0.0%	0.0%	0	0.0%	0.0%	1	3.4%	3.4%	29	29
Peltophorum pterocarpum	10	35.7%	28.4%	0	0.0%	1.2%	5	17.9%	27.8%	13	46.4%	42.6%	0	0.0%	6.2%	5	17.9%	14.2%	0	0.0%	0.6%	1	3.6%	1.2%	7	25.0%	20.4%	28	162
Minusops elengi	16	59.3%	48.6%	0	0.0%	0.0%	6	22.2%	32.7%	5	18.5%	18.7%	0	0.0%	0.9%	2	7.4%	8.4%	0	0.0%	0.0%	1	3.7%	1.9%	2	7.4%	7.5%	27	107
Maranthes corymbosa	11	44.0%	22.0%	0	0.0%	0.0%	13	52.0%	65.5%	1	4.0%	12.2%	0	0.0%	2.0%	0	0.0%	7.3%	0	0.0%	0.0%	0	0.0%	1.0%	1	4.0%	2.0%	25	205
Carpentaria acuminata	20	87.0%	94.4%	0	0.0%	0.0%	1	4.2%	1.4%	2	8.7%	4.2%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	2	8.7%	4.2%	0	0.0%	0.0%	23	71
Latania lodgeii	21	95.5%	94.3%	0	0.0%	0.0%	1	4.5%	2.9%	0	0.0%	2.9%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	2.9%	0	0.0%	0.0%	22	35
Corymbia ptychocarpa	8	50.0%	30.9%	0	0.0%	0.0%	1	6.3%	43.8%	7	43.8%	25.5%	0	0.0%	5.5%	3	18.8%	9.1%	0	0.0%	0.0%	1	6.3%	3.6%	3	18.8%	7.3%	16	55
Tamarindus indica	12	80.0%	83.3%	0	0.0%	0.0%	1	6.7%	4.2%	2	13.3%	12.5%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	2	13.3%	12.5%	15	24
Melaleuca bracteata	14	100.0%	100.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	14	14
Livistona muelleri	14	100.0%	100.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	14	14
Eucalyptus tetrodonta	2	15.4%	16.7%	0	0.0%	0.0%	5	38.5%	41.7%	6	46.2%	41.7%	0	0.0%	11.1%	2	15.4%	11.1%	0	0.0%	0.0%	2	15.4%	11.1%	2	15.4%	8.3%	13	36
Livistona benthamii	13	100.0%	100.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	13	13
Cycas media	13	100.0%	100.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	13	13
Alstonia actinophylla	8	66.7%	60.7%	0	0.0%	0.0%	0	0.0%	21.4%	4	33.3%	17.9%	0	0.0%	3.6%	3	25.0%	10.7%	0	0.0%	0.0%	1	8.3%	3.6%	0	0.0%	0.0%	12	28
Grand Total	290	50.1%	40.5%	0	0.0%	0.4%	87	15.0%	28.8%	202	34.9%	30.2%	0	0.0%	3.0%	44	7.6%	8.3%	0	0.0%	0.4%	29	5.0%	3.1%	129	22.3%	15.4%	579	2857

6 Summary and conclusions

A large exotic tree growing in an irrigated Darwin park in saturated deep massive earths with minimal management would have a high chance of being uprooted in a category 2 cyclone. Tropical Cyclone Marcus was an arboreal cleansing process, clearing the parks of many unstable tree species. It was a big wake up call for Darwin and provided an opportunity to develop more climate resilient plantings in parks, streetscapes and other landscaped areas in the municipality. Many of the surveyed parks are now quite open and require well planned plantings of suitable cyclone stable amenity species.

Darwin suffered major damage to thousands of trees in what was only a category 2 cyclone. A large proportion of these trees were made up of a small number of species of which the majority showed susceptibility to major damage in the cyclone. These particular species need to be looked at more thoroughly for future planning and management purposes. For example it would not be recommended to plant a low diversity of these unstable species in the future. Thankfully there were a couple of these abundant species that showed stable traits during the course of TC Marcus. Overall just over 40% of all trees suffered no damage at all (apart from some foliage loss). These are the specimens that require further scrutinization for potential use in the future urban revegetation of Darwin.

Exotic trees made up 24.7% of the all trees surveyed in the parks, had the highest rate of tree damage (39.7%) and the highest rate of uprooting by a large margin (30.8%). Of these exotic species, *Khaya senegalensis* had the highest rate of major damage (71.5%) and of these, 66% were uprooted. Uprooting was the major cause of infrastructure damage so *Khaya senegalensis*, coupled with its large size was one of the species that presented a high risk to this type of damage, the possibility of human harm and the enormous removal costs. Serious consideration should be given to the cessation of future planting of species in this category, as they present too high a risk. The surviving individuals should be surveyed further to determine the scope of potential future damage and costs of removal.

In contrast Australian Native and Local Provenance tree species had the lowest rates of uprooting (7.3% and 9.0% respectively) and should be looked at more closely for future plantings. Not all native plant species were resilient however, with a couple of the most abundant species showing high rates of major

damage. Once again these latter species need to be looked at more thoroughly from a risk adversity point of view.

Council managers need to determine where the cut off line is in regard to what is an acceptable level of risk. For example, trees that suffered greater than 20% uprooting (determined from a large sample size) may be deemed unsuitable for any future plantings. This would include the following: *Acacia auriculiformis, Eucalyptus camaldulensis, Khaya senegalensis, Peltophorum pterocarpum and Pterocarpus indicus* (weeping form).

There were no surprises with the direction of tree fall in the parks. It correlated well with the BoM wind direction and speed records for TC Marcus. The relatively uniform landforms found in the parks resulted in no obvious damage trends emerging. Slope and waterlogging didn't appear to have a significant effect on tree damage.

Interestingly, trees growing in shallow soils underlaid with unweathered rock suffered the least amount of major damage. The deeper massive earths with greater moisture holding capacity were likely more saturated than the aforementioned soils and provided less resistance for the roots to hang on in the category 2 cyclone.

In regard to management parameters, irrigated parks generally had a higher rate of tree damage including uprooting and significant branch damage. This could be due to more shallow root development resulting in easier uprooting and faster tree growth which produces weaker branches. With Darwin's limited water supply and climate change pointing towards more intense cyclones, further study of irrigated and non-irrigated plantings is warranted. Pre-existing weaknesses did not appear to be a good predictor of the tree damage although presence of termites had negative and positive results (more damage overall, but less uprooting respectively). The author did observe indicators of bad cultivation with the occasional signs of root curling in uprooted trees. This warrants further investigation, including collation of tree records from TC Marcus tree clearing and maintenance crews.

7 Recommendations

- Use results of this survey in conjunction with previous reports to establish a list of preferred species, and a list of plants to be discouraged for use around public infrastructure.
- For species that had high rates of major tree damage, determine where the cut off line is in regard to what is an acceptable level of risk (risk appetite). This process is a precursor to above and will determine the relative level of risk between species.
- Digitise through survey and mapping, all trees in Darwin parks, streetscapes and other landscaped areas. From this determine which species are deemed to be a risk to infrastructure and human safety.

- Consider the gradual phasing out of unstable species and replacement with resilient species. This could occur in stages over a ten year period, giving the newly planted trees time to establish shade cover before removing the next tranche of redundant species.
- Undertake further study of irrigated and non-irrigated plantings to determine the merits of non-irrigated plantings for future revegetation activities.
- Investigate further damage trends of pre-existing weaknesses of trees as a result of genetics, propagation and cultivation.
- Dertermine best practice methods for propagation and cultivation of resilient trees and shrubs.
- Develop a protocol for the planting and maintenance of trees in public areas, including policies, procedures, guidelines and specifications.

8 References

BoM, TC Marcus information for City of Darwin post cyclone tree survey, provided by BoM 5th June 2018.

BoM Website http://www.bom.gov.au/announcements/sevwx/nt/nttc20180316.shtml Accessed 23rd May 2018

City of Darwin Council: Twelfth Meeting of the Twenty-Second Council on Tuesday, 27 March 2018 (ORD03/36) under General Business, the council considered Dangerous Trees in the Darwin Municipality (Common No. 3777063) March 2018.

Department of Environment and Natural Resources (2000), The Land Resources of the Elizabeth, Darwin and Blackmore Rivers – Greater Darwin Area, NT.

Fogarty, P.J. Lynch, B. and Wood, B. (1984) The Land Resources of the Elizabeth, Darwin and Blackmore Rivers, Land Conservation Unit, Conservation Commission of the Northern Territory.

Merriam-Webster Dictionary: https://www.merriam-webster.com/dictionary/lithosol Accessed 30th May 2018.

CSIRO The Australian Soil Classification: www.clw.csiro.au/aclep/asc_re_on_line/ru/rudosols.htm Accessed 30th May 2018.

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:

- 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

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 and a quorum of 4 is required.

Agendas and Minutes will be prepared by a 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 City Operations, City of Darwin, on a weekly basis after each meeting via e-mail.

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 City Operations by early October 2018.

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 City Operations, City of Darwin.

ENCL: NO	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM:	14.1.3

REMOVAL OF CAR PARKING ON LITCHFIELD STREET

REPORT No.: 18CF0066 SG:nt **COMMON No.: 3226493** **DATE: 17/07/2018**

Presenter: **Acting General Manager City Operations, Nik Kleine**

Approved: **Acting General Manager City Futures, Shenagh Gamble**

PURPOSE

The purpose of this report is to seek Council approval for the removal of three car parking spaces on Litchfield Lane

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
2 Vibrant, Flexible and Tropical Lifestyle
Outcome
2.1 Improved access and connectivity
Key Strategies
2.1.4 Provide parking facilities to meet community needs

KEY ISSUES

- The (under construction) Cavenagh Street shade structure prevents the Northern Territory Fire and Rescue Service (NTFRS) from providing service to buildings in the area
- Large NTFRS vehicles would struggle to clear vehicles parked on the bend
- It is also likely NTFRS vehicles would park on that bend in the event of a structural fire in the area
- NTFRS request that the three carparks on the Litchfield Street bend between the Chung Wah Society driveway and Palm Court driveway be replaced by a yellow line indicating no parking.

RECOMMENDATIONS

A. THAT Report Number 18CF0066 SG:nt entitled Removal of Car Parking on Litchfield Street, be received and noted.

B. THAT Council approve the removal of the three carparks on the Litchfield Street bend between the Chung Wah Society driveway and Palm Court driveway.

BACKGROUND

Northern Territory Fire and Rescue Service has requested the removal of three car parking spaces on Litchfield Street.

DISCUSSION

As a result of the installation of the shade structure on Cavenagh Street the NT Fire and Rescue Service has identified a matter of access for large fire emergency vehicles.

The NTFRS requests the three carparks (shown in Figure 1 below) on the Litchfield Street bend between the Chung Wah Society driveway and Palm Court driveway be replaced by a yellow line indicating no parking, (refer attached image). NTFRS largest Aerial appliance would struggle to clear vehicles parked on the outside of the bend in the current arrangement. Additionally, in the event of a structure fire in surrounding buildings (particularly the Cavenagh Hotel) it would be highly probable NTFRS vehicles would be sited on the identified bend.

The parking bays in question are in zone A. The maximum income generated from these bays would be $23 daily (based on an assumption of full turnover and occupancy every week day), which comes to $5,750 per year per bay.

The actual 2017/2018 income generated from the parking meter servicing these bays was $776.20

Note that removing car parking bays does not directly result in loss of car parking income as other bays in the area can be utilised.

It is recommended that the parking bays be removed and the road be marked with a yellow line to indicate no parking. The parking meter would also be removed.

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REPORT NUMBER: 18CF0066 SG:nt
SUBJECT: REMOVAL OF CAR PARKING ON LITCHFIELD STREET

Figure 1 Three on street car parking bays requested to be removed

CONSULTATION PROCESS

In preparing this report, the following City of Darwin officers were consulted:

- Senior Project Officer Capital Works
- Senior CBD Carpark Coordinator

In preparing this report, the following External Parties were consulted:

- Project Manager Design, Department of Infrastructure, Planning and Logistics, Northern Territory Government

POLICY IMPLICATIONS

Nil

BUDGET AND RESOURCE IMPLICATIONS

The maximum possible revenue from each parking bay is $5,750 annually. The actual 2017/2018 income generated from the parking meter servicing these bays was $776.20

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

If the car parking spaces are not removed and made available to NTPFRS there is a risk the service would not be able to respond to emergencies in the area.

ENVIRONMENTAL IMPLICATIONS

Nil

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

NIK KLEINE
ACTING GENERAL MANAGER
CITY OPERATIONS

SHENAGH GAMBLE
ACTING GENERAL MANAGER
CITY FUTURES

For enquiries, please contact Nik Kleine on 89300586 or email: n.kleine@darwin.nt.gov.au.

ENCL: YES	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM: 14.1.4

COUNCIL RESPONSE TO LIQUOR LICENCE APPLICATIONS JULY 2018

REPORT No.: 18CL0069 EB:kl COMMON No.: 3824027 DATE: 17/07/2018

Presenter: Darwin Safer City Coordinator, Elly Bugg

Approved: Acting General Manager City Life, Matt Grassmayr

PURPOSE

The purpose of this report is to present to Council for consideration, responses to Liquor Licence Applications.

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
1. Collaborative, Inclusive and Connected Community
Outcome
1.4 Improved relations with all levels of government and significant stakeholders
Key Strategies
1.4.2 Play an active role in strategic and statutory planning processes

KEY ISSUES

- Council has been advised of eight (8) licence applications for comment.
- This report details City of Darwin Officers' recommended responses to the Northern Territory Government for the liquor licence applications and recommended responses to applications related to the sale of liquor on Council owned land/facilities.
- Council has endorsed the *Safer Vibrant Darwin Plan 2016-2019*, which outlines strategic directions and actions that contribute to a safer, more vibrant community. Recommendations within this report align with the framework.

RECOMMENDATIONS

A. THAT Report Number 18CL0069 EB:kl entitled Council Response To Liquor Licence Applications July 2018, be received and noted.

B. THAT Council endorses the Special Liquor Licence Application from Little Miss Korea to host a function in Austin Lane on Saturday, 28 July 2018 for the launch of 'Donate Life Week'.

C. THAT Council endorses the Special Liquor Licence Application from Foreshore Restaurant and Café in Nightcliff to extend their licenced area and consumption times to cater for a wedding on Sunday, 18 August 2018.

D. THAT Council endorses the Special Liquor Licence application from Waratah Cricket Club at Gardens Oval to cater for a wedding for up to 60 people on Saturday, 8 August 2018.

