
APPENDIX **D**
ECOLOGICAL REPORT – SITE B



VDM
CONSULTING
EcOz

Ecological Assessment for Master Planning of Area B, part of Lot 5182 , Town of Darwin



CONSULTING

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Executive Summary

EcOz were contracted by PLANIT Consulting to perform an ecological assessment as part of their Masterplan preparations for two parts of Lot 5182 in the Town of Darwin which have been rezoned **S D37** with specific use requirements imposed upon them. This report investigates **Area B** of the newly created **S D37** zone.

The assessment consisted of:

- Brief desktop search of available data
- Field visit to groundtruth vegetation and land units
- Mapping

The subject site is a small patch of land that contains a small patch of remnant native vegetation that is highly impacted by weeds, traffic, rubbish, and fire. The Darwin Cycad (*Cycas armstrongii*) is listed as vulnerable under the TPWC Act is abundant within the site and efforts towards translocation of larger individuals is recommended (under permit from Parks and Wildlife NT).

There are three (3) main vegetation communities found onsite:

- Eucalypt Woodland
- Pandanus communities
- Introduced Species (and cleared areas)

The desktop searches and field visit highlighted a few constraints to the development proposal:

- Vulnerable species Armstrong Cycad *Cycas Armstrongii* will require a management plan and permit to translocate elsewhere
- Gamba Grass and Mission Grass infestation within the subject site which will require planning and management during the construction phase to ensure that the weed spread is prevented/minimised
- Land Use / Unit mapping suggests that much of the development site is moderately suitable for urban subdivision due to seasonal waterlogging
- The current route of a drainage channel adjoins the southern boundary of the site, and may require re-routing to prevent erosion.
- A Heritage search shows that there are at least two prescribed archeological places on Lot 5182, Town of Darwin, which Area B forms part of. Further investigations are required to determine if Area B contains any archeological points of interest, as well as a full AAPA search to ensure that no sacred sites would be impacted by the proposed development.
- Part of the site would be subject to inundation during 1/1000 storm surge
- Old 44 Gallon drums along the eastern boundary, that may be a legacy potential legacy issue (i.e. contamination).

In summary, based on a qualitative assessment, the ecological condition of the site is not in good condition as it is highly disturbed by weeds, rubbish, busy traffic, and general human impacts.

Contents

1	Introduction	6
2	Methodology	9
3	Details of Site Investigation	10
3.1	Proposed Land Use	10
3.2	Climate, Geology and Hydrology	10
3.3	Land Title	12
3.4	Land Use.....	15
3.5	Land Systems	15
3.6	Site Inspection	19
3.7	Threatened Species.....	24
3.8	Weed Species.....	25
3.9	Wastes Generated on Site.....	25
3.10	Current Practices	26
4	Conclusions and Recommendations	27

Tables

Table 1:	Leaseholders that may be impacted by the proposed development.....	12
Table 2:	Land Units of the proposed development site and surrounds.....	16
Table 3:	Remnant Vegetation Types on the Proposed Development Site.....	18
Table 4	Vegetation Types found at Area B Zone S D37, Lot 5182, Ludmilla.....	22
Table 5:	Threatened species that may be present in the region	24

Figures

Figure 1:	Proposed Development Location	7
Figure 2	Proposed Development Location	8
Figure 3:	Darwin Airport Mean Maximum and Minimum Temperatures (source BOM 2011)	10
Figure 4:	Darwin Airport Rainfall Statistics (source BOM 2011)	11
Figure 5:	Soil Types at the subject site.....	11
Figure 6:	Darwin Primary and Secondary Storm Surge Levels.....	11
Figure 7:	Acid Sulphate Soils and the subject site	12
Figure 8:	Land Tenure of the proposed development area and surrounds.....	13
Figure 9:	Part of Lot 5182, Ludmilla, Town of Darwin Survey Plan.....	14
Figure 10:	Land Use	15
Figure 11:	Darwin Land Systems	16

Figure 12: Land Units within and surrounding the proposed development area.....	17
Figure 13: Natural Vegetation Information System	18
Figure 14: Remnant Vegetation Types within and surrounding the proposed development area	19
Figure 17 Heat affected <i>Brachychiton</i> sp. leaf with new growth leaves, and recovering Armstrong Cycads .	20
Figure 15 Gamba Grass Dominated Area	20
Figure 16 Recent Fire Activity	20
Figure 18 Google Earth Imagery used for vegetation line work	21
Figure 19 Field Verified Vegetation	22
Figure 20 Cycads growing amongst dumped and buried barrels.....	25

Appendices

Appendix A – Appendix Title style	29
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1 Introduction

PLANIT Consultants Pty Ltd (PLANIT) are proposing development on two parts of Lot 5182, Ludmilla in the town of Darwin.

The subject sites have recently been rezoned from **RD – Restricted Development** to **S D37 - Specific Use Zone Darwin No. 37** via an amendment to the Northern Territory Planning Scheme. The amendment determination gives specific conditions as to the types of development that will be possible on the subject sites. Under the requirements of the Northern Territory Planning Scheme amendment, the developer must prepare a Masterplan for the subject sites before submitting a development application for them.

This Environmental Site Assessment has only assessed **Area B** of **S D37**, part of Lot 5182, as seen in **Figure 1** which shows the proposed development location. Area B can generally be developed in accordance with the provisions of zone **LI – Light Industry**, but with certain development types prohibited.


The purpose of this Environmental Site Assessment is to review the proposed development area through a desktop appraisal and site inspection to determine the potential level of environmental liability that may be attached to the site, and will aid the proponent in the preparation of a master plan.

Figure 2 shows the existing cadastre boundaries that will be impacted as part of the proposed development.



Proposed Development Location

Legend

 Bagot_Road_Lots

Meters

0 125 250 500

1:8,000 at A4

Client: PLANIT Consulting
Coordinate System: GDA 1994 MGA Zone 52
Author: K.Munson for EcOz
Name: S D37 Proposed Location
Date Saved: 11/07/2011 11:50:40 AM
Data Sourced: Google Earth, PLANIT, NatMap



Figure 1: Proposed Development Location

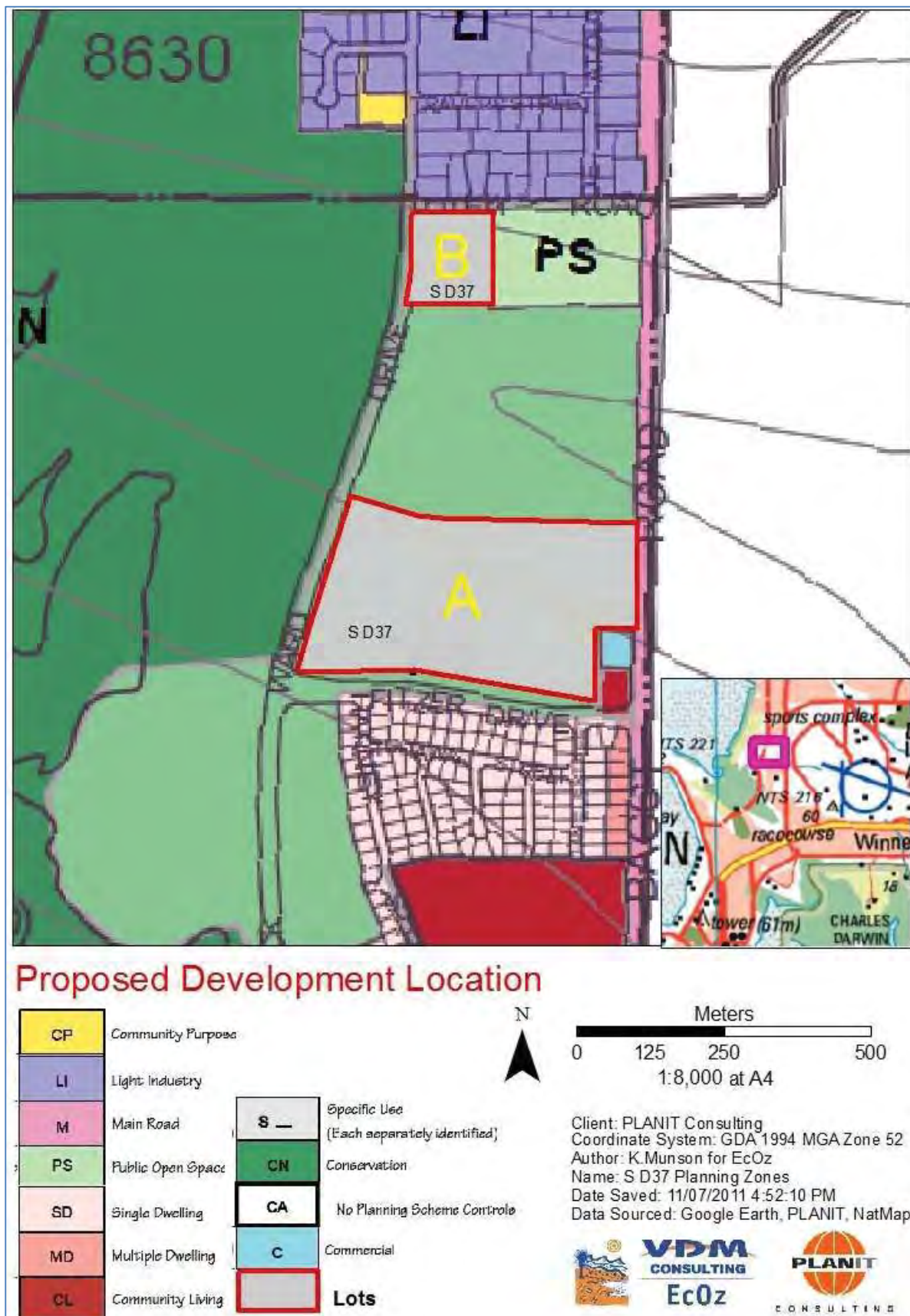


Figure 2 Proposed Development Location

2 Methodology

The scope of work for this report includes:

- Brief desktop searches of available data
- Field visit for groundtruthing vegetation and land units (one senior and one graduate)
- Report and mapping

This will aim to identify any existing, and potential constraints on redeveloping the subject site.