E. THAT Council does not support the Special Liquor Licence application from Hamark Holdings Pty Ltd to host 'The Litchfield Street Party' from Thursday 2 August 2018 to Monday 6 August 2018.

F. THAT Council has not identified any reason to object to the Special Liquor Licence application from One Mile Brewery NT Pty Ltd for an event called the 'Beer and BBQ Festival' to be held on Sunday, 5 August 2018 at 111 Coonawarra Road, Winnellie.

G. THAT Council has not identified any reason that would grounds for objection under Section 47F (2) of the Liquor Act for the Application for a Permanent Variation to a Liquor Licence from Pee Wees Pty Ltd trading as Pee Wees @ The Point, Fannie Bay.

H. THAT Council has not identified any reason that would be grounds for objection under Section 47F (2) of the Liquor Act for the application from Mr Mulga for a new wine bar and art gallery to be called 'Babylon Berlin' in the Air Raid Arcade.

I. THAT Council has not identified any reason that would be grounds for objection under Section 47F (2) of the Liquor Act for the application from Mr Brown for a new micro-brewery, to be called 'Beaver Brewery' at 2/14 Tang Street, Coconut Grove.

BACKGROUND

PREVIOUS DECISIONS

DECISION NO.21\5529 (27/06/17)

NT Alcohol Policies and Legislation Review
Report No. 17C0045 KH:es (27/06/17) Common No. 3562620

*B. THAT Council endorse the City of Darwin response submission to the Northern Territory (NT) Government Review of Alcohol Policies and Legislation at **Attachment A** as amended to suggest some stronger responses to licensing, takeaway licenses, closing hours, provision of support facilities, review of dry area legislation enforcement, impact on residents and other administrative matters to report Number 17C0045 KH:es entitled NT Alcohol Policies and Legislation Review.*

Status of Council's Objection to an Application for a Variation of the Liquor Licence Conditions for Hot Rock Restaurant and Bar
Report No. 10C0065 AF:kl (05/05/09) Common No. 1723985

B. THAT Council proceeds to object to all new applications in the municipality for extensions of late night trading hours after 2.00am.

Considerations under the *Liquor Act*

Licensing NT has advised City of Darwin that the following sections of the *Liquor Act* are relevant to these applications:

Under section 27(3) of the *Liquor Act*, if the application relates to premises within the area of a shire council or a regional council, the Director-General must, as soon as reasonably practicable, inform the CEO of the Council that a new liquor licence application has been made.

Grounds For Objection Under Section 47F(2) Of The Liquor Act

Pursuant to Section 47F(2) of the *Liquor Act*, an objection may only be made on the grounds that the grant of the licence may or will adversely affect:

(a) The amenity of the neighbourhood where the premises the subject of the application are or will be located; or
(b) Health, education, public safety or social conditions in the community.

Under Section 32A(2) of the *Liquor Act*, where the Director-General deems that the notice of publication is not required Section 47F does not apply. The Director-General may seek advice from stakeholders, but an objection under Section 47F(2) is not available as the application is not required to be published.

DISCUSSION

Special Liquor Licence Applications

City of Darwin has received five (5) Special Liquor Licence Applications for comment:

Applicant:	Little Miss Korea
Address / Location:	17/56 Smith Street, Darwin (including use of Austin Lane)
Council Controlled Land:	Yes

The applicant has provided an Application for a Special Liquor Licence to cater for 400-500 people at an event to launch 'Donate Life Week Australia' in Darwin on Saturday, 28th July from 6:30pm to 11:30pm.

The application includes the following conditions:

- Alcohol will be served via two bars, on premise only to guests within a designated area on Austin Lane. Water and soft drinks will also be available.
- Austin Lane will be closed off for the event. NT Police, Fire and Emergency Services have endorsed the permit application and the relevant Council Permit has been provided.
- No takeaway alcohol sales are permitted and the venue has a specific, separate smoking area.
- Event security will be provided, as per Industry standards.

Recommendation: Council Officers have assessed the application and recommend Council endorses the Special Liquor Licence Application from Little Miss Korea. If Council supports this recommendation the application will be signed by the General Manager, City Life and returned to the applicant for lodgement with Licencing NT.

Applicant: The Foreshore Restaurant and Cafe
Address / Location: 259 Casuarina Drive, Nightcliff
Council Controlled Land: Yes

The applicant has provided an Application for a Special Liquor Licence to cater for 90 guests at a wedding, to be held on Sunday, 18th August from 5:00pm to 10:30pm.

The application includes the following conditions:

- Alcohol will be served on premise only to wedding guests within a clearly delineated, licenced area.
- No takeaway alcohol sales are permitted and the venue is strictly no smoking.
- The Licensee is requesting an extension of the current licenced area (to include the grassed area at the front of the building).
- The Licensee is also requesting an extension to the licenced hours of one hour, from 10:00pm to 11:00pm.
- As per the current licence, all alcohol will be served ancillary to a meal.

Recommendation: Council Officers have assessed the application and recommend Council endorses the Special Liquor Licence Application from The Foreshore Restaurant and Cafe. If Council supports this recommendation the application will be signed by the General Manager, City Life and returned to the applicant for lodgement with Licencing NT**.**

Applicant: Waratah Cricket Club
Address / Location: Gardens Oval, Darwin
Council Controlled Land: Yes

The applicant has provided an Application for a Special Liquor Licence to cater for 60 guests at a wedding, to be held on Saturday, 8th August from 6:00pm to 11:30pm.

The application includes the following conditions:

- Waratah Cricket Club utilise the Council owned facilities of Gardens Oval.
- The Club currently holds a Continuing Special Liquor Licence to sell liquor to Members and Guests at specified times.
- Food will be provided and security is not required for this small, private event.
- No takeaway liquor will be sold.

Recommendation: Council Officers have assessed the application and recommend Council endorses the Special Liquor Licence Application from Waratah Cricket Club. If Council supports this recommendation the application will be signed by the General Manager, City Life and returned to the applicant for lodgement with Licencing NT.

Applicant: Hamark Holdings Pty Ltd
Address / Location: Litchfield Street Party, Darwin
Council Controlled Land: Yes

Hamark Holdings Pty Ltd (Hamark) has provided an Application for a Special Liquor Licence to hold a series of street party events to launch the Darwin Cup Carnival.

The application includes the following conditions:

- The events will run in the evenings over five (5) days from Thursday 2nd to Monday 6th August 2018, from 4:00pm to 12:00am each day.
- The capacity of patrons at each event is 1,800 maximum.
- The Saturday night street party event will be a ticketed event. It will include a live music event with headline performers 'The Veronicas'. It is assumed this event will attract significant interest and capacity patronage.
- Hamark are requesting the closure and use of a portion of Litchfield Street between the Cavenagh Hotel and the Palm Court building, including a small part of the street behind The Cavenagh Hotel for the duration of the events.
- Temporary fencing will be utilised to enclose the event area, effectively delineating it as the licenced area. The temporary fencing and partial road closure will remain in place for the duration of the event.
- Litchfield Street will become a two-way thoroughfare for the entirety of the event. Turn-around egress has been maintained and alterative access from Woods Street to private carparks is available. Event entry is at the Cavenagh/Litchfield Street intersection and licenced crowd controllers will be in place to assess patrons upon entry.
- Public transport will not be affected.

- Vehicles related to the event will be provided parking by the Cavenagh Hotel's private carpark.
- Food will be available for purchase by a food vendor (Cannon's Catering) and from the adjacent Cavenagh Hotel.
- Security, as per Industry standards, will be provided.
- This is a 'no glass' event.
- No takeaway liquor will be sold.
- Amplified music, a big screen, tables, chairs and shade will be utilised over the course of events and complementary water will be supplied.
- An approved Traffic Management Plan has been provided, as well as a detailed Event Management Plan.
- NT Police has endorsed the City of Darwin, Application for a Street Party/Event Permit.

Other considerations:

- The applicant first proposed this event on Cavanagh Street with a half road closure; applications were lodged with Council on 27 June 2018.
- The applicant then changed to request the closure of Litchfield Street and re-lodged applications on 9 July, 2018.
- At the time of this report only one letter of support for the event has been received, from the event partner Cavenagh Hotel. The applicant has advised of two other verbal confirmations of support from Tim's Surf & Turf and the Chung Wah Society.
- Council has not received evidence of consultation with other stakeholders.
- The applicant has advised ticket sales of up to 1,800 patrons for events, consideration is required regarding accessibility for crowds given current construction projects.
- Due to the extended length of time proposed for the road closures this event will effect parking and vehicle access in the surrounding area.
- A site plan of the proposed licenced area is provided at **Attachment A** to this report.

Recommendation: Council Officers have had limited time to assess this application and at the time of writing this report there is insufficient information to recommend that Council supports the application. The application has been included in this report as given the time frame there is no other opportunity to consider this request.

Council Officers recommend that Council does not support the Special Liquor Licence application from Hamark Holdings Pty Ltd to host 'The Litchfield Street Party' from Thursday 2 August 2018 to Monday 6 August 2018. Further evidence of community consultation needs to be provided by the applicant to determine the event/s will not unduly impact community and business amenity.

If Council determines to support the application, it will be signed by the General Manager, City Life and returned to the applicant for lodgement with Licencing NT.

Applicant: One Mile Brewery
Address / Location: 111 Coonawarra Road, Winnellie
Council Controlled Land: No

One Mile Brewery has provided an Application for a Special Liquor Licence to hold a series an event called the 'Beer and BBQ Festival', to be held on Sunday, 5th August 2018.

The application includes the following conditions:

- The event is to showcase locally brewed beers and ciders, as well as local food.
- Up to 1,000 patrons are expected over the course of the day.
- There is no glass and food will be provided all day.
- No takeaway alcohol will be sold.
- Event security will be provided, as per Industry standards.
- NTPOL has signed off on the Alcohol Safety and Event Management Plan and traffic management is not required on the day.

Recommendation: Council Officers have assessed the application and recommend Council endorses the Special Liquor Licence Application from One Mile Brewery. If Council supports this recommendation the application will be signed by the General Manager, City Life and returned to the applicant for lodgement with Licencing NT

Application for a Permanent Variation to a Liquor Licence

City of Darwin has received one Application for a Permanent Variation to a Liquor Licence for comment:

Applicant: Pee Wees Pty Ltd t/a Pee Wees @ The Point
Address / Location: Lot 5755, Alec Fong Lim Drive, Fannie Bay
Council Controlled Land: Yes

Pee Wees Pty Ltd, trading as Pee Wees @ the Point, has provided an application for a Permanent Variation to a Liquor Licence.

The application includes the following conditions:

- The Licensee is seeking approval for the licenced venue to serve alcoholic beverages to patrons without the requirement for the provision of a meal.
- The Licensee will continue to maintain the appearance of trade predominantly as a restaurant and function centre however requires the removal of conditions which prevents it from selling alcohol without a meal or snack.

- The Licensee requests that the Authority to sell liquor on the premises be changed from a 'Restaurant Authority' to an 'On-Licence Authority' (recognising that the relevant 'Authorities' are not defined under Statute.
- The removal of the provision of the sale of alcohol not ancillary to a meal will allow patrons of the venue to consume liquor at the venue and enjoy the location and ambiance, without having to purchase food.
- The application aligns with a significant investment and upgrade to the facilities at Pee Wees on the Point designed to attract tourism and trade and increase the functional use of the premises.
- This application is in alignment with other, similar Restaurants in Darwin that have provision to provide liquor not ancillary to a meal, so a precedence already exists for such venues.
- Pee Wees on the Point has been trading for the last 16 years and describes itself as having an exemplary compliance history. It is considered a quality 'high-end' premises, which does not attract they type of clientele who drink irresponsibly and to excess. Management are committed to ensuring the Restaurant retains its reputation as an upmarket venue offering a superior dining experience.

Recommendation: Council Officers have not identified any reason that would be grounds for objection under Section 47F (2) of the Liquor Act. Upon Council's determination regarding this application, the Council decision will be provided to Licencing NT. If Council objects to this application, an objection letter will be provided to Licensing NT outlining the reasons for objection.

New Liquor Licence Applications

City of Darwin has received two (2) New Liquor Licence Applications for comment:

Applicant: Matt Mulga - for 'Babylon Berlin'
Address / Location: Air Raid Arcade, 35 Cavenagh Street, Darwin
Council Controlled Land: No

Mr Mulga has provided an Application for New Liquor Licence for proposed new premises, to be called 'Babylon Berlin'.

The application includes the following conditions:

- The business proposed to be conducted on the premises will be an On-Licence liquor licence whereby liquor will be sold and supplied to patrons at the premises.
- The sale and consumption of liquor on the premises will be from 11:00am until 1:00am, the following day, 7 days a week, 365 days a year including public holidays, Good Friday and Christmas Day.
- Non-alcoholic products will also be available.
- Food will be available for purchase from 5:00pm to till close, Tuesdays to Saturdays.
- Sale and consumption of liquor on the premises is not ancillary to a meal.

- No takeaway liquor will be sold from the premises.
- From 8:00pm entry and exit will be via Austin Lane only.

Other considerations:

- Licencing NT and the Drug and Alcohol Policy Unit, NT Police, Fire & Emergency Services have expressed some concern regarding the inclusion of the central walkway of the building into the 'licenced area' of the proposed wine bar.
- Currently, there are multiple tenancies within the current complex. The general public, including children, must utilise the internal walkway to access these tenancies.
- A site plan of the proposed licenced area is provided at **Attachment B** to this report.

Recommendation: Council Officers have not identified any reason that would be grounds for objection under Section 47F (2) of the Liquor Act. Upon Council's determination regarding this application, the Council decision will be provided to Licencing NT. If Council objects to this application, an objection letter will be provided to Licensing NT outlining the reasons for objection.

Applicant: Mr Christopher Brown – for 'Beaver Brewery'
Address / Location: 2/14 Tang Street, Coconut Grove
Council Controlled Land: No

Mr Brown has provided an Application for New Liquor Licence for proposed new premises, to be called 'Beaver Brewery'.

The application includes the following conditions:

- The business proposed to be conducted on the premises will be an On-Licence liquor licence whereby liquor will be sold and supplied to patrons at the premises.
- The sale and consumption of liquor on the premises will be from 5:00pm until 10:00pm, on Friday Nights and 12:00pm to 10:00pm on Saturdays.
- The applicant will produce beer and cider at the premises for sale at the premises including full and mid-strength varieties.
- Non-alcoholic products will also be available.
- Food will be available for purchase through a third party food van whilst the premises are open.
- Sale and consumption of liquor on the premises is not ancillary to a meal.
- No trading on Good Friday, Public Holidays, or Christmas Day.
- No takeaway liquor will be sold from the premises.

Recommendation: Council Officers have not identified any reason that would be grounds for objection under Section 47F (2) of the Liquor Act. Upon Council's determination regarding this application, the Council decision will be provided to Licencing NT. If Council objects to this application, an objection letter will be provided to Licensing NT outlining the reasons for objection.

CONSULTATION PROCESS

In preparing this report, the following City of Darwin officers were consulted:

- Manager, Vibrant Communities

In preparing this report, the following External Parties were consulted:

- Principal Liquor, Gaming & Racing Licensing Officer, Licensing NT.
- Drug and Alcohol Policy Unit, NT Police, Fire & Emergency Services.

POLICY IMPLICATIONS

Policy 82, Alcohol in Council Controlled Spaces and Places, guides Council, its staff and customers in the management of Council's spaces and places in relation to the use of alcohol.

Council has endorsed the 'Safer Vibrant Darwin Plan 2016-2019'. This Plan provides Council a framework to work towards a safer, healthier and more inclusive community. Underpinning the Plan is a focus on reducing the harms associated with excessive alcohol consumption and abuse. Council advocates for supply reduction, demand reduction and harm minimisation to meet the objectives of the Safer Vibrant Darwin Plan.

BUDGET AND RESOURCE IMPLICATIONS

Nil

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

Risk, legal and legislative implications, if required, are noted in individual letter responses.

ENVIRONMENTAL IMPLICATIONS

Nil

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

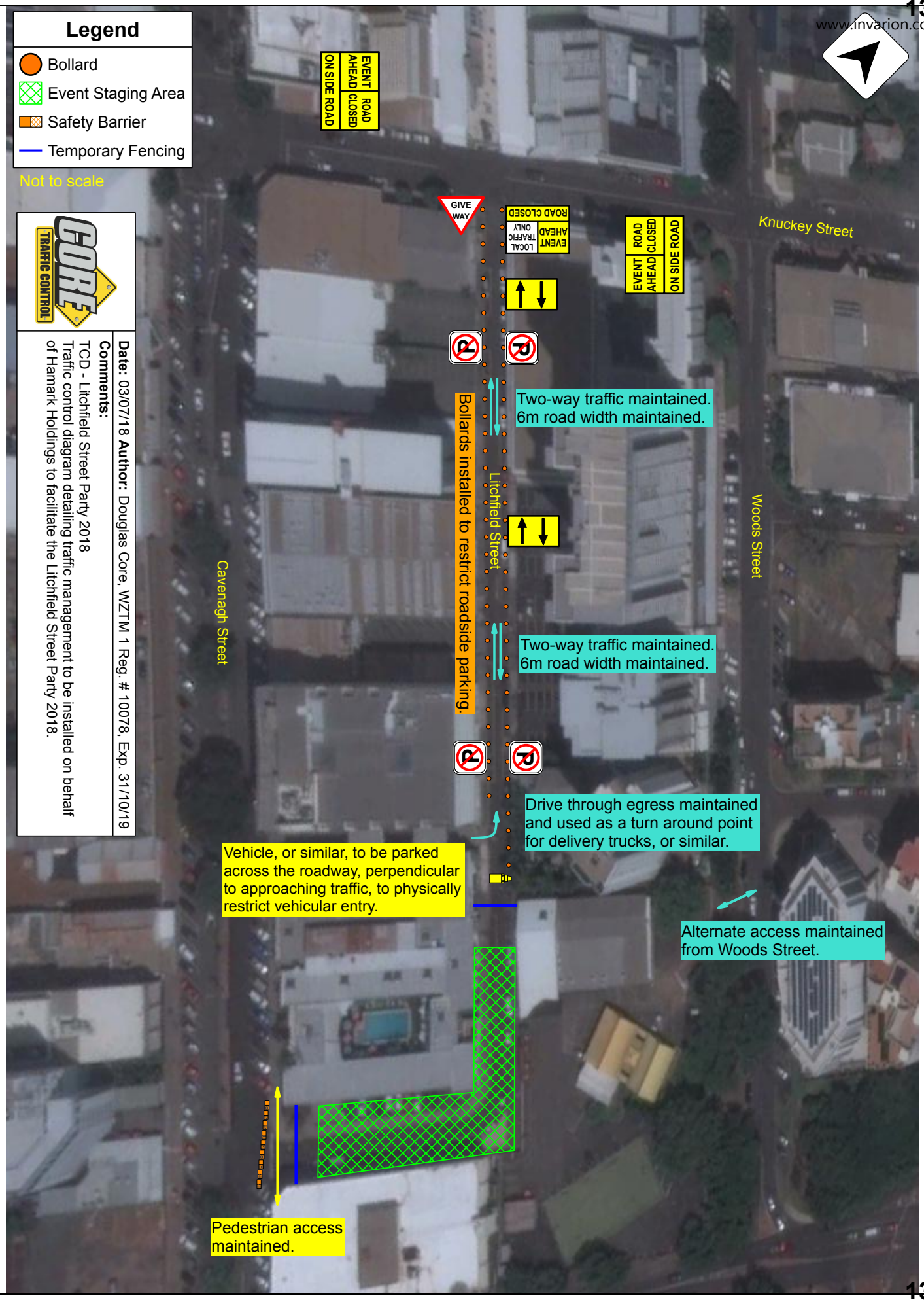
ELLY BUGG
DARWIN SAFER CITY COORDINATOR

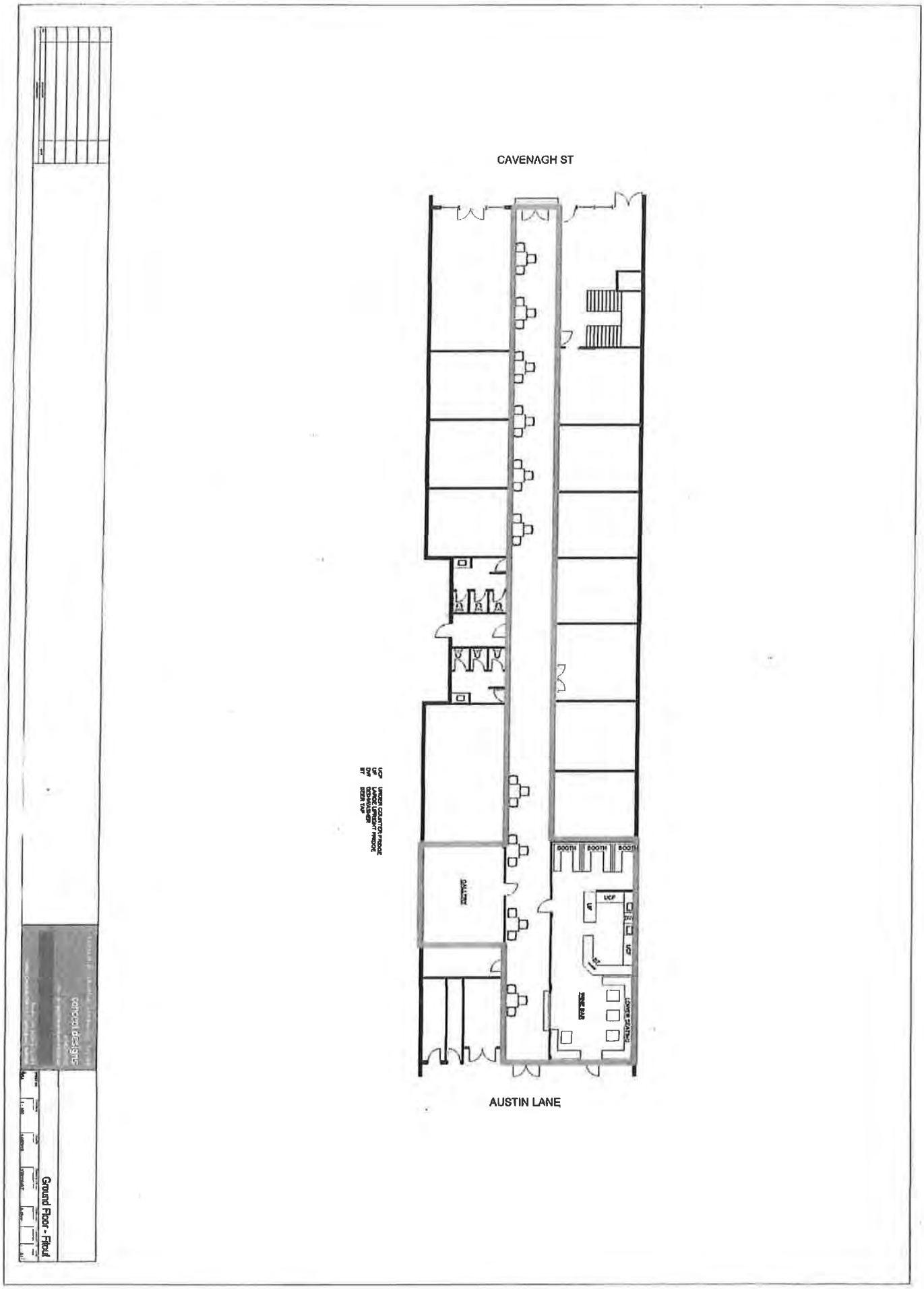
MATT GRASSMAYR
ACTING GENERAL MANAGER CITY LIFE

For enquiries, please contact Matt Grassmayr on 8930 0633 or email: m.grassmayr@darwin.nt.gov.au.

Attachments:

Attachment A: Site Plan for proposed licence area 'Litchfield Street Party'
Attachment B: Site Plan for proposed licence area 'Babylon Berlin' wine bar

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SERVERY
Ground Floor - Fitout

14.2 OFFICERS REPORTS (RECEIVE & NOTE)

ENCL: NO	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM:	14.2.1

PARAP POOL REDEVELOPMENT - FINAL UPDATE REPORT JULY 2018

REPORT No.: 18CL0029 MG:kl COMMON No.: 2918032 DATE: 17/07/2018

Presenter: **Acting Manager Leisure and Customer Experience, Clare Beacham**

Approved: **Acting General Manager City Life, Matt Grassmayr**

PURPOSE

The purpose of this report is to provide Council with a final report on the Parap Pool Redevelopment Project.

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
2 Vibrant, Flexible and Tropical Lifestyle
Outcome
2.3 Increased sport, recreation and leisure experiences
Key Strategies
2.3.2 Position Darwin as a host centre for local, national and international sport and other events

KEY ISSUES

- The notice of Practical Completion for stage one construction was issued on 23 November 2017.
- Public access was provided on 2 January 2018 with the official opening ceremony held on 26 January 2018.
- YMCA NT commenced management of the Parap and all Council pools on 2 January 2018.
- YMCA NT and Council Officers are working collaboratively with stakeholders, contractors and consultants to resolve any warranty defects or operational issues.
- Works are ongoing to replace components damaged through a lightning strike event during the wet season.
- A number of events have already been held successfully at Parap Pool and community feedback regarding the new facility has been extremely positive.

RECOMMENDATIONS

THAT Report Number 18CL0029 MG:kl entitled Parap Pool Redevelopment - Final Update Report July 2018, be received and noted.

BACKGROUND

PREVIOUS DECISIONS

DECISION NO.22\0275 (28/11/17)

Parap Pool Redevelopment Update November 2017
Report No. 17CL0032 AM:kl (28/11/17) Common No. 2918032

THAT Report Number 17CL0032 AM:kl entitled Parap Pool Redevelopment Update November 2017, be received and noted.

DECISION NO. 21\4787 (07/09/16)

Parap Pool Redevelopment - Award of Tender Contract
Report No. 16TS0152 NK:jg (07/09/16) Common No. 2918032

*A. THAT Council approve the reduction of project elements as detailed in **Attachment B** of Report Number 16TS0152 NK:jg entitled Parap Pool Redevelopment – Award of Tender Contract.*

B. THAT Council meet the additional funds required for the Parap Pool redevelopment by allocation of $223,000 from the anticipated end of year surplus funds and reallocation of $780,000 from the 2016/2017 Capital Works program as detailed in Report Number 16TS0152 NK:jg entitled Parap Pool Redevelopment - Award of Tender Contract.

C. THAT Council endorse a contingency amount of $1,400,000 (as detailed in Report Number 16TS0152 NK:jg entitled Parap Pool Redevelopment - Award of Tender Contract and that the options for funding this be considered as part of the quarterly budget review process.

D. THAT Council, pursuant to Section 32(2)(d) of the Local Government Act 2008, hereby delegates to the Chief Executive Officer, the power to finalise and enter into a contract for the redevelopment of the Parap Pool with Sunbuild Pty Ltd as described in report Number 16TS0152 NK:jd entitled Parap Pool Redevelopment - Award of Tender Contract.

E. THAT Council approach the Northern Territory Government to assist with additional funding for the community elements and contingency.

F. THAT the decision be moved into Open after the contract has been awarded.

DECISION NO. 21\4351 (26/04/16)

Parap Pool Redevelopment – Progress Report
Report No. 16C0043 AM:kl (26/04/16) Common No. 2918032

B. *THAT Council, pursuant to Section 32 (2) of the Local Government Act hereby delegates to the Chief Executive Officer power to finalise the funding agreement between the City of Darwin and the Northern Territory Government regarding the Parap Pool Redevelopment*.

DECISION NO. 21\4069 (09/02/16)

Parap Pool Redevelopment – Master Plan
Report No. 16TS0030 LC:jw (09/02/16) Common No. 2918032

*B. THAT Council endorse the Parap Pool Redevelopment Master Plan Stage 1, being **Attachment B** to Report Number 16TS0030 LC:jw entitled Parap Pool Redevelopment – Master Plan, and notes that the design and lodgement of a Development Application is proceeding.*

C. THAT Council note that the new amenities facility and the following community elements are estimated to cost $5 million;

a. Children's water play area (wet activity)
b. Children's playground (dry activity area)
c. Shaded facilities to prepare and share food (community space)
d. Aquatic activity for children and youth (leisure water)
e. Outdoor shaded area for community and group exercise

D. THAT Council not proceed with the new amenities facility and community elements unless the Northern Territory Government commits to substantially funding these components of the project.

DISCUSSION

Public access to Parap Pool commenced on 2 January 2018 and the facility was officially opened by Lord Mayor Kon Vatskalis, Chief Minister Michael Gunner and Senator Nigel Scullion on 26 January 2018 as part of Australia Day celebrations. The opening ceremony was attended by Olympic Gold Medallist Leisel Jones with approximately 600 people enjoying the event that included pool inflatables, fun bus activities for kids, giveaways and a talk by Jill Chism, the designer of the facility's integrated art work.