Items included in the desktop search include:

- Climate Details
- Soil Types
- Storm Surge
- Acid Sulphate & Potential Acid Sulphate soils
- Land Systems
- Land Units
- Vegetation Types
- Remnant Vegetation
- Heritage Register

Data searches of government maps and reports were studied for the project site and ground truthed during a site visit on the 14th July 2011 by two environmental scientists from EcOz. During the site visit, the proposed development site was inspected for visible signs of:

- Weeds
- Endangered Species
- Property conditions or activities which could potentially result in soil or groundwater contamination
- Waterlogging or seepage areas
- Existing vegetation type and condition

3 Details of Site Investigation

3.1 Proposed Land Use

Area B has recently been rezoned from **RD Restricted Development** to **S D37**. Area B can generally be developed in accordance with the provisions of zone **LI – Light Industry** with some conditions placed upon development. Before it can be developed, a Masterplan must be prepared detailing the development plan, how the developer plans to meet requirements placed upon Area B, and an assessment showing possible flora, fauna and cultural impacts of development upon the land.

3.2 Climate, Geology and Hydrology

The subject site area experiences a tropical savannah climate with a distinct Wet and Dry season. The Wet season brings monsoonal rain and during times of cyclones (including the lows before and after cyclones), the project area experiences significant rainfall events. These rainfall events can cause flooding which is determined by the volume, duration and spatial distribution of the rainfall. In contrast, the Dry season experiences negligible rain.

Most of the rain falls during the Wet season between November and April, while the Dry season from May to October brings negligible rainfall. Darwin falls within the Hot Humid zone, with a mean maximum temperature of 32°C and mean minimum temperature of 23.2°C (**Figure 3**). The mean rainfall for Darwin is 1715mm, with 93.5 days of rain, falling mainly within the wet season of November to April (**Figure 4**).

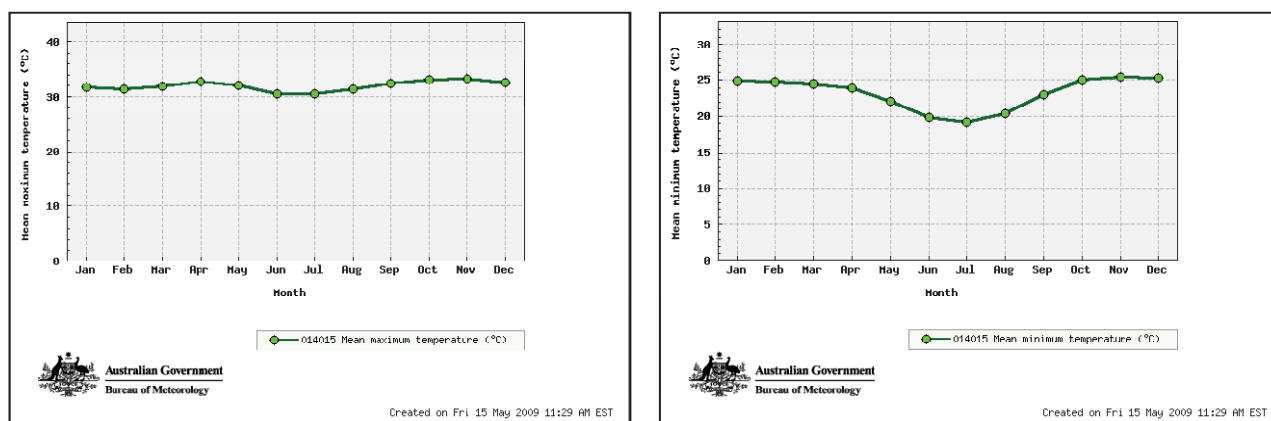


Figure 3: Darwin Airport Mean Maximum and Minimum Temperatures (source BOM 2011)

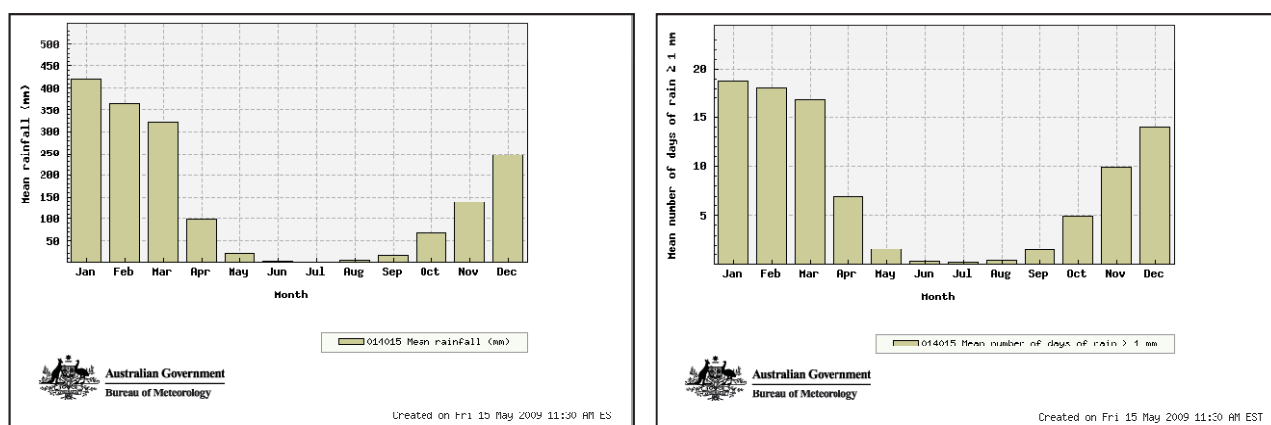


Figure 4: Darwin Airport Rainfall Statistics (source BOM 2011)

The CSIRO - Atlas of Australian Soils, NT Portion, while at a coarse scale, suggests that there is one soil type on the subject site (**Figure 5**). Kandosols lack strong texture contrast, have massive or only weakly structured B horizons, and are not calcareous throughout (Isbell, 2002).



Figure 5: Soil Types at the subject site

The proposed development site is around 1km from the high water mark of Beagle Gulf in the Arafura Sea, and is on a gentle slope (<2 %) from east to west. The North West corner of the site is subject to flooding due to storm surge. **Figure 6** shows that approximately 25% of the site could be affected by Secondary Darwin Storm Surge (one in one thousand year event).



Figure 6: Darwin Primary and Secondary Storm Surge Levels

3.2.1 Acid Sulphate Soils

The potential development site has not been assessed for acid sulphate or potential acid sulphate soils. It is classified under the heading of 'No Known Occurrence of Acid Sulphate Soils' in the ACID SULFATE SOILS – Darwin map (NRETAS, 2009).



Figure 7: Acid Sulphate Soils and the subject site

3.3 Land Title

A title search was conducted on the land parcels that may be impacted by the proposed development. The current leaseholder for both parcels of land is Gwala Daraniki Association Inc (**Table 1**). The NT Atlas (accessed 12/06/2011) also shows that the property has a Crown Lease Perpetual tenure type (**Figure 8**).

Table 1: Leaseholders that may be impacted by the proposed development

Lot	Leaseholder	Street Address	Tenure
5182, Ludmilla, Town of Darwin	Gwala Daraniki Association Inc	Dick Ward Drive, Ludmilla,	Crown Lease in Perpetuity 671

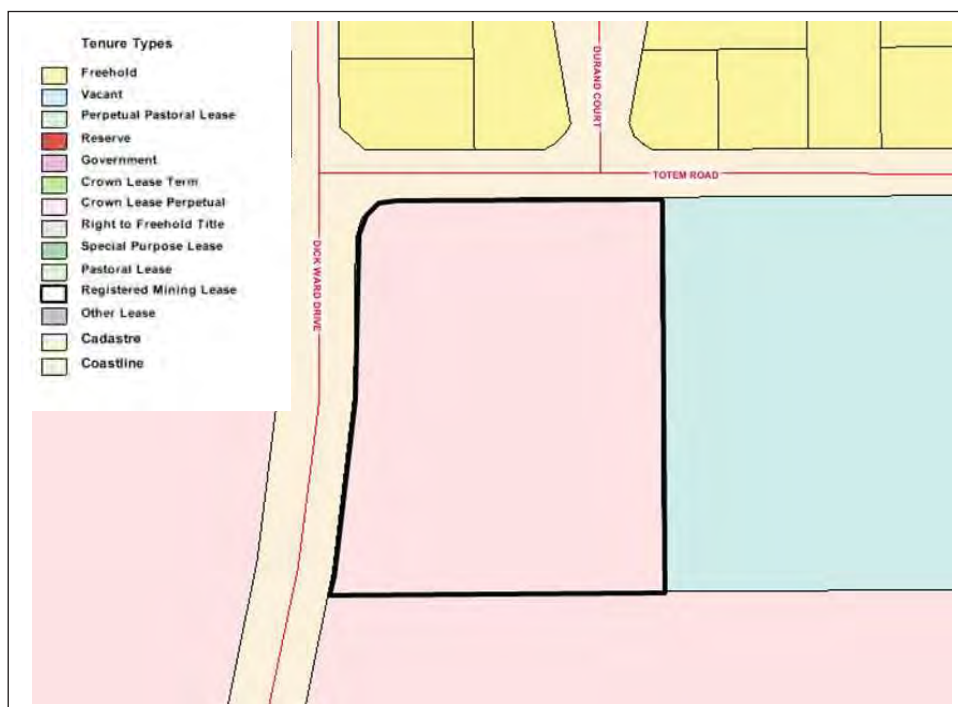


Figure 8: Land Tenure of the proposed development area and surrounds

3.3.1 Land Information

On the NT Darwin Area zoning map, the subject site is zoned **S D37 - Specific Use Zone Darwin No. 37**, (**Figure 2**). This has recently been rezoned via an amendment to the Northern Territory Planning Scheme. The amendment determination gives specific conditions as to the types of development that will be possible on the subject sites. Area B can generally be developed in accordance with the provisions of zone **LI – Light Industry**, but with certain development types prohibited.

The NT Atlas describes the subject site as part of parcel 5182 in Ludmilla suburb in the Town of Darwin in survey plan S77/93B. **Figure 9** shows one easement possibly affecting the subject site. There is a drainage easement in the south east corner of the site, which turns slightly south, away from the subject which may need to be considered when developing further plans for the site.

3.3.2 Heritage and AAPA searches

A search was performed with the Heritage Branch of NRETAS on Lot 5182 in Ludmilla, Town of Darwin. The Heritage Branch reported that there are no Declared Heritage Places within Lot 5182, but that there are two prescribed archaeological places in either Lot 5182, or nearby Lot 8630. The Heritage Branch also commented that there was the possibility of further burial sites within the boundary of the Lots.

Lots 5182 and 8630 incorporate large areas of land either side of Dick Ward Drive, and no further clarification as to the location of these sites was provided.

No Aboriginals Area Protection Authority (AAPA) search was performed on the site, but it is recommended that the proponent gains appropriate clearance before any development commences.

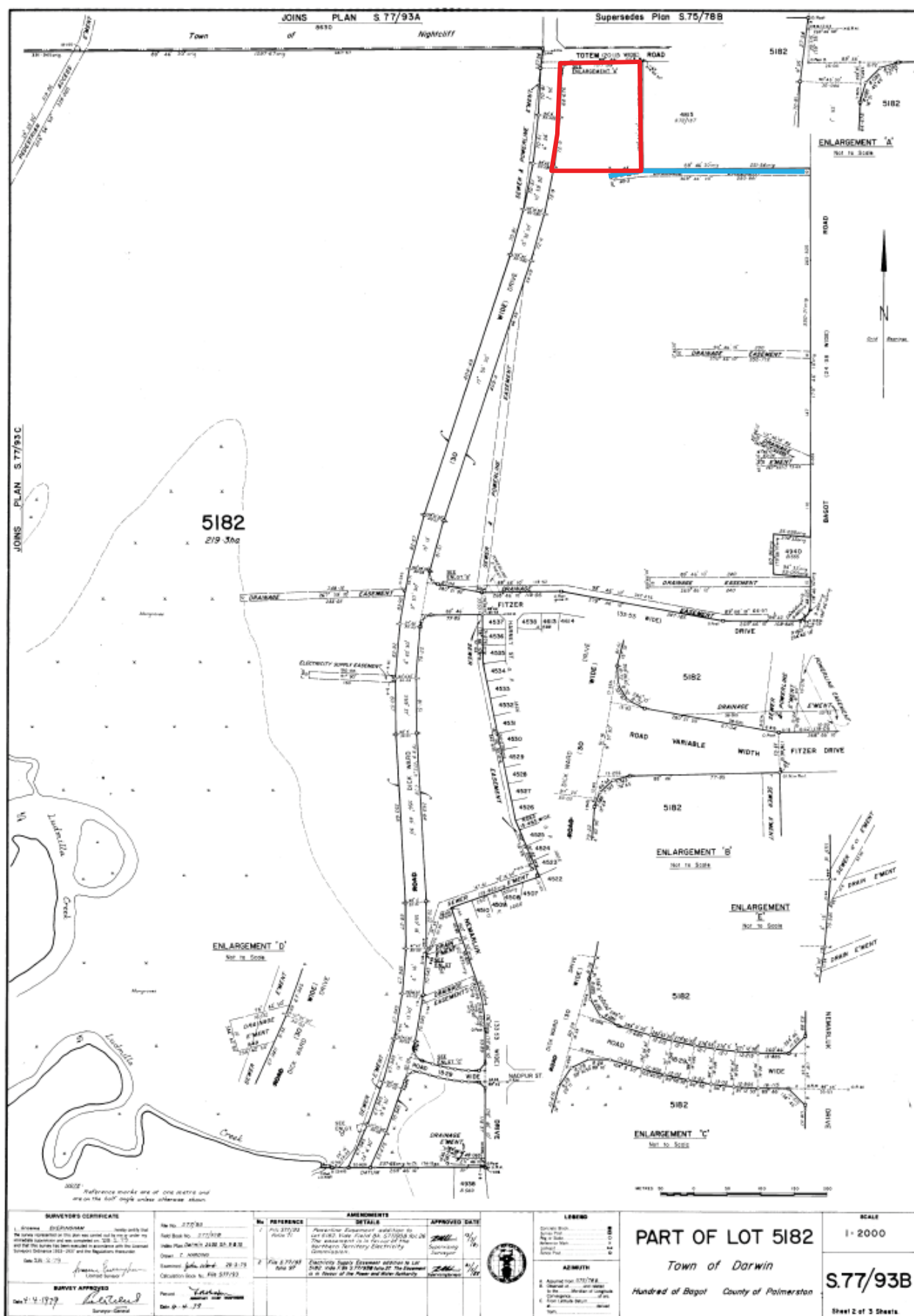


Figure 9: Part of Lot 5182, Ludmilla, Town of Darwin Survey Plan

3.4 Land Use

NRETAS uses Land Use mapping within their assessment process to help in determining:

- the suitability of land use
- environmental impacts
- agricultural productivity
- condition trends

The subject sites have both been designated as Conservation and Natural Environments land use type (**Figure 10**).

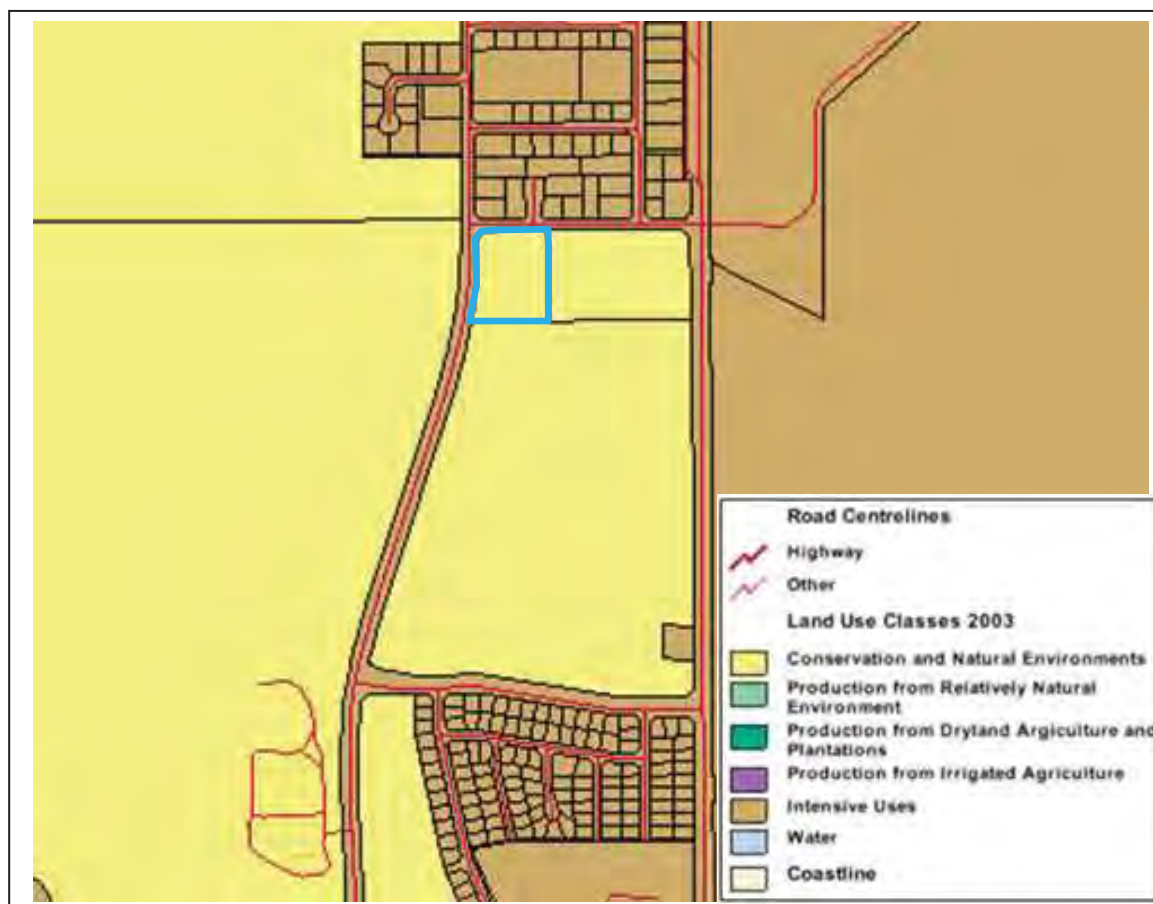


Figure 10: Land Use

3.5 Land Systems

Land Systems present broad scale information used for land management and identifying areas which require further investigation.

The Land System mapping of the Darwin Regional Area is quite coarse, and does not provide good detail for the subject site. The map suggests that the subject sites fall within the Koolinpayah Surface: Krans Land System type (**Figure 11**). This land system type is steep dissected terrain forming the edge of the key plateau, in places developed on lower Cretaceous sandstone and shale, and occasionally on underlying Lower Proterozoic sedimentary rocks; shallow lithosols and gravelly yellow massive earths with open forest of tall open forest vegetation types.

The Krans Land System type was given a rating of C2 in The Land Systems of the Darwin Region (Wood, Fogarty & Day, 1985) which means it has a moderate capability for urban subdivision with few limitations present.

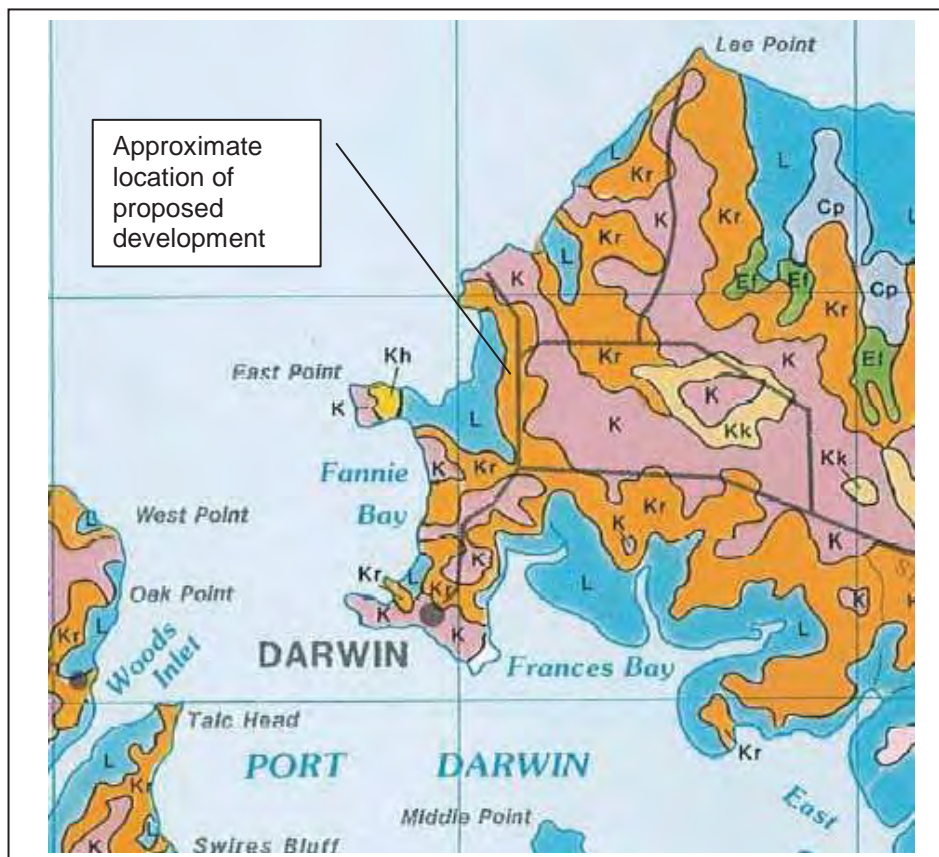


Figure 11: Darwin Land Systems

3.5.1 Land Units

According to NTG information maps, two land units occur within the proposed sub-division (**Figure 12**). Descriptions of these land units are provided in **Table 2** and reflect definitions provided by Fogarty *et al.* 1984, which was remapped by the NT Government in April 2007. Only slight adjustments to the land unit mapping were necessary, and these adjustments are likely due to this survey being of a finer scale.