The first major FINA compliant event held at Parap Pool was the Vorgee NT Open and Age Championships on 9-11 February 2018, hosted by Swimming NT with over 350 swimmers participating. This event attracted over 140 visitors to the city, including 80 from interstate.

The facility hosted the South Australian Sports Institute Swim Team training camp in May 2018. The team consisted of 12 swimmers and staff, including a number of Australian Olympic swimmers.

Facility Management

YMCA NT commenced management of all three Council pools on 2 January 2018. Council Officers have been working closely with YMCA NT, stakeholders and the general public to assist with the transition.

YMCA NT has introduced a number of programs and initiatives at Parap Pool including:

- Café offering healthy options, barista coffee, using local suppliers where possible, re-usable keep cups for purchase and discounts for BYO cup.
- Parents and bubs dry land group fitness sessions
- Deep Water Running in 50m pool
- Aqua Aerobics in 25m pool
- Learn to Swim classes
- Easter Family Fun Day
- Links Point of Sale System

YMCA NT has reported attendance of 44,960 for the period January to July 2018. This is an increase of 4,868 compared to the same period prior to the re-development of Parap Pool.

Operational Issues

The redeveloped Parap Pool now has two bodies of water for program activities. As these pools are temperature controlled access and allocation has been requested by a number of stakeholders. YMCA NT in consultation with Council Officers and stakeholders has worked to finalise lane allocations at the new facility in an equitable manner.

The new facility includes a movable bulkhead in the 50m pool to enable alternate configurations for user requests such as Water Polo and short course training. Initially, the time required for the bulkhead relocation was considerable, however following training and staff familiarisation, set up times have significantly reduced. YMCA NT now relocates the bulkhead on a weekly basis to meet user requirements.

Parap Pool infrastructure was undamaged during Cyclone Marcus, however the facility was closed for a number of days due to power outages in the area. The Cyclone did result in considerable leaf material being deposited in the pools. Manual cleaning was undertaken until power could be restored and once power was re-established the facility was re-opened within 24 hours.

Warranty Defect and Maintenance Issues

The 12 month warranty defect period for Parap Pool commenced on 23 November 2017 with the issuing of the notice of practical completion.

Liquid Blu conducted the first on-site warranty inspection on 20 June 2018 to perform the following works:

- Physical review on-site to upgrade the defects registers and review performance of the facility elements
- Operational reviews of all engineering matters
- Project review in consultation with City of Darwin incorporating:
    - Defects review
    - Administrative review to identify outstanding information
    - Contract review to identify requests
    - Data requirements for asset management
- General discussions around project development and execution including any ongoing issues / concerns and future planning

The issues identified for resolution prior to finalisation of the defects period at this time include:

- Pool concourse and surrounds drainage
- Lighting control system and design
- Chemical storage room ventilation system

A lightning strike immediately adjacent to the facility on 30 January 2018 caused damage to electrical and communication components including timing equipment, PA system, scoreboard, internet and CCTV. This impacted on NT Championships and some smaller events. While most equipment has been repaired, the scoreboard works are still ongoing due to the order and delivery times for replacement components.

Community Feedback

Council has established a Facebook page for social media interaction and has revitalised website content. The community can now view all swimming pool bookings online and can access up to date program information for all facilities.

YMCA NT and Council have received overwhelming positive feedback regarding the redeveloped Parap Pool including the overall design, shade structure, water temperature, retention of the shaded grassed area and Beauty Leaf trees and the two pool design which caters for a variety of needs. The zero depth wet play area has proved very popular with children and the 25m pool is highly utilised as a family friendly option for patrons at the facility.

Neighbouring residents have raised concerns regarding the increase in lighting compared with the old facility and the impact on surrounding properties. Council Officers continue to liaise with residents and these concerns are being addressed operationally and will be resolved as part of the warranty defect process.

Swimming NT and other user groups have provided feedback concerning the lack of sun and rain protection at the deep end of the 50m pool resulting in issues during swim meets including sun glare for participants and additional infrastructure requirements.

The facility has proved very popular with the community especially in the Dry Season due to the ability to temperature control the water. The warmer water is of particular benefit for children's swim lessons and adult aqua aerobics. This is evident by the increase in attendance compared with the same period prior to upgrade.

CONSULTATION PROCESS

In preparing this report, the following City of Darwin officers were consulted:

- Acting General Manager City Operations
- Manager, Capital Works
- Senior Project Officer Capital Works

In preparing this report, the following External Parties were consulted:

- YMCA NT
- Liquid Blu

POLICY IMPLICATIONS

City of Darwin Policy No. 046 – Recreation and Healthy Lifestyle, provides a framework for the design, development and management of facilities that support pursuits to encourage healthy lifestyles and community connectedness.

BUDGET AND RESOURCE IMPLICATIONS

Funding		**Expenditure**	
CW Grant	$ 4,483,000	Design & Supervision	$ 1,165,830
CoD Matched	$ 4,483,000	Construction	$14,873,170
NTG	$ 5,000,000		
COD Capital Program	$ 2,073,000		
TOTAL	**$16,039,000**	**TOTAL**	**$16,039,000**

The design and supervision costs include a commitment of $61,535 payable to the project supervisor on completion of warranty defect process. Council holds a security guarantee from the contractor until the warranty defect period concludes on 23 November 2018.

The National Stronger Regions Fund project completion report and audited financial statement for the Commonwealth Government will be submitted in July 2018 in order for the final milestone payment of $448,300 to be made.

The public art component was funded through Council's Public Art Reserve for design, construction and installation.

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

Risks and mitigation measures are monitored and reviewed to ensure all identified risks are managed. Marsh Insurance conducted an independent hazard and risk assessment of all Council swimming pools. Council Officers have consulted with YMCA NT and the assessment recommendations will be adopted.

ENVIRONMENTAL IMPLICATIONS

The design for the redevelopment has taken into consideration environmental measures, subject to budget availability. This includes measures for temperature control of the two water tanks, future solar power, energy, water efficient devices and pool shade.

The Master Plan features the retention of the established Beauty Leaf trees and sensitive landscaping throughout both the internal and external areas of the facility.

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

CLARE BEACHAM
ACTING MANAGER LEISURE EVENTS & CUSTOMER EXPERIENCE

MATT GRASSMAYR
ACTING GENERAL MANAGER CITY LIFE

For enquiries, please contact Matt Grassmayr on 89300633 or email: m.grassmayr@darwin.nt.gov.au.

ENCL: NO	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM:	14.2.2

REVIEW OF PAYSTAY

REPORT No.: 18CF0058 SG:nt **COMMON No.: 3275805** **DATE: 17/07/2018**

Presenter: **Acting General Manager City Futures, Shenagh Gamble**

Approved: **Acting Chief Executive Officer, Diana Leeder**

PURPOSE

The purpose of this report is to provide Council with an update on the implementation of PayStay in Darwin

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
5 Effective and Responsible Governance
Outcome
5.1 Quality service
Key Strategies
5.1.3 Research, implement and support technology and communication systems to deliver services more efficiently

KEY ISSUES

- PayStay launched in Darwin on 19 January 2018
- Income from PayStay is steadily increasing across all zones
- Income from cash and credit card has declined by a comparable amount to the increase in PayStay
- Anecdotal feedback suggests the community supports PayStay

RECOMMENDATIONS

THAT Report Number 18CF0058 SG:nt entitled Review Of PayStay, be received and noted.

PAGE: 2
REPORT NUMBER: 18CF0058 SG:nt
SUBJECT: REVIEW OF PAYSTAY

BACKGROUND

At its 2nd Ordinary Meeting of November 2017 Council resolved the following:

Free On-Street Car Parking in the CBD
Report No. 17CF0024 LC:nt (28/11/17) Common No. 1952026

Procedural Motion

THAT this item lay on the table until six months after the implementation of the "PayStay" application scheduled in January 2018.

DISCUSSION

In November 2017 Council deferred a decision to introduce free parking options in the city centre until PayStay had been operational for six months. By all accounts PayStay provides an efficient and convenient payment option for parking.

Anecdotally across Council customer response to PayStay has been overwhelmingly positive. The steady increase in use of PayStay confirms that the community is responding well to this option for paid parking. Whilst PayStay is available through the website, text and telephone the most common method for using the service is through the smart phone app. Figure 1 below shows the use of PayStay across the city centre.

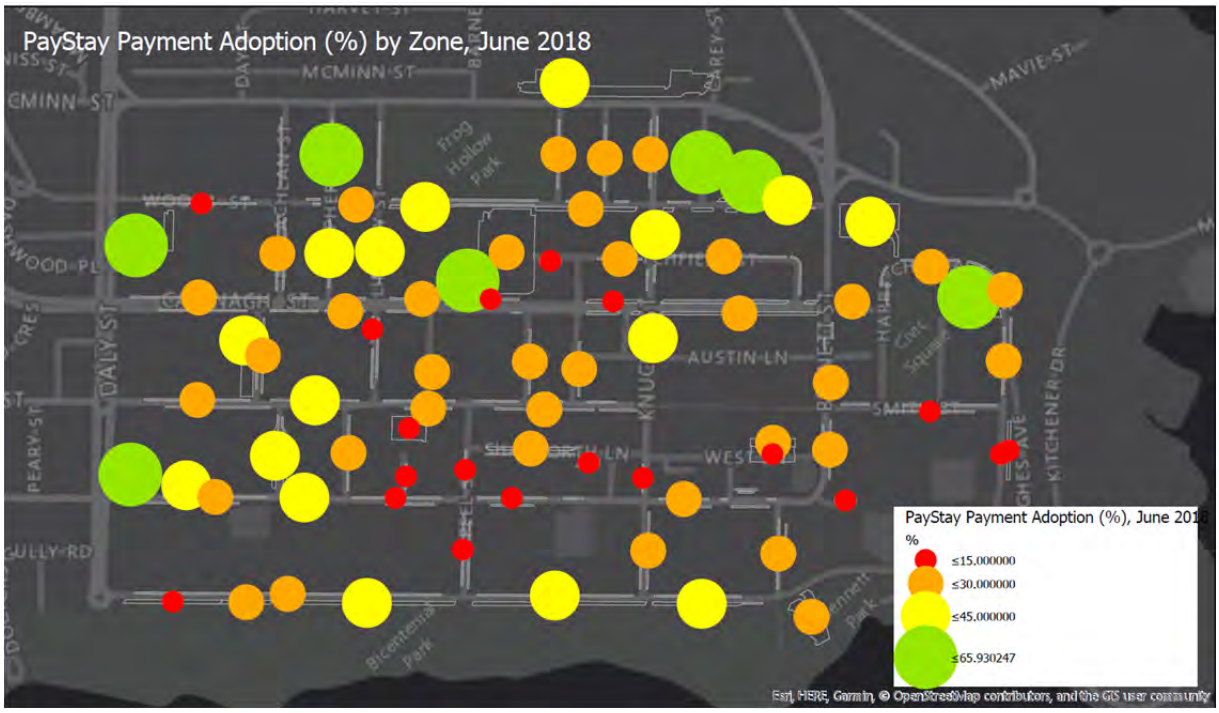

Figure 1 Use of PayStay across the city centre

Since PayStay was introduced in January 2018 the income from this option has steadily increased. Accordingly the income from cash and credit cards has

decreased by a comparable value. The overall income from parking has not changed significantly.

Figures 2 and 3 below show parking income for off street and on street parking respectively, by source for the quarters January – March 2017, April – June 2017 (pre-PayStay), January – March 2018 and April – June 2018.

For the purpose of this report the income from annual off street parking purposes has not been included as this is not accessible by PayStay.

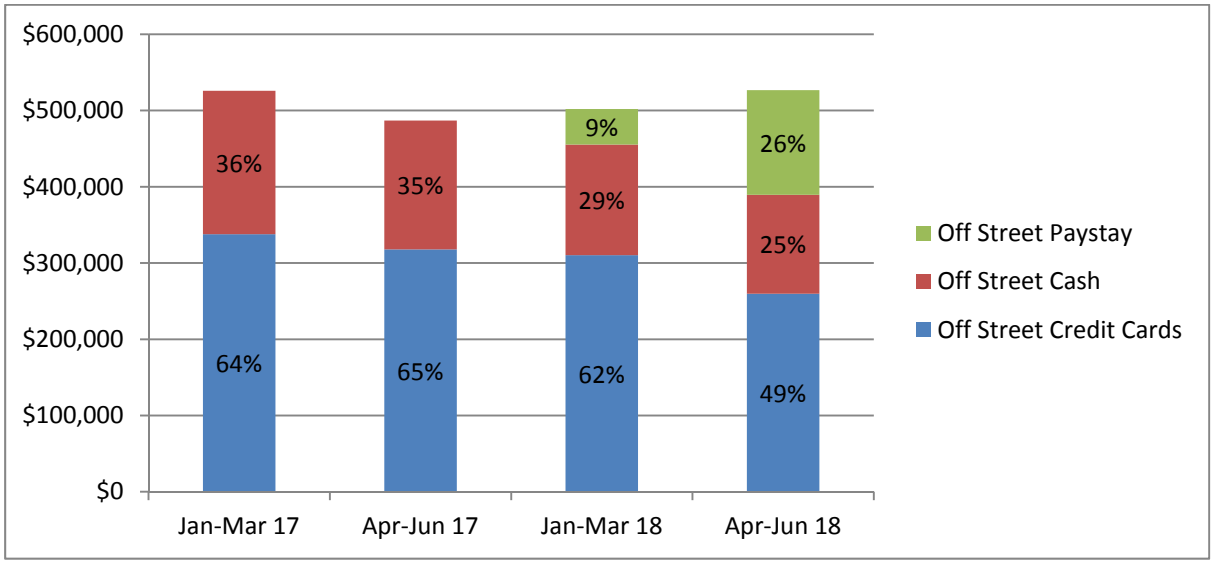

Figure 2 Off street parking income by source (note, income from annual parking permits is excluded)

It is worth noting that the income from paystay in off street parking is already equivalent with the cash earnings for off street parking.