Land Unit types 4c accounts for approximately 95% of the site, with the remainder being 2B1.

Table 2: Land Units of the proposed development site and surrounds

Land Unit	Heading	Description	Drainage / Waterlogging Potential	Land Capability Rating for subdivision
4c	Gently Undulating Lower Slopes	Gentle lower slopes; gradient 0.5-1.5%; deep mottled grey lateritic earths: Eucalypt Open Woodland, minor Woodland.	Slow drainage, wet season waterlogging, often dry season seepage	Low – moderate capability for urban subdivision with few limitations
2B1	Undulating Rises and Side Slopes	Gentle sideslopes; gradient 2-5%; moderately deep gravelly yellow massive earths, minor lithosols: Eucalypt Open Woodland to Woodland.	Well Drained	Moderately suited, limitations present.

Source Fogarty Lynch and Wood (1984)

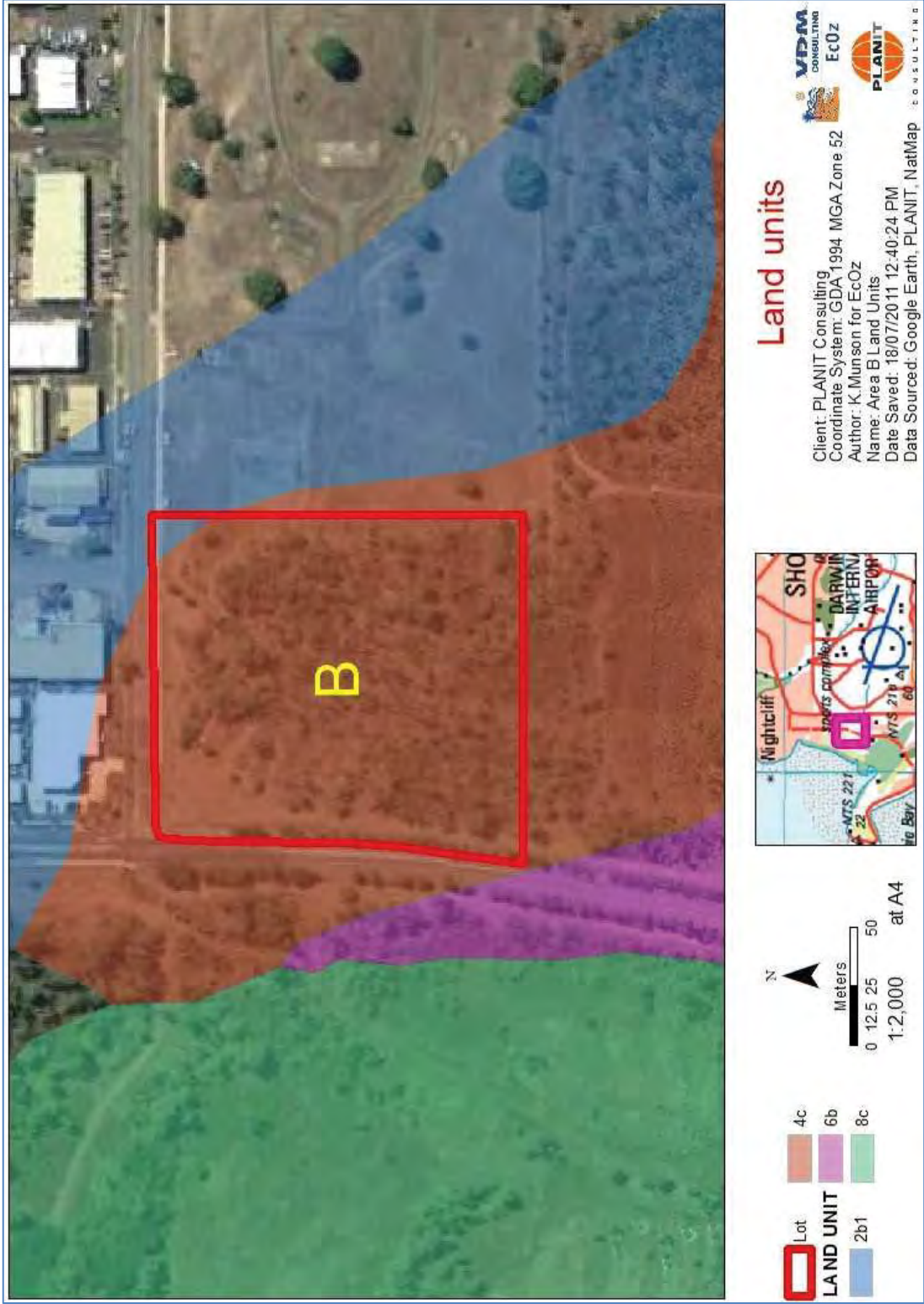


Figure 12: Land Units within and surrounding the proposed development area

3.5.2 Vegetation

The National Vegetation Information System (NVIS, 2005) is a broadscale system that provides information on the extent and distribution of vegetation across Australia. As it is such a broadscale system, NVIS has limited value when looking at a small suburban allotment such as this; however, it does give some indication as to the general vegetation types to be found on a site.

For Area B, NVIS (**Figure 13**) classifies approximately 60% of the site as being Woodlands, with the remainder Infrastructure / Agriculture.

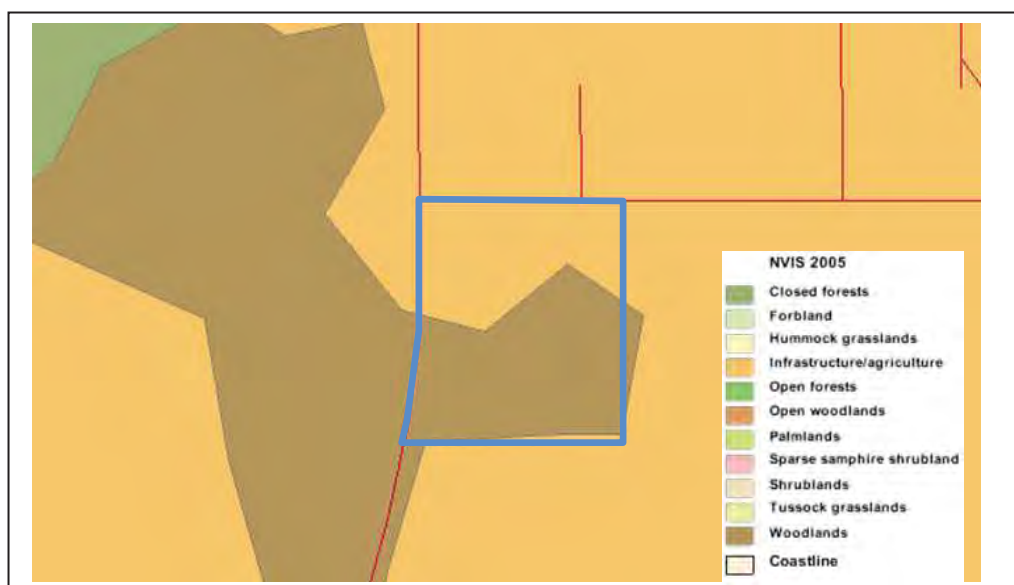


Figure 13: Natural Vegetation Information System

3.5.3 Remnant Vegetation

Remnant Vegetation mapping of the Darwin Municipality (Brock 1995) suggests there is one vegetation type on the subject site, with small areas of non-remnant, shown in **Figure 14** and described in **Table 3**.

Table 3: Remnant Vegetation Types on the Proposed Development Site

Remnant Veg type	Community	Description
15	Eucalypt communities	<i>Eucalyptus tetradonta</i> , <i>E. miniata</i> woodland with mixed species mid stratum and grassland understorey

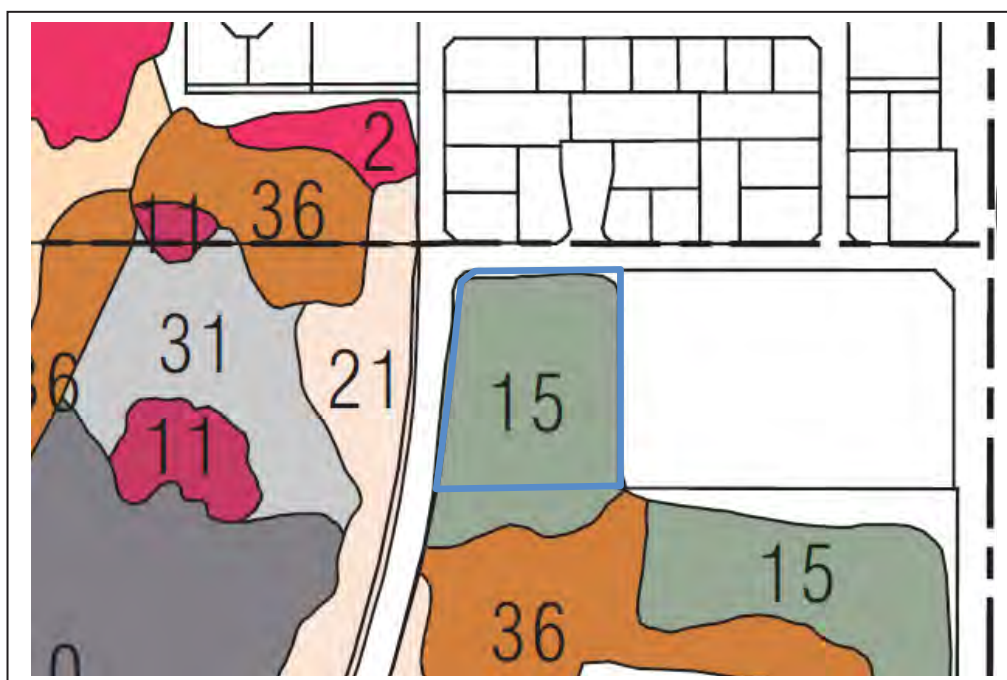


Figure 14: Remnant Vegetation Types within and surrounding the proposed development area

3.6 Site Inspection

3.6.1 Site Description

The subject site was visited by EcOz Environmental Scientists on Thursday 14th July 2011.

The site is fenced on the North, West, and Eastern boundaries, but is currently accessible from the RD zoned land to the south. Sections of the land (near the eastern boundary) have been cleared to accommodate over head power lines. Area B is almost directly under the flight path into Darwin airport during the Dry Season, when the prevailing wind comes from the South East.

In some parts, particularly around the edges, the subject site is seriously degraded. Weeds, such as Gamba Grass (*Andropogon gayanus*), and Mission Grass (*Pennisetum polystachyon*), dominate the understory in disturbed areas and become the dominant species in areas which have been cleared. Other weeds such as Passion vine (*Passiflora foetida*) were also present, however a recent fire made identification of many species difficult.

The site has also been degraded by the dumping of dozens of metal barrels, with unknown contents (**Figure 20**). There were several piles of the barrels in the southwestern quadrant of the subject site. Many of the barrels had severely corroded, suggesting they had been there a long time. The contents of the barrels could not easily be determined as no labels could be seen. A lot of the barrels had so many rust holes that the contents have already have been released into the environment. Several soil piles were also dumped around the site.

A fire had recently been through the subject site. A lot of damage had been caused by the fire, with trees having burnt trunks, losing leaves, and grasses burnt to stubble (**Figure 15**). Many of the species were starting to recover from the fire, with new growth visible throughout the site (**Figure 16**). Because of the fire, soil cover estimates may vary from the norm, as there appeared to be greater leaf litter than usual for similar areas.



Figure 15 Gamba Grass Dominated Area



Figure 16 Recent Fire Activity



Figure 17 Heat affected *Brachychiton* sp. leaf with new growth leaves, and recovering Armstrong Cycads

The remnant vegetation map shows only one distinct vegetation community within the site (**Figure 14**), however EcOz identified three groups within the project area. A Google Earth image (**Figure 18**) was used to progress vegetation line work which was later ground-truthed in the field by two EcOz field ecologists. The site vegetation map is provided in **Figure 18**. **Table 4** shows photos and brief description of each vegetation type within the proposed development.



Figure 18 Google Earth Imagery used for vegetation line work

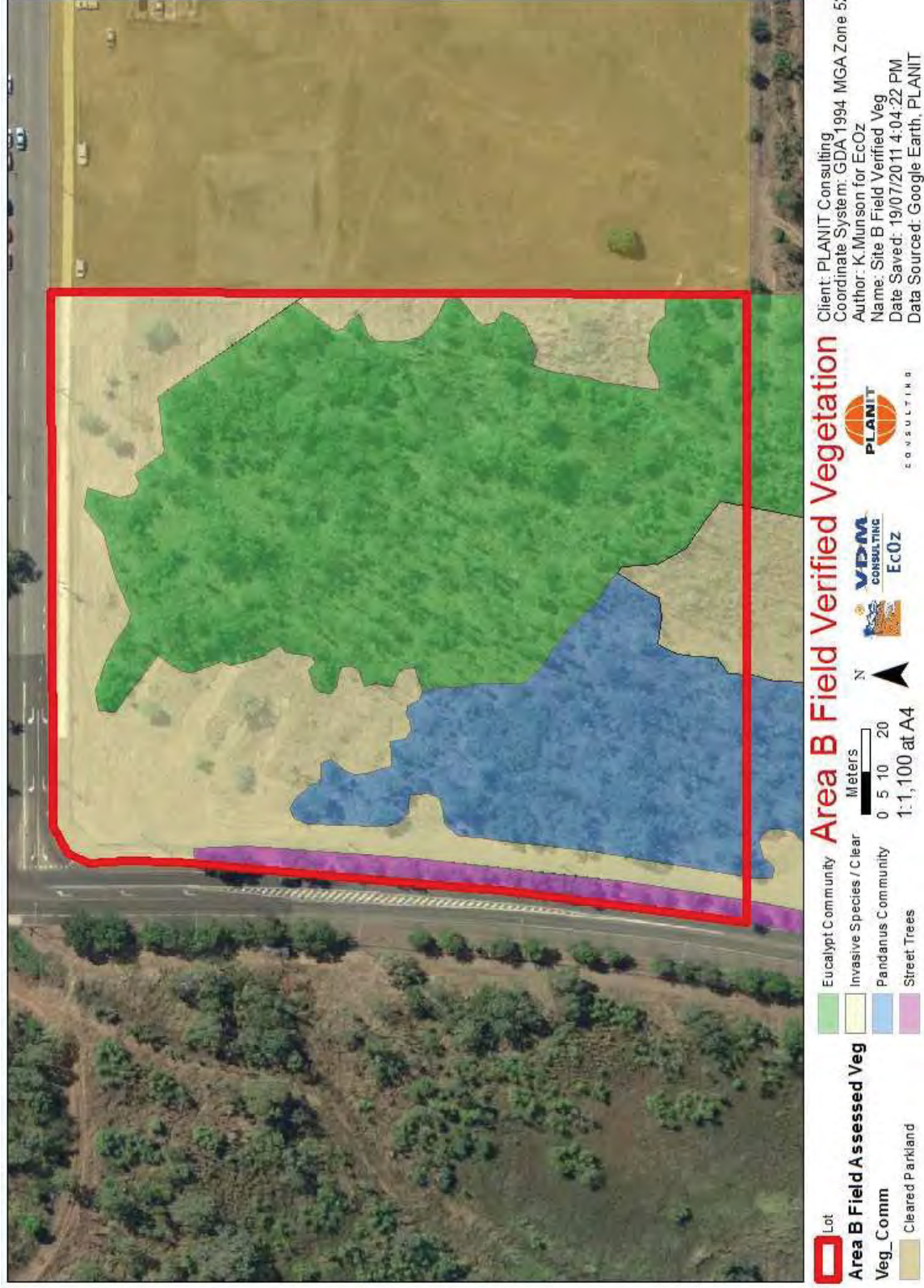


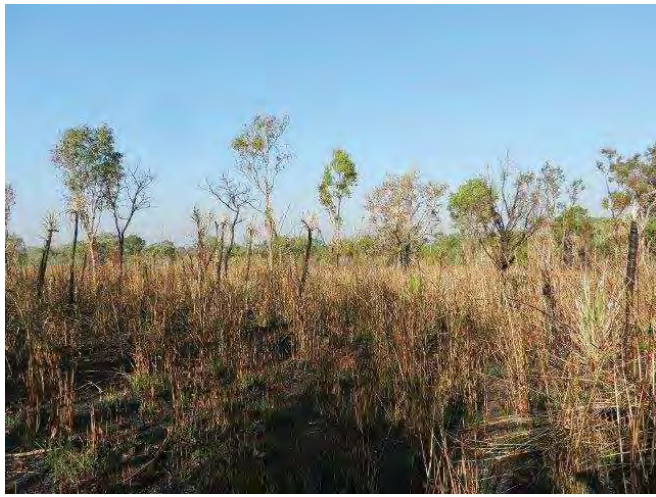


Figure 19 Field Verified Vegetation

Table 4 Vegetation Types found at Area B Zone S D37, Lot 5182, Ludmilla.

Community	Description	Photo
Mixed Eucalyptus Woodland	<p>Woodland to Open Woodland. Bloodwood (<i>Corymbia polycarpa</i>) were the dominant upper story species, with scattered Milkwood (<i>Alstonia actinophylla</i>), Darwin Woollybutt (<i>Eucalyptus miniata</i>), Stringybark (<i>E.tetradonta</i>), Northern Kurrajong (<i>Brachychiton diversifolius</i>).</p> <p>Midstory consisting of the Green Plum (<i>Buchanania obovata</i>), Armstrong's Cycad (<i>Cycas armstrongii</i>), <i>Pandanus spiralis</i>, Sandpaper Fig (<i>Ficus scobina</i>) and scattered <i>Acacia spp.</i> Gamba and missions grasses were the abundant ground level species (however this was mostly burnt at time of survey).</p>	
Pandanus Community	<p>Woodland. Located along the western boundary of the property. Upper storey of <i>Brachichyton diversifolius</i>, <i>Alstonia actinophylla</i>, <i>E. Corymbia polycarpa</i>, with midstory of <i>Pandanus spiralis</i>, <i>Persoonia falcata</i>, <i>E. tetradonta</i>, <i>Lophostomen lactifluuiss</i>, <i>Acacia auriculaformis</i> <i>Grewia sp.</i> & <i>Cycas armstrongii</i>. Gamba and missions grasses were the abundant ground level species.</p>	
Invasive species community	<p>Mainly Gamba Grass <i>Andropogon gayansus</i>, and Mission Grass (<i>Pennisetum polystachyon</i>).</p> <p>Area now burnt, and juvenile species difficult to identify</p>	

3.7 Threatened Species

It is highly unlikely that the proposed development will impact threatened species. An NT INFONET NRM Snapshot for the area around the subject site (**Appendix A**) shows 22 species that are classed as either Vulnerable or Endangered by the Northern Territory or Commonwealth Governments within the grid square that the subject site exists. Eight of those species are marine based species, and will therefore not occur on the site and have been omitted from our table (**Table 5**). The majority of these listed species are unlikely to reside or utilise existing habitat within the subject site due to different habitat requirements, and/or current disturbances within and adjacent to the vegetation communities.

At the subject site Armstrong's Cycad (*Cycas armstrongii*), listed as Vulnerable under the NT *TPWC Act*, was found in most of the habitats and is the only threatened species that will be impacted by the proposed development. Liddle (2009) states that there is concern about the sustainable management of NT cycads due to land clearance and fire regimes as they grow so slowly, and little is known about their ecology. Under the management plan (Liddle, 2009) cycads likely to be destroyed by legitimate development should be salvaged using a clearing permit. These cycads are currently under pressure from fire due to the abundance of Gamba Grass (*Andropogon gayanus*), and Mission Grass (*Pennisetum polystachyon*) at the development site. Approximately 300 individual cycads measured at over 100cm in height were counted within the subject area, along with several multi-stemmed specimens that would be sought after for landscaping purposes (some may sell up to \$1000 each).