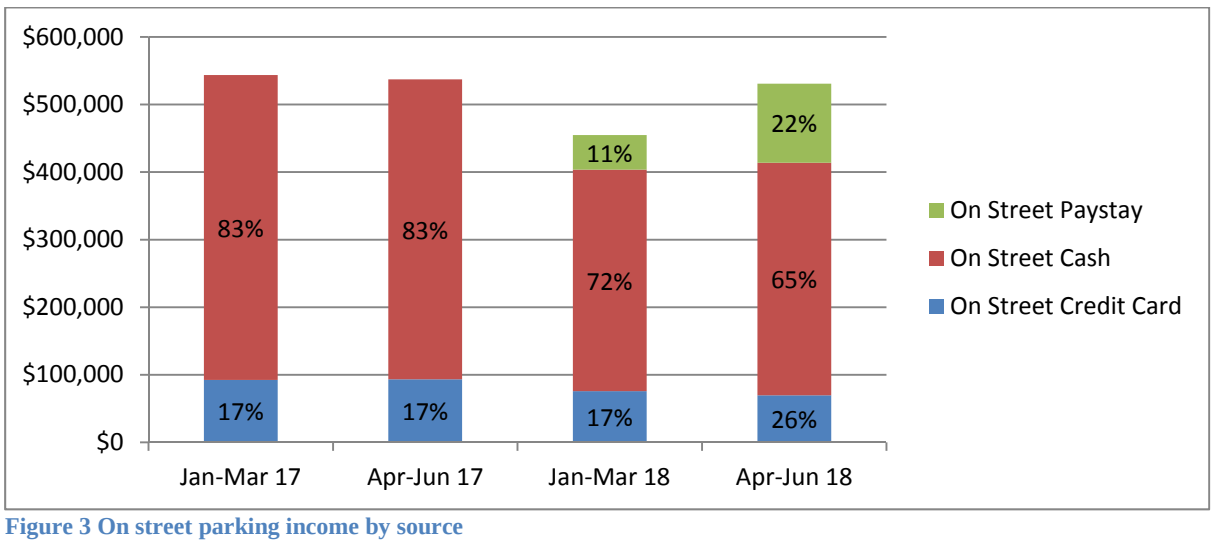

Figure 3 On street parking income by source

Figure 4 below shows parking income from PayStay by zone. The income from PayStay is steadily increasing across all zones.

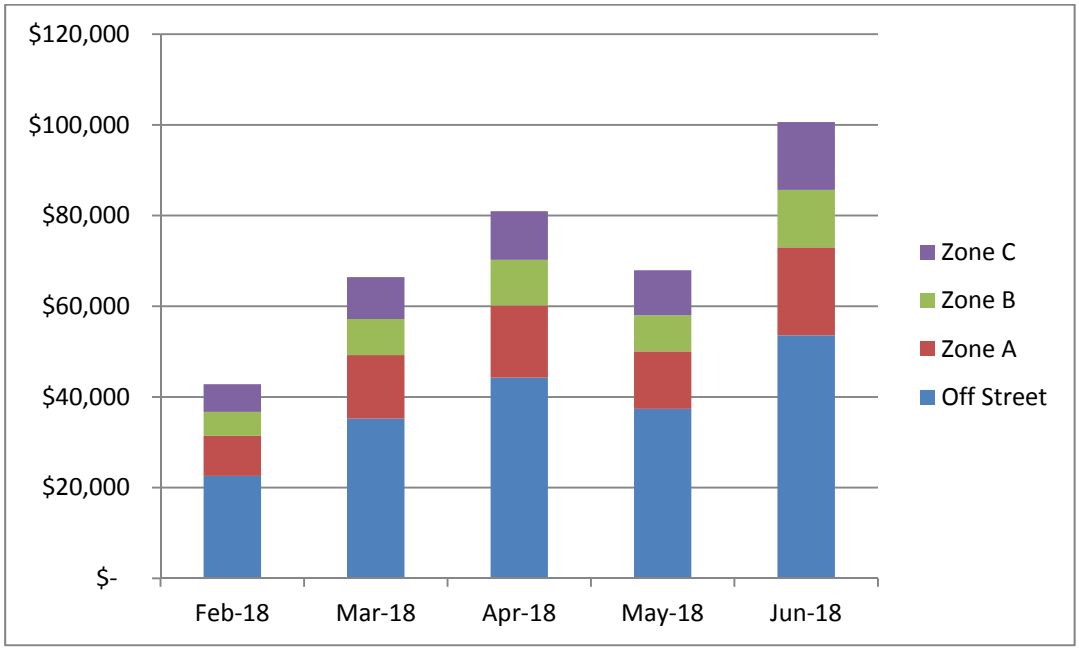

Figure 4 Income from PayStay by zone

From a regulatory perspective, some complaints do arise from the use of PayStay, primarily around user error in mis-typing the car registration. In these instances, where the user can demonstrate a parking session has indeed been paid for, the infringement is waived. In comparing the six months from January to June from 2017 to 2018, the overall number of infringements withdrawn has not increased. Anecdotally again, there is some additional time spent by officers in assessing car parking (ie, to determine if the payment is by ticket or through PayStay), however this is not considered to be significant in the overall regulatory process.

CONSULTATION PROCESS

In preparing this report, the following City of Darwin officers were consulted:

- Regulatory Operations Supervisor
- Car Park Office Administrator
- Customer Service Officer
- Graduate Data Analyst

POLICY IMPLICATIONS

Provision of paid parking is in keeping with the City of Darwin CBD Parking Strategy

BUDGET AND RESOURCE IMPLICATIONS

Any reduction in paid parking in the city centre will have budget and resource implications that have not been accounted for in the current operational budget.

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

Nil

ENVIRONMENTAL IMPLICATIONS

Nil

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

SHENAGH GAMBLE
ACTING GENERAL MANAGER
CITY FUTURES

DIANA LEEDER
ACTING CHIEF EXECUTIVE OFFICER

For enquiries, please contact Shenagh Gamble on 893005444 or email: s.gamble@darwin.nt.gov.au.

ENCL: NO	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM:	14.2.3

FREE ON STREET CARPARKING IN THE CBD

REPORT No.: 17CF0024 LC:nt **COMMON No.: 1952026** **DATE: 17/07/2018**

Presenter: **Acting General Manager City Futures, Shenagh Gamble**

Approved: **Acting Chief Executive Officer, Diana Leeder**

PURPOSE

This report brings back onto the table for consideration a 2017 request from Council to introduce free parking options in Darwin CBD as part of the 2018/19 budget process. Given the passage of time, the introduction of PayStay and the adoption of the 2018/19 budget it is for information only. Only the recommendations have been updated from the previous report.

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
5 Effective and Responsible Governance
Outcome
5.5 Responsible financial and asset management
Key Strategies
5.5.1 Manage Council's business based on a sustainable financial and asset management strategy

KEY ISSUES

- The report considers a request from Council to introduce free parking options in the Darwin CBD.
- In June 2013 Council adopted its CBD Parking Strategy which covers a range of polices one of which is primarily to support local business through various parking initiatives including pricing mechanisms.
- It is proposed to roll out an alternative, convenience based payment option for the payment of parking in the New Year with the introduction of PayStay - pay by phone application.
- Changes to provide free parking may undermine the intent of the pricing principles in the existing Car Parking Strategy which seek to support local businesses.

- 1 hour free, 2 hour free and all day free parking will have significant financial implications and possibly impact on the funding available to provide a range of Council services beyond car parking.
- Officers highlight that should Council consider some form of free car parking, the application should be consistent across all three zones to prevent confusion and inconsistency for users.

RECOMMENDATIONS

THAT Report Number 17CF0024 LC:nt entitled Free On Street Carparking In The CBD, be received and noted.

BACKGROUND

At is meeting on 12 September 2017 Council resolved as follows

DECISION NO.22\0010 (12/09/17)

THAT a report be prepared and presented to Council in November 2017:

A. outlining the financial and non-financial implications of 1 hour, 2 hour and all day free on-street parking and other reasonable options within the CBD, with current zones and time limits to remain;
B. outlining the financial and non-financial matters that would need to be considered if weekly, fortnightly and monthly off-street parking permits were introduced;
C. outlining consideration of a park and ride facility for the CBD; and
D. that all Elected Members be consulted along with relevant stakeholders.

It is noted that Council has a number of previous decisions that relate to Car parking; however this report focuses on the above Council Resolution from 12 September 2017.

DISCUSSION

Council adopted its car parking strategy in June 2013. The strategy establishes a strategic framework and direction for the future supply and management of on and off-street parking within the Darwin CBD. The policy statements deal with matters such as:

- NT Planning Scheme
- Developers Parking contributions
- Management and planning of kerbside space
- Transport and land use planning matters
- Pricing structures for on and off street car parking
- Long term financial planning and enforcement of Parking

As it stands, Council's current CBD Parking Strategy has not identified short term free car parking as a mechanism to support its objective.

A key policy statement contained within the strategy is Policy Statement 3.1 – Pricing Principles. Councils pricing principles are outlined in the "Implementation Plan" based on the following policy guidelines:

- The pricing structure for on and off-street parking is equitable, financially viable and fosters economic development in the best interest of the city, having regard for all issues relating to the supply and demand of short to long-term car parking in the Darwin Central Business Zone.
- Council's involvement in the parking market, reflected through its pricing management, is primarily ***"to support local business through short to medium-term parking".***

The underpinning key to an active city centre car parking service is to encourage customer turnover, particularly for land uses and businesses that rely on the turnover of parking to ensure customer turnover occurs. The pricing mechanisms of the Car Parking Strategy are vital to achieving this.

It is highlighted that the City of Darwin already currently provides 80 short term free car parking bays (15 minutes) within the CBD, which from 1 July 2016 have been highlighted by pavement marking within each bay to make these clearly identifiable to motorists. Furthermore, up to two hours free parking is also available at the Mitchell Centre Shopping Centre.

Current Parking Fees

Council charges the current fees for car parking;

Casual Parking

Zone A - $2.50 per hour (Max of 2 Hours)
Zone B – $1.80 per hour (Max of 3 Hours)
Zone C - $1.30 per hour (All Day)

All Day Parking

Westlane Car Park - Early Bird before 9.00am – $10.00 per day
Chinatown - Early Bird – Early Bird before 9.00am – $7.00 per day
Cavenagh St, Nichols Pl, MLachlan St, Stott Ln - $5.30 per day
McMinn St, Mitchell St, Woods/Daly St, Daly/Mitchell St - $3.20 per day

Image 1: Parking by zone in the City

Financial Considerations

Council has 1,686 on-street car parking bays which generate the following fee income (2016/2017):

Zone	Number of Bays	Parking Fee Income ($)
A	680	1,383,071
B	557	424,677
C	449	488,756
TOTAL	1,686	2,296,504

Financial Implications of Free Parking Options

To ensure the financial implications of free parking for on-street parking were explored, actual data for timed parking was extracted from Council's on-street parking machines. A summary of the expected minimum financial implications is outlined below. Whilst not requested in the resolution, Officers have also included the financial data for "up to 30 minutes" in addition to 1 hour and 2 hour free parking.

All Zone A, B & C	Minimum Financial impact ($)
30 minutes free parking	$135,010
One hour free parking	$657,967
Two hours free parking	$1,653,818
More than Two hours free parking	$2,296,504

Officers highlight that the above figures are a minimum estimate on the possible financial impact of free parking options. Consultation with other Council's interstate suggest that the behavioural changes that would result from the implementation of free parking would compound a significant increase to these estimated figures. The exact quantifiable increases are unknown given the behavioural context, but will likely occur.

Further information on the financial implications is discussed under the budget and resource implications heading.

Non-Financial Implications

The key non-financial implications of providing free parking will be the change in behaviour of motorists and the flow-on effects.

Should Council introduce additional free parking, evidence suggests there will be unintended flow on consequences which may include the utilisation of off-street car parks and displacement from paid parking at the Waterfront to the CBD.

It can reasonably be expected that should Zone A provide free parking it will become fully occupied at 100% and detract from motorists parking in Zones B and C. Regardless of whether this is intended behaviour, this type of changing behaviour raises uncertainty as to the ultimate financial implications and also whether the intent of the car parking strategy (particularly turnover) will be compromised.

Parking Permits

Current Council policy involves phasing out off street parking permits and has reduced the number of permits by almost 50% since June 2014 to 450 permits in 2017.

The key rationale for adopting this policy was due to a change in demands for off-street car parking. Most off-street car parks are currently running at maximum capacity. Subsequently, the issuing of permits for reserved bays reduced the available number of bays for public casual parking.

A key issue with parking permits is that they are administratively labour intensive under the current manual process used by Council. The issue of a parking permit implies to the permit holder a guarantee of a parking bay which Council is not in a position to do unless it reserves a specific bay for the permit holder. Officers note, with Council's current initiative to roll out pay by phone technology, it is believed this

will address many of the conveniences that would otherwise be addressed by permit system

Park and Ride

Currently, there are three Park and Ride facilities at Coolalinga, Humpty Doo and Berry Springs. These Park and Ride facilities provide free car storage and a direct route to the Palmerston Bus Interchange.

Best practice review states “Park & Ride can only be successful as part of an overall parking strategy. In order to attract motorists, Park & Ride must offer a more efficient, cheaper and / or quicker alternative. Key elements of any parking strategy must include; a parking restraint policy, residents parking schemes, the promotion of walking and cycling, and bus priority measures.”

Officers recommend Council begin conversations with NTG to progress the matter.

PayStay – Pay by Phone

Council is currently in the process of rolling out its pay by phone application PayStay which is expected to be up and running in the New Year.

The application will provide a convenient cashless solution for both on and off street car parking. It will also allow motorists to pay for only the time actually used when parked and addresses the parking permit options suggested by Elected Members.
This is expected to significantly improve convenience and provide an easily accessible payment option for users outside of the traditional coins and card operated machines.

A comprehensive media rollout campaign is also being formulated to ensure city users understand and are aware of the new payment platform.

Industry

Although a number of representations have been made around the perceived benefits of increasing free parking options some caution has also been expressed by key stakeholder groups such as the Darwin City & Waterfront Retailers Association and the NT Property Council. Feedback from these industry groups highlighted the intent of the parking strategy pricing mechanisms to support turnover and local business.

Conclusion

Council officers do not recommend proceeding with the proposal for ‘free” parking periods as there is no conclusive evidence that the economic benefits will outweigh the costs, both financially and in ad hoc amendment to the adopted CBD parking strategy.

Council is currently trialling non regulation of timed parking restrictions in the CBD on Saturday mornings and anecdotal evidence suggests this is causing issues for retailers in terms of reducing turnover of parking and customers for small businesses. An outcome report on the trial will be presented to Council in the first quarter of 2018.

Officers note that from a financial implication the option of least financial impact would be up to 30 minutes free parking. Officers highlight that this would result in a minimum loss of $135,000 and behaviour changes in parking users could compound this figure to a significantly higher cost. Furthermore, should Council consider some form of free car parking, the application of this free parking would have to be across all three on street zones to prevent confusion and inconsistency for parking users.