The Darwin Coastal Bioregion Conservation Values and Environmental Resources map shows that two other vulnerable species, the Red Goshawk (*Erythroriorchis radiatus*) and the Northern Quoll (*Dasyurus hallucatus*) are known to exist in the vicinity of the subject site. The Northern Quoll's preferred habitat consists of rocky escarpment associated with open forest and/or open woodland, which is supported within the subject site. The Red Goshawk favours coastal and sub coastal tall open forests and woodlands and the edges of rainforest, which does not occur within the subject site. Northern Quolls and Red Goshawks have not been identified in the general areas for many years, despite intensive survey effort by local enthusiasts.

Table 5: Threatened species that may be present in the region

Group	Common Name	Scientific Name	NT Status	National Status
Cycads	Armstrong's Cycad	<i>Cycas armstrongii</i>	VU	.
Insects	Atlas Moth	<i>Attacus wardi</i>	EN	
Reptiles	Mertens' Water Monitor	<i>Varanus mertensi</i>	VU	
	Yellow-spotted Monitor	<i>Varanus panoptes</i>	VU	
Birds	Emu	<i>Dromaius novaehollandiae</i>	VU	
	Red Goshawk	<i>Erythroriorchis radiatus</i>	VU	VU
	Australian Bustard	<i>Ardeotis australis</i>	VU	
	Australian Painted Snipe	<i>Rostratula australis</i>	VU	VU
	Masked Owl	<i>Tyto novaehollandiae</i>	EN/VU	EN/VU
	Masked Owl (northern mainland)	<i>Tyto novaehollandiae kimberli</i>	VU	VU
	Gouldian Finch	<i>Erythrura gouldiae</i>	EN	EN
Mammals	Northern Quoll	<i>Dasyurus hallucatus</i>	CR	EN
	Northern Brush-tailed Phascogale	<i>Phascogale pirata</i>	VU	
	Bare-rumped Sheath-tailed Bat	<i>Saccolaimus saccolaimus</i>		CR

CR = Critically Endangered EN = Endangered VU = Vulnerable DD = Data deficient

3.8 Weed Species

A variety of weeds were identified throughout the property (**Figure 19**). These species are abundant along the boundaries of the property, as well as in areas which have been cleared of native vegetation. The site has been recently burnt, therefore many of the groundcover species could not be identified. The following weed species were identified on site (declared species in bold):

- **Gamba Grass (*Andropogon gayanus*)**
- **Perennial Mission Grass (*Pennisetum polystachion*)**
- Passion vine (*Passiflora foetida*)

The InfoNet search highlighted that 73 weed species have been recorded in the general region of the potential development site. These are listed in the NT NRM Snapshot (**Appendix A**).

Weed management will be required during the construction phase of the development, and as two declared weeds are abundant on the site a specific management plan is recommended. The Weeds Branch of the NTG should be involved in early planning stages to agree on vegetation removal techniques and an appropriate transport and disposal area. The top soil will be highly infested with weed seed, and it is best that this is kept onsite and buried. Gamba Grass and Mission Grass at the site have either seeded or been burnt, therefore chance of vegetation removal containing loose seed is low, however, if vegetation is chosen to be taken offsite we suggest covering the trucks to reduce chance of weed spread. Any cleared vegetation could be mulched onsite and used for future landscaping, or transported to an approved location. All vehicles and machinery that come into contact with vegetation and soil should be washed down prior to leaving the site to ensure that chance of weed spread is minimised.

3.9 Wastes Generated on Site

No waste is currently generated onsite. There are several dozens of rusted 44 gallon drums near the eastern boundary of the site. Many of the barrels are rusting away, and their contents could not easily be determined without proper testing. These barrels appear to have been there for quite some period of time and it appears that some may have been buried (**Figure 20**). The contents of the barrels should be investigated and (if required) safely removed before further development takes place.



Figure 20 Cycads growing amongst dumped and buried barrels

3.10 Current Practices

There is a drainage easement which connects with the south east corner of the site (**Figure 9**). Power lines run along the western and northern borders of the property, and area has been cleared around them for access. A pathway also extends across most of the northern boundary.

4 Conclusions and Recommendations

The subject site, on part of Lot 5182, Town of Darwin has recently been rezoned from **RD** to Area B of **S D37**. Area B can generally be considered to be zoned as **LI** – Light Industry with certain constraints placed upon it.

Soils

Water could be a constraint for the proposed development site. It is mapped as having Kandosols which can be waterlogged during the wet season. Approximately 25% of the site falls within the Secondary Darwin Storm Surge zone. The Land Use and Land Unit mapping suggest that the site has low to moderate suitability for urban subdivision with limitations due to drainage, a high seasonal water table, and a hard setting surface. In order to gain development approval the developer will need to be prepared to adopt appropriate engineering and drainage to make this area suitable for the proposed development for the above issues.

Vegetation

The proposed development site supports 3 distinct vegetation communities, all common within the local region. The proposed development site has been highly disturbed by weeds. There are sections where Gamba grass and mission grasses are the dominant species. In addition to this the other vegetation types have understories including a large proportion of weeds.

Weeds

A weed management plan should be incorporated into a Construction Environmental Management Plan prior as part of the development consent approvals. Weed management onsite (at minimum) should include the following commitments - no soils taken off-site, all cleared grasses and shrubs be piled and buried on-site to a depth of 1m. During the vegetation clearing operation all vehicles should be washed free of vegetation and soil matter. Any earth transported for use onsite should be weed-free

Threatened Species

Armstrong's cycad (*Cycas armstrongii*), which was found onsite, is listed as Threatened by the Northern Territory Government. The species is locally abundant, but recognised as vulnerable as its habitat coincides with much of the urban development occurring around the Darwin area. The NT government has produced a cycad management program to provide for the use of these cycads which would otherwise be destroyed through clearing associated with Development. A management plan for the removal of the specimens at the subject site will need to be created in order to receive a permit to move the cycads elsewhere. EcOz can help liaise with local sub-contractors and NT Parks and Wildlife staff to approve translocation of the cycads.

Other species are known to exist within the vicinity of the proposed development site; however none of these will be impacted by the proposed development.

Native title / AAPA / Heritage Search

A full AAPA search should be made to ensure that no sacred sites would be impacted by the proposed development. A Heritage search showed two prescribed archaeological places and the possibility of further burial places within the boundaries of Lot 5182. Whether these places are located in Area B is not clear, however further investigation should be made before further development commences as archaeological places and objects are protected under the *NT Heritage Conservation Act 1991*.

Drainage Channel

The drainage channel which connects to the southern boundary of the property may impact any development. The developer will need to consider the implications of appropriate engineering and drainage to re-route it, or ensure that erosion is not an issue.

Onsite Waste

In the past, the site has been used to dump dozens of metal barrels, as well as several soil piles. The contents of the barrels will require investigation to determine how they should be disposed of, and to determine the level of contamination that may have already occurred.

5 References

Brock. J. 1994-1995 *Remnant Vegetation of the Darwin Municipality*, Greening Australia (NT)

Bureau of Meteorology (BOM) 2011 *Climate statistics for Australian locations*, viewed 12/06/2011
http://www.bom.gov.au/climate/averages/tables/cw_014015.shtml

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

Isbell, R 2002 *The Australian Soil Classification: Revised Edition*. Australian Soil and Land Survey Handbooks, Series 4

Liddle, D.T. 2009. *Management Program for Cycads in the Northern Territory of Australia 2009-2014*. Northern Territory Department of Natural Resources, Environment, the Arts and Sport, Darwin. A management program prepared under the *Territory Parks and Wildlife Conservation Act*.

Wood B.G., Fogarty P.J. & Day K.J. 1985 *The Land Systems of the Darwin Region Technical Report Number 24*. Conservation Commission of the Northern Territory, Darwin N.T

Appendix A – NRM INFONET Snapshot

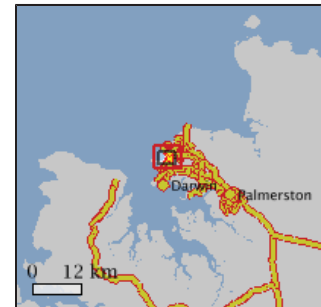
(provided as separate attachment)



Dick Ward Drive

Dick Ward Drive encompasses an area of 10.1 sq km extending from 12 deg 23.0 min to 12 deg 24.0 min S and 130 deg 50.0 min to 130 deg 52.0 min E.

Dick Ward Drive is located in the Darwin Coastal, bioregion(s)



Location of Dick Ward Drive



Dick Ward Drive Climate

The closest long-term weather station is DARWIN AIRPORT (12 deg 25.0 min S, 130.8925E) 5 km SE of the center of selected area

Statistics

Mean max temp (deg C)
Mean min temp (deg C)
Average rainfall (mm)
Average days of rain