CONSULTATION PROCESS

In preparing this report, the following City of Darwin officers were consulted:

- Manager Regulatory Services
- Manager Design Planning and Projects
- General Manager Infrastructure
- Manager Finance

In preparing this report, the following External Parties were consulted:

- Darwin City & Waterfront Retailers Association
- NT Property Council
- City of Sydney Council
- Leichhardt Municipal Council

Officers highlight that the introduction of such a change as free parking of any duration would require a high level of public education and awareness. Prior to any changes the Darwin City & Waterfront Retailers Association (DCWRA), Chamber of Commerce & Property Council should be formally consulted.

If recommendation B is adopted Council will utilise TV advertisements, social and print media to promote existing parking options, funded from within the existing car parking operational budget.

POLICY IMPLICATIONS

Council's current CBD Parking Strategy has not identified short term free car parking as a mechanism to support its objective.

BUDGET AND RESOURCE IMPLICATIONS

In summary the minimum financial implications of providing free parking in the CBD is as follows:

All Zone A, B & C	Minimum Financial impact ($)	%
30 minutes free parking	$135,010	5.9%
One hour free parking	$657,967	28.7%
Two hours free parking	$1,653,818	72.0%
More than two hours free parking	$2,296,504	100.0%

Officers highlight that the above figures are a minimum estimate on the possible financial impact of free parking options. Behavioural changes that would result from the implementation of free parking would compound an increase to these estimated figures. The exact quantifiable increases are unknown given the behavioural context but will likely occur.

Furthermore, Officers note that that CBD car parking fees have been experiencing decline over the past 18 months, car parking fees for the 12 months to June 2017 demonstrated a decline of $64,013 on the previous year. For the quarter to September 2017 car parking fees were down $99,692 on the previous year's quarter. This can be attributed to a range of aspects including the softening economic climate and lower occupation of available city centre properties.

A key consideration to consider is the annual transfer of car parking incomes fees. Officers highlight that for the year ended 30 June 2017 Council allocated $3.9 million from car parking fees income to fund (amongst other items) general operations and services to the community via a transfer to consolidated revenue.

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

Consultation with other Council's interstate suggest that a risk of the introduction of free parking even on trial basis is the ability to Council to revoke the initiative should the trial not be successful in both a strategic and financial impact sense. This difficulty has generally been borne out community pressure to maintain an initiative beyond the life of the trial.

ENVIRONMENTAL IMPLICATIONS

Nil

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

SHENAGH GAMBLE
ACTING GENERAL MANAGER
CITY FUTURES

DIANA LEEDER
ACTING CHIEF EXECUTIVE OFFICER

For enquiries, please contact Shenagh Gamble on 89300651 or email: s.gamble@darwin.nt.gov.au.

15. TOWN PLANNING REPORT/LETTERS

ENCL: YES	1ST ORDINARY COUNCIL MEETING/OPEN	AGENDA ITEM: 15.1

COUNCIL RESPONSES TO PLANNING APPLICATIONS- JULY 2018

REPORT No.: 18CF0054 BS:hd **COMMON No.: 2547669** **DATE: 17/07/2018**

Presenter: Manager City Planning, Cindy Robson

Approved: Acting General Manager City Futures, Shenagh Gamble

PURPOSE

The purpose of this report is to present to Council for consideration responses to Planning Applications received between 16 June and 6 July 2018.

LINK TO STRATEGIC PLAN

The issues addressed in this Report are in accordance with the following Goals/Strategies as outlined in the 'Evolving Darwin Towards 2020 Strategic Plan':-

Goal
1. Collaborative, Inclusive and Connected Community
Outcome
1.4 Improved relations with all levels of government and significant stakeholders
Key Strategies
1.4.2 Play an active role in strategic and statutory planning processes

KEY ISSUES

- A summary of City of Darwin responses to the Development Consent Authority for development applications exhibited between 16 June and 6 July 2018 is provided.
- A summary of City of Darwin responses to other planning applications received between 16 June and 6 July 2018 is provided.

RECOMMENDATIONS

A. THAT Report Number 18CF0054 BS:hd entitled Council Responses to Planning Applications - July 2018, be received and noted.

B. THAT Council endorse the responses to the Development Consent Authority within **Attachments A, B,** and **C** to Report Number 18CF0054 BS:hd entitled Council Responses to Planning Applications- July 2018,

C. THAT the responses for the planning-related applications at **Attachment D** to Report Number entitled Council Responses to Planning Applications - July 2018 , be received and noted.

BACKGROUND

City of Darwin responded to nine development applications between 16 June and 6 July 2018.

City of Darwin responded to three other planning applications received between 16 June and 6 July 2018.

City of Darwin approved one outdoor dining (non-licensed) application between 16 June and 6 July 2018.

DISCUSSION

Development Applications

Of the nine development applications, City of Darwin officers recommend supporting all nine (either subject to normal or specific conditions).

Development applications supported, subject to normal Council conditions

The table below describes the development applications that are supported by City of Darwin officers, subject to Council's normal development permit conditions in regard to issues including, but not necessarily limited to, waste collection, access and stormwater drainage.

Responses to these development applications are provided as **Attachment A** to this report.

Property Address	Description of Development Proposal
Section 6196 - Hundred of Bagot **171 Hidden Valley Road, Hidden Valley** (Hidden Valley Motor Sports Complex)	A two-storey administration and function building addition to an existing leisure and recreation facility (Motor Sports Complex) The application is to replace the existing Motor Sports House.
Lot 2293 - Town of Darwin **11 Knuckey Street, Darwin City** **Non La Restaurant**	Extensions to an existing restaurant. City of Darwin standard conditions requested.

Property Address	Description of Development Proposal
Lot 7748 - Town of Darwin **57 Ruddick Circuit, Stuart Park**	Single dwelling with a reduced front setback Front setback variation is only to the entrance porch which is only 2.2m wide, and a supporting column at 0.39m wide. Front setback requires 4.5m, proposes 3.9m to porch & 3.7m to supporting column. The variation is minor and is not expected to affect the amenity of the area.
Lot 33 - Town of Nightcliff **286 Casuarina Drive, Rapid Creek**	Re-subdivision under the *Unit Title Scheme Act* for the purpose of reallocation of parking spaces Application exchanges internal car parking bays between two units.
Lot 6692 - Hundred of Bagot **29 Fotiades Road, Berrimah**	Illuminated sign Located outside City of Darwin's municipal boundary.

Development applications supported subject to specific matters being adequately resolved:

The table below describes the development applications that are supported by City of Darwin officers subject to the following specific matters being adequately resolved.

Responses to these development applications are provided as **Attachment B** to this report.

Property Address	Description of Development Proposal	Specific Matters
Lot 8641 - Town of Darwin **4 Steele Street, Winnellie**	Part change of use from warehouse to place of worship and a caretakers residence exceeding 50m²	A site inspection indicated that access to some of the proposed car parks would be limited given that a gate and an existing building restrict access to both areas. In the event that a development permit is issued there should be a requirement to ensure that the proposed car parks are made available for the intended uses.

Property Address	Description of Development Proposal	Specific Matters
Lot 728 - Town of Sanderson **1 Enterprise Street, Anula**	Independent unit with a reduced front setback. 6m required, approximately 2.5m proposed (corner allotment), reduced setbacks exists within the existing streetscape character.	Four car parking spaces are required however the plans only indicate three car parking spaces. In the event that a development permit is issued, it is requested that the minimum car parking requirements be complied with.
Lot 2365 - Town of Darwin **38 Cavenagh Street, Darwin City**	Re-exhibition of amended application. Office and ground level commercial tenancies in a 10 storey building plus 2 levels of basement car parking. The primary change to the plans is the addition of another storey, resulting in 10 storeys as opposed to nine storeys.	A response in relation to relevant points of the subject amendment have been raised, Council's previous letter refers to conditions and commentary beyond the subject amendment. Council's previous request for deferral in relation to traffic matters, remains and the City of Darwin and the applicant are progressing the matter. **Car parking** As a result of the amendment there is an increase in net floor area for the commercial and office tenancies to 12,998m^2 and therefore a total of 389.98 (390) car parks are required. Whilst 62 car parks have been provided it results in a car parking shortfall of 327.98 (328) car parks which exceeds the 320 public car parks proposed by PA2018/0159 (12 and 14 Litchfield Street). As per Decision No. 22\0806 the final quantity of the car parking shortfall payment, subject to the *Local Government (Darwin Parking Local Rates) Regulations,* will be determined following a decision on the subject development application and the car parking proposed by PA2018/0159, should development permits be granted.

Property Address	Description of Development Proposal	Specific Matters
		Awnings City of Darwin acknowledges the greater functionality of the amended awning as a result of the reduced height and setbacks. Council's position in relation to full length awnings remains (i.e. continuation to the stairwells in Cavenagh Street and Litchfield Street facades). **Street trees** It is noted that the amended plans indicate that the existing street tree on the corner of Knuckey Street and Cavenagh Street is to be removed and replaced with an alternate tree. Council does not object to the removal of the existing tree provided that the species, tree-planting pit and irrigation are to the satisfaction of City of Darwin. **Volumetric controls** The principles of Council's commentary previously raised remain, in particular the impacts to the adjoining site to the north-western boundary due to the zero metre setback to an overall height in excess of 40.44 metres above ground level. However, if a development permit is approved; Council encourages and supports a mural to that façade. Whilst the applicant has identified that a design is to be put out for a competitive process, it is requested that a condition be included to ensure that such artwork occurs.
Lot 10448 - Town of Darwin	Alterations and additions to an existing single dwelling with a reduced	The proposed driveways are not supported. When combined, the two driveways total 11.45m in width

Property Address	Description of Development Proposal	Specific Matters
8 Green Street, Fannie Bay	side setback	on a 18.78m wide lot. A single driveway, which complies with City of Darwin requirements has been requested. Issues related to works already occurred/occurring within the road reserve have been addressed.

Development applications where additional information has been submitted for assessment

The table below describes development applications that have submitted further information and whether or not the information submitted addressed Council concerns.

Responses to these development applications are provided as **Attachment C** to this report.

Property Address	Description of Development Proposal	Council Concerns Addressed
Lot 5390 - Town of Darwin **27 Lambell Terrace, Larrakeyah**	Independent unit with a floor area in excess of 50m²	Council does not object.

<u>Other Planning Applications</u>

Below are descriptions of other planning related applications that have been received and responded to by City of Darwin.

Responses to these applications are provided as **Attachment D** to this report.

Outdoor Dining

An application for outdoor dining was received from the Rabbit Hole café and approved by City of Darwin officers under delegation. The Rabbit Hole, was previously known as Monty's on the Mall, and is located within Lot 2354 (44) The Mall.

The outdoor dining area will contain six tables, and span the length of the premises, and the two adjoining businesses. Both adjoining business owners and the land owner's representative have supported the outdoor dining area plans.

Developer Contribution Plans

The annual adjustment to CB Zone Car Parking Contribution Rate was calculated. This was advertised in the Northern Territory Government Gazette on Wednesday 27 June 2018 and letters sent to the Development Consent Authority and Property Council of Australia Northern Territory Division advising of the reduction from $23,262 to $22,994 per car parking bay shortfall.

The following contribution plans were also gazetted in the same edition:

- Adjustment to Developer Contribution Plan for Lee Point Road Roadwork;
- Adjustment to Developer Contribution Plan for Stormwater Drainage CBD Area A, B, C, D & E; and
- Adjustment to Developer Contribution Plan Stormwater Drainage Stuart Park Areas A, B, C & D.

Re-Exhibition Proposed PS Amendment

An altered proposal has been exhibited, to introduce controls on the establishment and operation of Helicopter Landing Sites (HLS) in certain zones, subject to provisions to protect amenity and the use remaining ancillary to the single dwelling on a site.

City of Darwin supported the altered proposed Planning Scheme Amendment, which includes alterations to the previously exhibited proposal, as requested by City of Darwin.

Occupation Licence

An application was received by City of Darwin for Part Section 4235 Administrative Section 6665 & Part Section 1164 Administrative Section 7472 (A), (768) Tiger Brennan Drive, Hidden Valley and (5) Amy Johnson Avenue, Winnellie requested by the Royal Agricultural Society of the Northern Territory for the purpose of car parking and show ground related activities for a five year period.

No issues are raised for this occupation licence application in relation to matters that fall within the responsibility of City of Darwin

CONSULTATION PROCESS

In preparing this report, the following City of Darwin officers were consulted:

- Strategic Town Planner
- Town Planner
- Planning Officer

POLICY IMPLICATIONS

Relevant Council policies are noted in individual letter responses.

BUDGET AND RESOURCE IMPLICATIONS

Budget implications may arise from individual development applications, including payment in lieu of car parking, payment of various contribution plans, and long term upgrading of infrastructure and services as a result of accumulative development.

The annual adjustments to developer contribution plans will impact the amount collected by the City of Darwin through contribution plans.

RISK/LEGAL/LEGISLATIVE IMPLICATIONS

Risks, legal and legislative implications, if applicable, are noted in individual letter responses.

ENVIRONMENTAL IMPLICATIONS

Environmental implications, if applicable, are noted in individual letter responses.

COUNCIL OFFICER CONFLICT OF INTEREST DECLARATION

We the Author and Approving Officers declare that we do not have a Conflict of Interest in relation to this matter.

CINDY ROBSON
MANAGER CITY PLANNING

SHENAGH GAMBLE
ACTING GENERAL MANAGER CITY FUTURES

For enquiries, please contact Cindy Robson on 8930 0528 or email: c.robson@darwin.nt.gov.au.

Attachments:

Attachment A: Letters of support, subject to normal Council conditions, for development applications not yet considered by the Development Consent Authority

Attachment B: Letters of conditional support to development applications not yet considered by the Development Consent Authority.

Attachment C: Letters of response where additional information has been submitted for assessment on development applications not yet considered by the Development Consent Authority.

Attachment D: Letter responses to other planning applications

CITY OF DARWIN
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22 June 2018 Reference: PA2018/0231 BS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Section 6196 - Hundred of Bagot**
171 Hidden Valley Road, Hidden Valley

Proposed Development: **Two-storey administration and function building addition to an existing leisure and recreation facility (Motor Sports Complex)**

Thank you for the development application referred to this office 7 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

No issues are raised for this Development application in relation to matters that fall within the responsibility of City of Darwin.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

CINDY ROBSON
MANAGER CITY PLANNING

CITY OF DARWIN
ABN 11 503 313 301

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22 June 2018 Reference: PA2018/0226 :hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 2293 - Town of Darwin**
11 Knuckey Street, Darwin City

Proposed Development: **Extensions to an existing restaurant**

Thank you for the development application referred to this office 7 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

The following issues are raised for consideration by the Authority:

i). **City of Darwin does not object to the granting of a development permit.**

ii). **City of Darwin requests that should a development permit be issued, that the following be provided as a condition precedent:**

a). **City of Darwin requests that the Authority require a schematic plan demonstrating all stormwater to be collected on the site and discharged underground to City of Darwin's stormwater drainage system.** The applicant's plans fail to demonstrate how on-site stormwater will be collected and discharged underground to City of Darwin's drainage network.

1). The plan shall include details of site levels and City of Darwin's stormwater drain connection point/s. The plan shall also indicate how stormwater will be collected on the site and connected underground to City of Darwin's system.

2). City of Darwin requires a stormwater drainage plan to confirm that it is technically feasible to collect stormwater on the site and dispose of it into City of Darwin's stormwater drainage system. It is also necessary to ensure that no stormwater will sheet-flow into the road reserve or onto adjoining properties.

b). **Site Construction**
City of Darwin requests that an Environmental and Construction Management Plan (ECMP) be required.
The ECMP should specifically address the following:

- waste management,
- traffic control,
- haulage routes,
- storm water drainage,
- use of City of Darwin land, and
- how this land will be managed during the construction phase;

to the satisfaction of City of Darwin.

Note: Building rubbish or debris must not be placed, or be permitted to be placed, on any adjoining public reserve, footway or road, without first obtaining a works approval from City of Darwin.

Should this application be approved, the following conditions pursuant to the *Planning Act* and City of Darwin's responsibilities under the *Local Government Act* are also recommended for inclusion in the development permit issued by the Development Consent Authority.

- All developments on/or adjacent to any easements on-site, in favour of City of Darwin shall be carried out to the requirements and satisfaction of City of Darwin.

- Waste bin storage and pick-up shall be provided in accordance with City of Darwin Policy Number 54 - Waste Management.

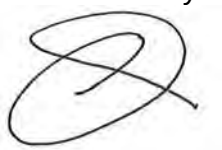
- Any proposed signage for the site shall be subject to a separate assessment in accordance with City of Darwin Policy Number 42 – Outdoor Advertising Signs Code.

- Any proposed stormwater connections to City of Darwin stormwater system or proposed works on/over City of Darwin property shall be subject to separate application to City of Darwin and shall be carried out to the requirements and satisfaction of City of Darwin.

In considering this application, the Development Consent Authority is requested to take into account any implications of the *Disability Discrimination Act* (Cth) or the *Anti-Discrimination Act* (NT) with regard to access for the disabled.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully



CINDY ROBSON
MANAGER CITY PLANNING

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22 June 2018 Reference: PA2018/0235 BS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 7748 - Town of Darwin**
57 Ruddick Circuit, Stuart Park

Proposed Development: **Single dwelling with a reduced front setback**

Thank you for the development application referred to this office 7 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

The following issues are raised for consideration by the Authority:

i). **City of Darwin does not object to the granting of a development permit.**

ii). **City of Darwin requests that should a development permit be issued, that the following be provided as a condition precedent:**

a). **A dilapidation report covering infrastructure within the road reserve to the satisfaction of City of Darwin at no cost to Council.**

b). **Access to the site shall meet City of Darwin requirements.**

c). **City of Darwin requests that the Authority require a schematic plan demonstrating that stormwater run-off is capable of being discharged across the lot surface to the main drainage system or to an approved alternate connection.** The applicant's plans fail to demonstrate how on-site stormwater will be collected and discharged to City of Darwin's drainage network.

1). City of Darwin stormwater discharge guidelines do not allow concentrated discharge of stormwater from a single dwelling lot to adjoining properties or the road reserve. All stormwater is to be piped or dispersed via sheet flow to the road reserve.

d). **Site Construction**
City of Darwin requests that an Environmental and Construction Management Plan (ECMP) be required.
The ECMP should specifically address the following:

- waste management,
- traffic control,
- haulage routes,
- storm water drainage,
- use of City of Darwin land, and
- how this land will be managed during the construction phase;

to the satisfaction of City of Darwin.

Note: Sediment control measures are to be established and maintained, to prevent silt and sediment escaping the site or producing erosion.

Building rubbish or debris must not be placed, or be permitted to be placed, on any adjoining public reserve, footway, road or private land, without first obtaining a works approval from City of Darwin.

Should this application be approved, the following conditions pursuant to the *Planning Act* and City of Darwin's responsibilities under the *Local Government Act* are also recommended for inclusion in the development permit issued by the Development Consent Authority.

- Designs and specifications for landscaping of the road verges adjacent to the property shall be submitted for approval by City of Darwin and all approved works shall be constructed at the applicant's expense, to the requirements of City of Darwin.

- The location, design and specifications for proposed and affected crossovers shall be provided at the applicant's expense, to the satisfaction of City of Darwin.

- Kerb crossovers and driveways to the site shall be provided and disused crossovers removed, public footpath and cycleways shall be provided, stormwater shall be collected and discharged into City of Darwin's drainage network, and reinstatement works carried out, all of which is to be provided at

the applicant's expense and to the requirements and satisfaction of City of Darwin.

- All developments on/or adjacent to any easements on-site, in favour of City of Darwin shall be carried out to the requirements and satisfaction of City of Darwin.

- Waste bin storage and pick-up shall be provided in accordance with City of Darwin Policy Number 54 - Waste Management.

- Any proposed stormwater connections to City of Darwin stormwater system or proposed works on/over City of Darwin property shall be subject to separate application to City of Darwin and shall be carried out to the requirements and satisfaction of City of Darwin.

In considering this application, the Development Consent Authority is requested to take into account any implications of the *Disability Discrimination Act* (Cth) or the *Anti-Discrimination Act* (NT) with regard to access for the disabled.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

CINDY ROBSON
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3 July 2018 Reference: PA2018/0261 BS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 33 - Town of Nightcliff**
286 Casuarina Drive, Rapid Creek

Proposed Development: **Re-subdivision under the *Unit Title Scheme Act* for the purpose of reallocation of parking spaces**

Thank you for the development application referred to this office 25 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

No issues are raised for this Development application in relation to matters that fall within the responsibility of City of Darwin.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

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29 June 2018 Reference: PA2018/0240 BS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 6692 - Hundred of Bagot**
29 Fotiades Road, Berrimah

Proposed Development: **Illuminated sign**

Thank you for the development application referred to this office 14 June 2018, concerning the above.

The subject Lot 6692 - Hundred of Bagot, is located outside City of Darwin's municipal boundary and as a result, Council has no comments in relation to the above mentioned application.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

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MANAGER CITY PLANNING

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22 June 2018 Reference: PA2018/0238 :hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 8641 - Town of Darwin**
4 Steele Street, Winnellie

Proposed Development: **Part change of use from warehouse to place of worship and a caretaker's residence exceeding 50m²**

Thank you for the development application referred to this office 7 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

The following issues are raised for consideration by the Authority:

i). **City of Darwin does not object the granting of a development permit provided the following issue is addressed:**

a). A site inspection has indicated that access to proposed car parks numbered 5-10 on sheet 1/4 dated 30 May 2018 would be limited given that a gate and an existing building restricts access to both areas. In the event that a Development Permit is issued there should be a requirement to ensure that the proposed car parks are made available for the intended uses.

Should this application be approved, the following conditions pursuant to the *Planning Act* and City of Darwin's responsibilities under the *Local Government Act* are also recommended for inclusion in the development permit issued by the Development Consent Authority.

- Sight lines shall be provided at crossovers to public streets, to the satisfaction of, City of Darwin. No fence or tree exceeding 0.6 metres in height shall be planted in front of the sight line.

- Any gate over an access to a public road shall be placed on the subject site at least 4.5 metres from the face of the kerb line of the adjoining public road.

- Car parking spaces and internal driveways shall meet the requirements of the relevant Australian Standard and be line-marked and sealed with an impervious material.

- The total number of required disabled car parking bays shall be met on site.

- Waste bin storage and pick-up shall be provided in accordance with City of Darwin Policy Number 54 - Waste Management.

- Any proposed signage for the site shall be subject to a separate assessment in accordance with City of Darwin Policy Number 42 – Outdoor Advertising Signs Code.

- Any proposed works on/over City of Darwin property shall be subject to separate application to City of Darwin and shall be carried out to the requirements and satisfaction of City of Darwin.

In considering this application, the Development Consent Authority is requested to take into account any implications of the *Disability Discrimination Act* (Cth) or the *Anti-Discrimination Act* (NT) with regard to access for the disabled.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

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22 June 2018 Reference: PA2018/0230 NS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 728 - Town of Sanderson**
1 Enterprise Street, Anula

Proposed Development: **Independent unit with a reduced front setback**

Thank you for the development application referred to this office 7 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

The following issues are raised for consideration by the Authority:

i). **City of Darwin does not object to the granting of a development permit, provided the following is addressed:**

a). The NTPS requires a total of four car parking spaces to be provided onsite however the plans only indicate three car parking spaces. In the event that a Development Permit is issued, it is requested that the minimum car parking requirements be complied with. It is also noted that the proposed carports have not been included in the subject planning application, should planning approval be required it is requested that separate planning approval be sought.

ii). **City of Darwin requests that should a development permit be issued, that the following be provided as a condition precedent:**

a). **City of Darwin requests that the Authority require a schematic plan demonstrating all stormwater to be collected on the site and**

discharged underground to City of Darwin's stormwater drainage system. The applicant's plans fail to demonstrate how on-site stormwater will be collected and discharged underground to City of Darwin's drainage network.

1). The plan shall include details of site levels and City of Darwin's stormwater drain connection point/s. The plan shall also indicate how stormwater will be collected on the site and connected underground to City of Darwin's system.

2). City of Darwin requires a stormwater drainage plan to confirm that it is technically feasible to collect stormwater on the site and dispose of it into City of Darwin's stormwater drainage system. It is also necessary to ensure that no stormwater will sheet-flow into the road reserve or onto adjoining properties.

Should this application be approved, the following conditions pursuant to the *Planning Act* and City of Darwin's responsibilities under the *Local Government Act* are also recommended for inclusion in the development permit issued by the Development Consent Authority.

- Sight lines shall be provided at crossovers to public streets, to the satisfaction of, City of Darwin. No fence or tree exceeding 0.6 metres in height shall be planted in front of the sight line.

- Any gate over an access to a public road shall be placed on the subject site at least 4.5 metres from the face of the kerb line of the adjoining public road.

- All developments on/or adjacent to any easements on-site, in favour of City of Darwin shall be carried out to the requirements and satisfaction of City of Darwin.

- Waste bin storage and pick-up shall be provided in accordance with City of Darwin Policy Number 54 - Waste Management.

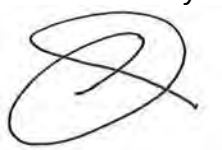
- Any proposed works on/over City of Darwin property shall be subject to separate application to City of Darwin and shall be carried out to the requirements and satisfaction of City of Darwin.

- Any proposed stormwater connections to City of Darwin stormwater system or proposed works on/over City of Darwin property shall be subject to separate application to City of Darwin and shall be carried out to the requirements and satisfaction of City of Darwin.

In considering this application, the Development Consent Authority is requested to take into account any implications of the *Disability Discrimination Act* (Cth) or the *Anti-Discrimination Act* (NT) with regard to access for the disabled.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully



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29 June 2018 Reference: PA2018/0158 NS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 2365 - Town of Darwin**
38 Cavenagh Street, Darwin City

Proposed Development: **Re-exhibition of amended application. Office and ground level commercial tenancies in a 10 storey building plus 2 levels of basement car parking**

Thank you for the development application referred to this office 14 June 2018, concerning the above. This letter may be placed before City of Darwin's Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

Please note that the below commentary is in relation to relevant points of the subject amendment, refer to City of Darwin's letter dated 15 May 2018 for Council's conditions and commentary beyond the subject amendment. Council's previous request for deferral in relation to traffic matters, remains and the City of Darwin and the applicant are progressing the matter.

a). Car parking

As a result of the amendment there is an increase in net floor area for the commercial and office tenancies to 12,998m^2 (using the GFA calculations on Drawing No. PL-1-65-01 dated 08/06/18 revision B). The Parking Requirements of Clause 6.5.1 of the Northern Territory Planning Scheme require a total of 389.98 (390) car parks whilst 62 car parks have been provided it results in a car parking shortfall of 327.98 (328) car parks which exceeds the 320 public car parks proposed by PA2018/0159 (12 and 14 Litchfield Street).

As per previous conversations with the applicant and Development Assessment Services, Council resolved at their meeting held on 29 May 2018 the following:

DECISION NO.22\0806

E. THAT Council, pursuant to Section 10(2) of the Local Government (Darwin Parking Local Rates) Regulations, hereby resolve to reduce the local rates payable in respect of any car parking shortfall at 38 Cavenagh Street, Darwin City, and 18 Cavenagh Street, Darwin City, as a result of offset car parking being provided at 12 & 14 Litchfield Street, Darwin City and that Council pursuant to Section 32 (2) of the Local Government Act, hereby delegates to the Chief Executive Officer, the power to determine the final quantity of the car parking shortfall, and the power to finalise the design and all other matters in accordance with Report Number 18CF0035 NS:hd entitled PA2018/0158 Lot 2365 (38) Cavenagh Street, Darwin City & PA2018/0159 Lots 2396 & 2397 (12 & 14) Litchfield Street, Darwin City.

The final quantity of the car parking shortfall payment, subject to the *Local Government (Darwin Parking Local Rates) Regulations,* will be determined following a decision on the subject development application and the car parking proposed by PA2018/0159, should development permits be granted.

b). Awnings

City of Darwin acknowledges the greater functionality of the amended awning as a result of the reduced height and setbacks. As previously mentioned, City of Darwin will still need to understand how the awning will interact with Council infrastructure, which can be dealt with via a condition precedent if a development permit is issued.

Council's position in relation to full length awnings remains (i.e. continuation to the stairwells in Cavenagh Street and Litchfield Street facades). Awnings provide shade and weather protection and promote pedestrian movements adjacent what is an important intersection within the city centre.

c). Street trees

It is noted that the amended plans indicate that the existing street tree on the corner of Knuckey Street and Cavenagh Street is to be removed and replaced with an alternate tree. Council does not object to the removal of the existing tree provided that the species, tree-planting pit and irrigation are to the satisfaction of City of Darwin.

d). Volumetric controls

The principles of Council's commentary previously raised remain, in particular the impacts to the adjoining site to the north-western boundary due to the zero metre setback to an overall height in excess of 40.44 metres above ground level.