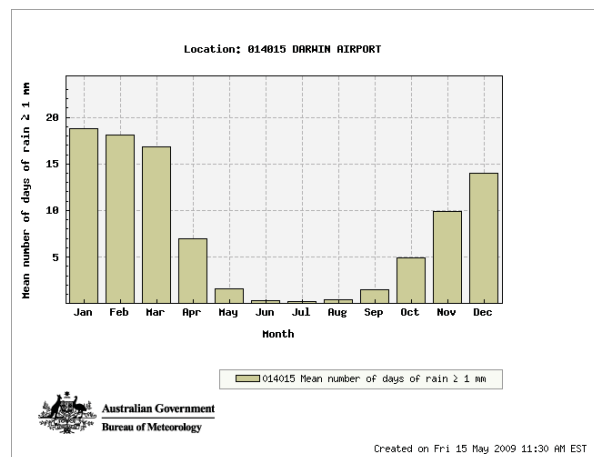
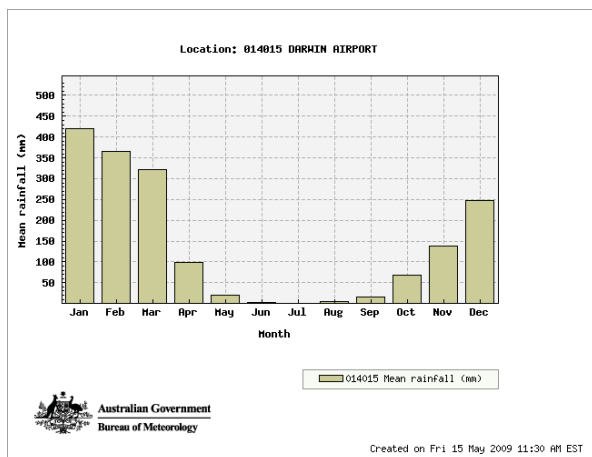
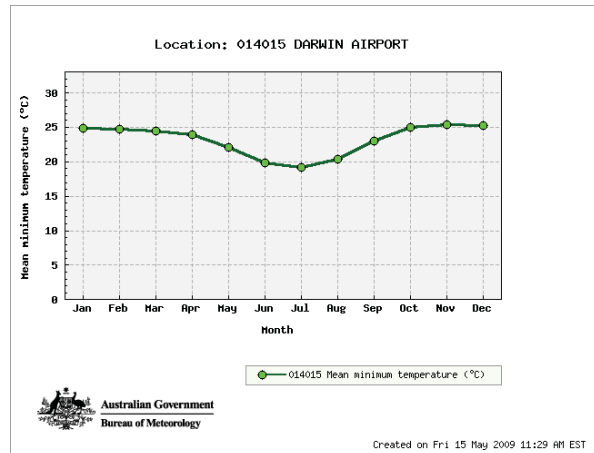
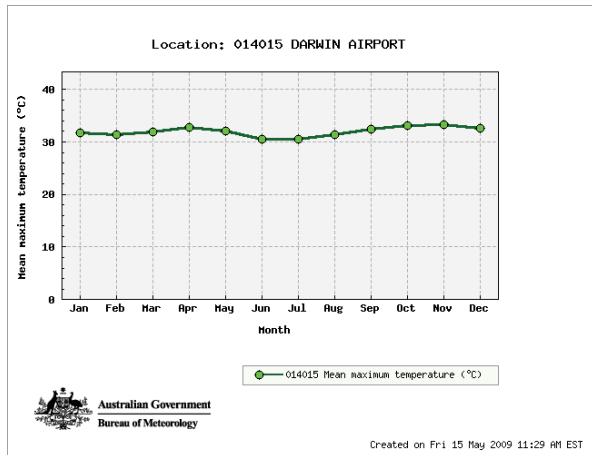
Annual Values

32.0
23.2
1715.0
93.5

Years of record

68
68
68
68

Climate summaries from Bureau of Meteorology (www.bom.gov.au)



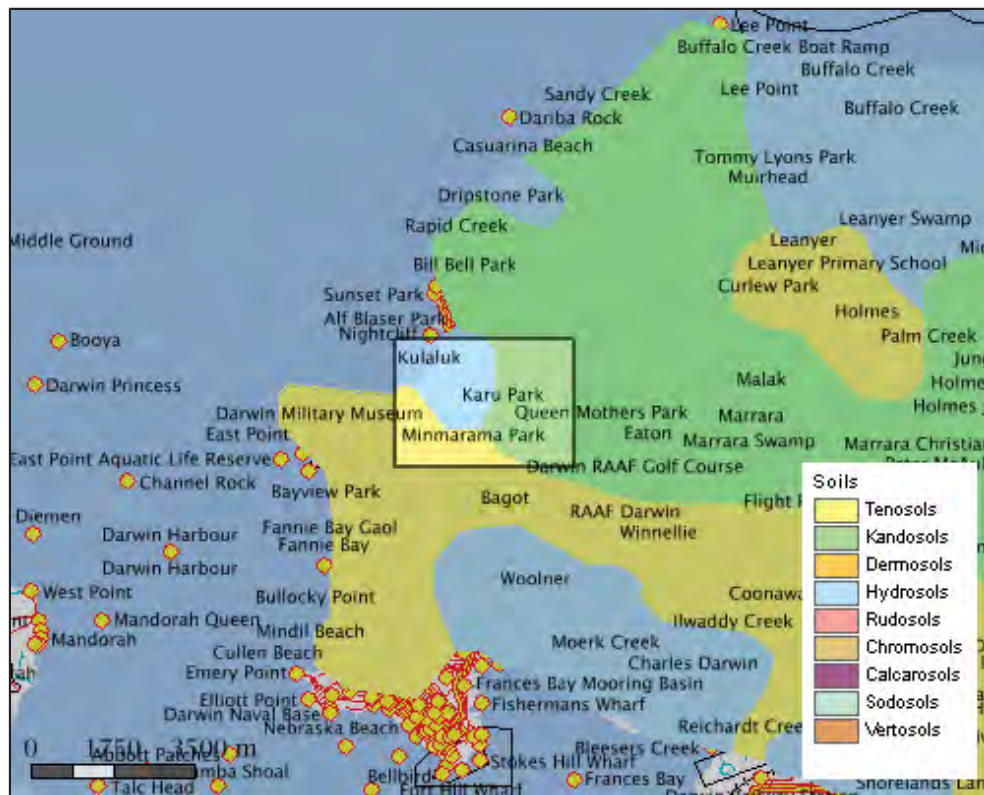
Dick Ward Drive Soils

Soil Types

Area of soil types (Northcote Factual Key)

Selected area is too small to produce reliable statistics

Soil Types



Soils 1:2M Layer is a copy of the NT portion (1:2,000,000 scale dataset) of the CSIRO Atlas of Australian Soils - K.H. Northcote et al. Data scale: 1:2,000,000 ANZLIC Identifier: 2DBC8771205D06B6E040CD9B0F274EFE
More details: Go to www.nt.gov.au/nreta/nretamaps/ and enter the ANZLIC identifier in the Spatial Data Search

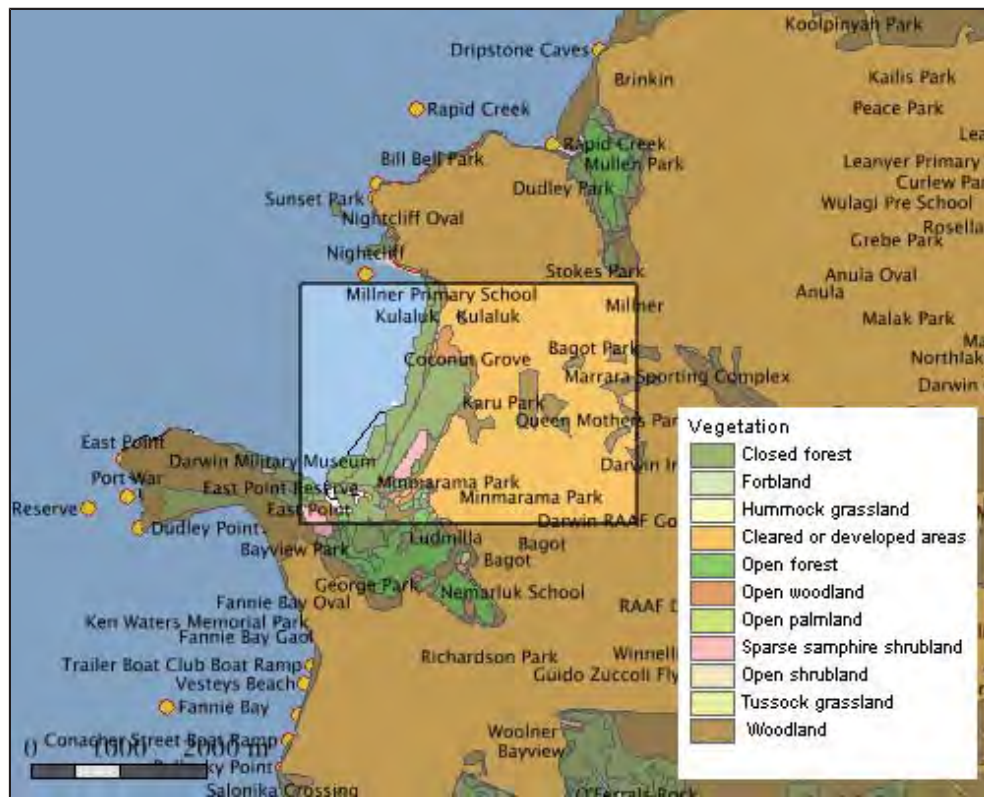
Dick Ward Drive Vegetation

Vegetation Communities

Area of vegetation communities

Selected area is too small to produce reliable statistics

Vegetation Communities



The NVIS 2005 Layer is compiled from a number of vegetation and land unit survey maps that were recoded and re-attributed for the National Vegetation Information System (NVIS)

Data scale variable depending on location. ANZLIC Identifier:2DBC771207006B6E040CD9B0F274EFE

More details: Go to www.nt.gov.au/nreta/nretamaps/ and enter the ANZLIC identifier in the Spatial Data Search