However, if a development permit is approved; Council encourages and supports a mural to that façade. Whilst the applicant has identified that a design is to be put out for a competitive process, it is requested that a condition be included to ensure that such artwork occurs.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

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MANAGER CITY PLANNING

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26 June 2018 Reference: PA2018/0205 BS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 10448 - Town of Darwin**
8 Green Street, Fannie Bay

Proposed Development: **Alterations and additions to an existing single dwelling with a reduced side setback**

Thank you for the development application referred to this office 15 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

The following issues are raised for consideration by the Authority:

i). **City of Darwin supports the granting of a development permit provided the following issues are adequately addressed:**

a). City of Darwin does not support the two proposed driveways for this development, which combined, total 11.45 metres in width. City of Darwin will permit a single driveway, which complies with City of Darwin requirements.

b). Works are currently being undertaken within these premises. Landscaping of the verge has been damaged, as it is currently being used as a storage area. Works undertaken in the nature strip have occurred without obtaining a works permit or City of Darwin approval.

City of Darwin requests that the Authority require a detailed landscaping plan for the nature strip, which is to be provided to the satisfaction of City of Darwin and at no cost to Council.

c). It has been noted that damage to City of Darwin infrastructure has occurred to the kerb during these works. All damaged City of Darwin City infrastructure is to be replaced to City of Darwin standards, at the cost of the developer.

ii). **City of Darwin requests that should a development permit be issued, that the following be provided as a condition precedent:**

a). **A dilapidation report covering infrastructure within the road reserve to the satisfaction of City of Darwin at no cost to Council.**

b). **City of Darwin requests that the Authority request an amended plan demonstrating access to the site meeting City of Darwin requirements.**

c). **City of Darwin requests that the Authority require a schematic plan demonstrating that stormwater run-off is capable of being discharged across the lot surface to the main drainage system or to an approved alternate connection.** The applicant's plans fail to demonstrate how on-site stormwater will be collected and discharged to City of Darwin's drainage network.

1). City of Darwin stormwater discharge guidelines do not allow concentrated discharge of stormwater from a single dwelling lot to adjoining properties or the road reserve. All stormwater is to be piped or dispersed via sheet flow to the road reserve.

d). **Site Construction**
City of Darwin requests that an Environmental and Construction Management Plan (ECMP) be required.
The ECMP should specifically address the following:

- waste management,
- traffic control,
- haulage routes,
- storm water drainage,
- use of City of Darwin land, and
- how this land will be managed during the construction phase;

to the satisfaction of City of Darwin.

Note: Sediment control measures are to be established and maintained, to prevent silt and sediment escaping the site or producing erosion.

Building rubbish or debris must not be placed, or be permitted to be placed, on any adjoining public reserve, footway, road or private land, without first obtaining a works approval from City of Darwin.

Should this application be approved, the following conditions pursuant to the *Planning Act* and City of Darwin's responsibilities under the *Local Government Act* are also recommended for inclusion in the development permit issued by the Development Consent Authority.

- Designs and specifications for landscaping of the road verges adjacent to the property shall be submitted for approval by City of Darwin and all approved works shall be constructed at the applicant's expense, to the requirements of City of Darwin.

- The location, design and specifications for proposed and affected crossovers shall be provided at the applicant's expense, to the satisfaction of City of Darwin.

- Kerb crossovers and driveways to the site shall be provided and disused crossovers removed, public footpath and cycleways shall be provided, stormwater shall be collected and discharged into City of Darwin's drainage network, and reinstatement works carried out, all of which is to be provided at the applicant's expense and to the requirements and satisfaction of City of Darwin.

- Sight lines shall be provided at crossovers to public streets, to the satisfaction of, City of Darwin. No fence or tree exceeding 0.6 metres in height shall be planted in front of the sight line.

- All developments on/or adjacent to any easements on-site, in favour of City of Darwin shall be carried out to the requirements and satisfaction of City of Darwin.

- Waste bin storage and pick-up shall be provided in accordance with City of Darwin Policy Number 54 - Waste Management.

- Any proposed stormwater connections to City of Darwin stormwater system or proposed works on/over City of Darwin property shall be subject to separate application to City of Darwin and shall be carried out to the requirements and satisfaction of City of Darwin.

In considering this application, the Development Consent Authority is requested to take into account any implications of the *Disability Discrimination Act* (Cth) or the *Anti-Discrimination Act* (NT) with regard to access for the disabled.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

CINDY ROBSON
MANAGER CITY PLANNING

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29 June 2018 Reference: PA2018/0098 BS:hd

Ms Dawn Parkes
Manager Urban Planning
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Dear Ms Parkes

Parcel Description: **Lot 5390 - Town of Darwin**
27 Lambell Terrace, Larrakeyah

Proposed Development: **Independent unit with a floor area in excess of 50m²**

Thank you for the Development Application referred to this office 14 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

The following issues are raised for consideration by the Authority:

i). **City of Darwin does not object to the granting of a development permit**

ii). **City of Darwin requests that should a development permit be issued, that the following be provided as a condition precedent:**

a). **City of Darwin requests that the Authority require a schematic plan demonstrating that stormwater run-off is capable of being discharged across the lot surface to the main drainage system or to an approved alternate connection.** The applicant's plans fail to demonstrate how on-site stormwater will be collected and discharged to City of Darwin's drainage network.

1). City of Darwin stormwater discharge guidelines do not allow concentrated discharge of stormwater from a single dwelling lot

to adjoining properties or the road reserve. All stormwater is to be piped or dispersed via sheet flow to the road reserve.

Should this application be approved, the following conditions pursuant to the *Planning Act* and City of Darwin's responsibilities under the *Local Government Act* are also recommended for inclusion in the development permit issued by the Development Consent Authority.

- All developments on/or adjacent to any easements on-site, in favour of City of Darwin shall be carried out to the requirements and satisfaction of City of Darwin.

- Any proposed stormwater connections to City of Darwin stormwater system or proposed works on/over City of Darwin property shall be subject to separate application to City of Darwin and shall be carried out to the requirements and satisfaction of City of Darwin.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

CINDY ROBSON
MANAGER CITY PLANNING

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2 July 2018

Please quote: 428253 NS:hd

Ms Suzanne Philip
Chairman
Development Consent Authority
GPO BOX 1680
DARWIN NT 0801

Dear Ms Philip

Annual Adjustment to CB Zone Car Parking Contribution Rate

In accordance with section *5.2 Adjustment of Contributions* of the *Central Business District Parking Strategy and Contribution Plan*, adopted by Council on 23 February 2010, the contribution rate payable per car parking bay shortfall in the Darwin Central Business Zone, has decreased from $23,262 to $22,994.

The contribution adjustment reflects a decrease in the Darwin Central Business Zone land value of 3.0% and a minimal increase of 0.7% in construction costs in Darwin from 1 July 2017 to 30 June 2018.

The revised contribution rate of $22,994 per car parking bay shortfall applies from 1 July 2018.

Yours sincerely

THE HON. KON VATSKALIS
LORD MAYOR

CITY OF DARWIN
ABN 11 503 313 301

Civic Centre Harry Chan Avenue Darwin NT 0800
GPO Box 84 Darwin NT 0801
E darwin@darwin.nt.gov.au
P 08 8930 0300
F 08 8930 0311

2 July 2018

Please quote: 428253 NS:hd

Ms Ruth Palmer
NT Director
The Property Council of Australia NT Division
GPO BOX 2200
DARWIN NT 0801

Dear Ms Palmer

Annual Adjustment to CB Zone Car Parking Contribution Rate

In accordance with section *5.2 Adjustment of Contributions* of the *Central Business District Parking Strategy and Contribution Plan*, adopted by Council on 23 February 2010, the contribution rate payable per car parking bay shortfall in the Darwin Central Business Zone, has decreased from $23,262 to $22,994.

The contribution adjustment reflects a decrease in the Darwin Central Business Zone land value of 3.0% and a minimal increase of 0.7% in construction costs in Darwin from 1 July 2017 to 30 June 2018.

The revised contribution rate of $22,994 per car parking bay shortfall applies from 1 July 2018.

Yours sincerely

THE HON. KON VATSKALIS
LORD MAYOR

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28 June 2018 Reference: 3665646 CR:hd

Northern Territory Planning Commission
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Via email: planning.ntg@nt.gov.au

Dear Northern Territory Planning Commission

Altered proposal to include controls on the establishment and operation of Helicopter Landing Sites (HLS) in certain zones provisions to protect amenity and the use remaining ancillary to the single dwelling on a site.

Thank you for the proposed Planning Scheme Amendment referred to this office 1 June 2018, concerning the above. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

City of Darwin supports the altered proposed Planning Scheme Amendment, which includes alterations to the previously exhibited proposal, as requested by City of Darwin.

If you require any further discussion in relation to this application, please feel free to contact me on 8930 0528.

Yours faithfully

CINDY ROBSON
MANAGER CITY PLANNING

CITY OF DARWIN
ABN 11 503 313 301

Civic Centre Harry Chan Avenue Darwin NT 0800 GPO Box 84 Darwin NT 0801 P 08 8930 0300 E darwin@darwin.nt.gov.au F 08 8930 0311

29 June 2018 Please quote: 3825095 BS:hd

Mr Stuart Cook
Senior Project Officer
Department of Infrastructure, Planning & Logistics
GPO Box 1680
DARWIN NT 0801

Via email: stuart.cook@nt.gov.au

Dear Mr Cook

Parcel Description: **Part Section 4235, Administrative Section 6665 - Hundred of Bagot**
768 Tiger Brennan Drive, Hidden Valley &
5 Amy Johnson Avenue, Winnellie

Proposed Application: **Royal Agricultural Society of the Northern Territory - Occupation Licence for the purpose of car parking and show ground related activities for a five year period**

Thank you for the Occupation Licence application referred to this office 15 June 2018. This letter may be placed before City of Darwin's, Ordinary Council Meeting. Should this letter be varied or not endorsed by Council, you will be advised accordingly.

No issues are raised for this Occupation Licence application in relation to matters that fall within the responsibility of City of Darwin.

If you require any further discussion in relation to this application, please feel free to contact myself on 8930 0528, or email c.robson@darwin.nt.gov.au

Yours faithfully

CINDY ROBSON
MANAGER CITY PLANNING

16. INFORMATION ITEMS AND CORRESPONDENCE RECEIVED

16.1 Local Government Association of the NT - Nominations called for Executive Positions

(17/07/18) Common No. 375173

*The request from the Local Government Association of the NT is **Attachment A**.*

Alderman G J Haslett is the current Vice President - Municipals until the Annual General Meeting in November 2018.

Alderman S Cullen is the Executive Board Member - Municipal (City of Darwin appointed), until the Annual General Meeting in November 2018.

Possible positions that City of Darwin Elected Members can nominate for are:

- *President*
- *Vice President - Municipals*
- *Executive Board Member - Municipals*
- *Executive Board Member - all councils*

The Executive Board Member - Municipal (City of Darwin appointed) requires a nomination.

13 June 2018

Local Government Association of the Northern Territory

Email to: LGANT Executive
Mayors and Presidents
Council CEOs

Elections for the LGANT Executive are to be held on 9 November 2018 at the LGANT Annual General Meeting (AGM) being held at the City of Darwin.

Nominations are called for the eight LGANT Executive positions listed in Table 1 below.

TABLE 1
LGANT Executive Positions and Elections to be held (in descending order)

Position and order of elections	Number of positions available	Councils that can vote
1. **President**	One (1)	All councils
2. **Vice President – Shires and Regionals**	One (1)	Shire and regional councils only
3. **Vice President – Municipals**	One (1)	Municipal councils only
4. **Executive Board Members – Shires and Regionals**	Two or three (2 or 3)	Shire and regional councils only
5. **Executive Board Members – Municipals**	One or two (1 or 2)	Municipal councils only
6. **Executive Board Member**	One	All councils

There is also one appointed member from the City of Darwin which together with those listed in Table 1 above makes up the nine LGANT Executive positions.

Telephone (08) 8944 9688
Fax (08) 8941 2665
Website www.lgant.asn.au

21 Parap Road, Parap, NT, 0820
PO Box 2017, Parap, NT, 0820

Attached is the nomination form for the various positions.

Councils should bear in mind that if they submit more than one nomination for positions on the Executive that:

- only one candidate can be elected per council (this also includes the City of Darwin)
- once a candidate is elected from a council if there are other nominations submitted for further Executive positions then those nominations:
    - will lapse
    - will be withdrawn by having the names of candidates crossed out on ballot papers for remaining elections.

The election of the President has impact on municipal and shire and regional council Board positions (rows 4 & 5 above in Table 1) because:

- the number of positions left to contest for either type of council will depend on the outcome of the election of the President (who can be from either a municipal, shire or regional council)
- the City of Darwin appointed position further reduces the number available for municipal councils to contest.

Currently the Executive has four members from municipal councils and five members from regional and shire councils.

I would be grateful if you could have the matter considered at one of your upcoming council meetings. **Nominations are required to be with me by Tuesday 7 August 2018 along with a short biography so it can be included in the agenda papers for the AGM.** Members nominating are usually asked at the annual general meeting if they wish to say anything in support of their nominations.

The Northern Territory Electoral Commission will again be approached to do the counting of votes for the election.

Under LGANT's governance charter (policy) the President and one of the Vice Presidents become LGANT's representatives on the Australian Local Government Association Board. If the President is from a municipal council the Vice President has to be from a shire or regional council and vice versa.

Further information on this matter is available on the LGANT website which includes the LGANT Constitution – clauses 14-18 are relevant. If you have any other queries please contact me.

Yours sincerely

Tony Tapsell
Chief Executive Officer

17. REPORTS OF REPRESENTATIVES

18. QUESTIONS BY MEMBERS

19. GENERAL BUSINESS

20. DATE, TIME AND PLACE OF NEXT ORDINARY COUNCIL MEETING
Common No. 2695130

THAT the next Ordinary Meeting of Council be held on Tuesday, 31 July 2018, at 5:30pm (Open Section followed by the Confidential Section), Council Chambers, 1st Floor, Civic Centre, Harry Chan Avenue, Darwin.

21. CLOSURE OF MEETING TO THE PUBLIC
Common No. 2695131

THAT pursuant to Section 65 (2) of the Local Government Act and Regulation 8 of the Local Government (Administration) Regulations the meeting be closed to the public to consider the Confidential Items of the Agenda.

22. ADJOURNMENT OF MEETING AND MEDIA LIAISON