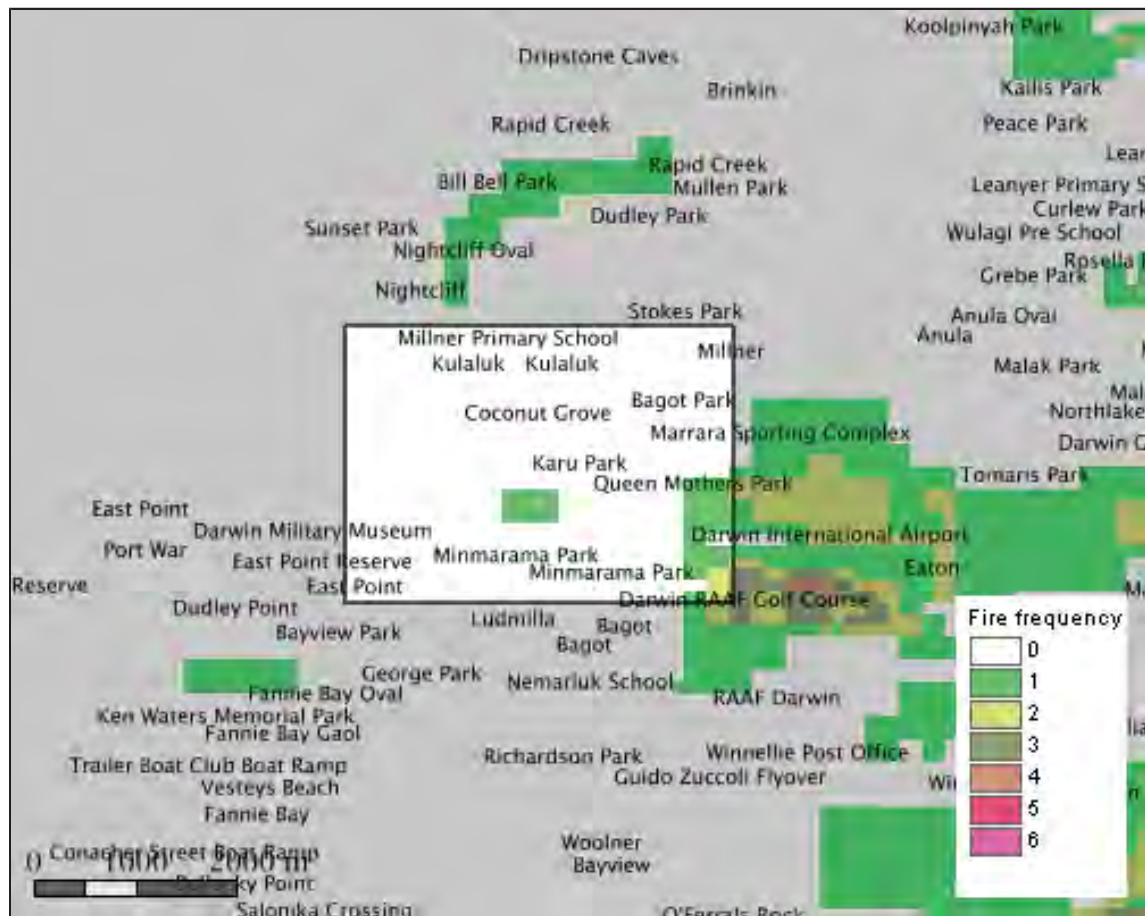
Dick Ward Drive Fire History

Years burnt 2004-2009

and area burnt in each category

Selected area is too small to produce reliable statistics

Years burnt 2004-2009



The fire frequency(250m) Layer is derived from satellite imagery sourced from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the NASA Terra satellite
Spatial Resolution: 250m x 250m pixels (at Nadir). Extent: NT to approx 19 Deg S only

Dick Ward Drive Threatened Species

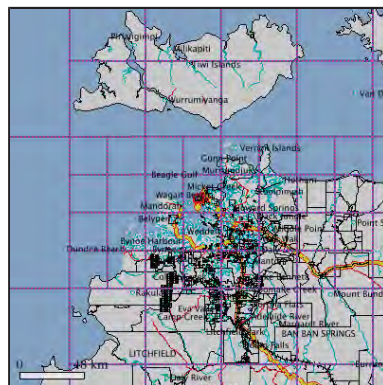
Threatened species recorded in the grid cell(s) in which Dick Ward Drive occurs

Group	Common Name	Scientific Name	NT Status	National Status	ID
Cycads	Armstrong`s Cycad	<i>Cycas armstrongii</i>	VU	.	351085
Insects	Atlas Moth	<i>Attacus wardi</i>	EN	.	183182
Fish	Dwarf Sawfish	<i>Pristis clavata</i>	VU	.	176943
Fish	Green Sawfish	<i>Pristis zijsron</i>	VU	VU	176965
Reptiles	Green Turtle	<i>Chelonia mydas</i>	.	VU	176291
Reptiles	Hawksbill Turtle	<i>Eretmochelys imbricata</i>	.	VU	176298
Reptiles	Olive Ridley	<i>Lepidochelys olivacea</i>	.	EN	176305
Reptiles	Flatback Turtle	<i>Natator depressus</i>	.	VU	176284
Reptiles	Mertens` Water Monitor	<i>Varanus mertensi</i>	VU	.	347295
Reptiles	Yellow-spotted Monitor	<i>Varanus panoptes</i>	VU	.	347307
Birds	Emu	<i>Dromaius novaehollandiae</i>	VU	.	176363
Birds	Red Goshawk	<i>Erythrorhynchus radiatus</i>	VU	VU	176391
Birds	Australian Bustard	<i>Ardeotis australis</i>	VU	.	176354
Birds	Australian Painted Snipe	<i>Rostratula australis</i>	VU	VU	246428
Birds	Masked Owl	<i>Tyto novaehollandiae</i>	EN/ VU	EN/VU	177895
Birds	Masked Owl (northern mainland)	<i>Tyto novaehollandiae kimberli</i>	VU	VU	594609
Birds	Gouldian Finch	<i>Erythrura gouldiae</i>	EN	EN	176370
Mammals	Northern Quoll	<i>Dasyurus hallucatus</i>	CR	EN	176443
Mammals	Northern Brush-tailed Phascogale	<i>Phascogale pirata</i>	VU	.	177965
Mammals	Bare-rumped Sheath-tailed Bat	<i>Saccolaimus saccolaimus</i>	.	CR	177111
Mammals	Blue Whale	<i>Balaenoptera musculus</i>	DD	EN	233883
Mammals	Humpback Whale	<i>Megaptera novaeangliae</i>	DD	VU	280686

EX = Extinct EW = Extinct in the Wild ER= Extinct in the NT EN = Endangered
 EN/VU = One Endangered subspecies/One Vulnerable subspecies
 VU=Vulnerable
 VU/- = One or more subspecies vulnerable EN/- = One or more subspecies endangered

More species info: Go to www.landmanager.org.au/view/index.aspx?id=####
 where #### is the ID number from the tables above for the species of interest.

Species listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Dick Ward Drive



Dick Ward Drive Weeds and Potential Weeds

Introduced plants recorded in the grid cell(s) in which Dick Ward Drive occurs and that have been identified as problem weeds in one or more locations in northern Australia. Occurrence based on Department of Natural Resources, Environment and The Arts databases.

Common Name	Scientific Name	NT Status	National Status	Other Status	ID
African Mahogany	<i>Khaya senegalensis</i>	.	.	C&E	361295
African Tulip Tree	<i>Spathodea campanulata</i>	.	.	Q3 WeedsAus	292854
American Rat's Tail Grass	<i>Sporobolus jacquemontii</i>	.	.	Q2 G&M	292904
Awnless Barnyard Grass	<i>Echinochloa colona</i>	.	.	DEU	290114
Barleria	<i>Barleria prionitis</i>	A C	ALERT	MP K2 C&E G&M	288734
Bellyache Bush	<i>Jatropha gossypifolia</i>	B C	.	K2 WA1 WA4 Q2 C&E G&M CYP DEU	113957
Bitter Broom	<i>Scoparia dulcis</i>	.	.	DEU	292424
Blue Trumpet Vine	<i>Thunbergia grandiflora</i>	.	.	Q2 C&E CYP	293124
Branched Porterweed	<i>Stachytarpheta australis</i>	B C	.	.	361505
Calopo	<i>Calopogonium mucunoides</i>	.	.	MP C&E CYP	288904
Caltrop	<i>Tribulus terrestris</i>	B C	.	CYP SA	361555
Candle Bush	<i>Senna alata</i>	B C	.	WA1 WA2	292444
Caribbean Stylo	<i>Stylosanthes hamata</i>	.	.	DEU	292974
Cayenne Snakeweed	<i>Stachytarpheta cayennensis</i>	B C	.	NSW	292924
Centro	<i>Centrosema molle</i>	.	.	MP	289184
Cinderella Weed	<i>Synedrella nodiflora</i>	.	.	C&E	293024
Clustering Fishtail Palm	<i>Caryota mitis</i>	.	.	C&E WeedsAus	361015
Coast Morning Glory	<i>Ipomoea cairica</i>	.	.	NSW	290774
Coffee Bush	<i>Leucaena leucocephala</i>	.	.	MP C&E G&M CYP	290894
Columbus Grass	<i>Sorghum alnum</i>	.	.	NSW	361495
Common Sensitive Plant	<i>Mimosa pudica</i>	C	.	WA1 WA2	291294
Common Sensitive Plant	<i>Mimosa pudica var. hispida</i>	C	.	WA1 WA2	291294
Common Stylo	<i>Stylosanthes guianensis</i>	.	.	DEU	292964
Cow Itch	<i>Mucuna pruriens var. utilis</i>	.	ALERT	NAQS C&E	291384
Creeping Wood-sorrel	<i>Oxalis corniculata</i>	.	.	NSW	291584
Cupid's Flower	<i>Ipomoea quamoclit</i>	.	.	C&E	371932
Fierce Thornapple	<i>Datura ferox</i>	A C	.	WA1 WA3 WA4 G&M	289904
Flannel Weed	<i>Sida cordifolia</i>	B C	.	WA1 G&M DEU	292594
Fringed Spiderflower	<i>Cleome rutidosperma</i>	.	.	NAQS Gr	289494
Gamba Grass	<i>Andropogon gayanus</i>	A C	.	MP K1 Q2 WA2 C&E G&M CYP	179446
Gambia Pea	<i>Crotalaria goreensis</i>	.	.	MP	183442
Golden Shower	<i>Cassia fistula</i>	.	.	WeedsAus	289034
Gomphrena Weed	<i>Gomphrena celosioides</i>	.	.	DEU	290514
Grader Grass	<i>Themeda quadrivalvis</i>	B C	.	G&M CYP DEU	107883
Guinea Grass	<i>Megathyrsus maximus</i>	.	.	MP DEU	291184
Hyptis	<i>Hyptis suaveolens</i>	B C	.	G&M	290734
Indian Bluegrass	<i>Bothriochloa pertusa</i>	.	.	DEU	288804
Indian Heliotrope	<i>Heliotropium indicum</i>	.	.	DEU	290584
Ivy Gourd	<i>Coccinia grandis</i>	.	.	WA1 WA2 C&E	289524
Jamaican Snakeweed	<i>Stachytarpheta jamaicensis</i>	B C	.	.	292924
Jaragua Grass	<i>Hyparrhenia rufa</i>	.	.	G&M	290694
Lantana	<i>Lantana camara</i>	B C	WONS	K2 WA1 Q3 Gr G&M CYP DEU NSW SA	237738
Mexican Clover	<i>Richardia brasiliensis</i>	.	.	DEU	292244
Mimosa	<i>Mimosa pigra</i>	A (S of 14 deg S) B (N of 14 deg S) C	WONS	MP K2 WA1 WA2 Q1 G&M CYP SA	291304
Mission Grass (annual)	<i>Pennisetum pedicellatum</i>	.	.	WeedsAus	291864
Mission Grass (perennial)	<i>Pennisetum polystachion</i>	B C	.	MP K2 C&E G&M	291884
Mission Grass (perennial)	<i>Pennisetum polystachion</i> subsp. <i>polystachion</i>	B C	.	MP K2 C&E G&M	291884
Mission Grass (perennial)	<i>Pennisetum polystachion</i> subsp. <i>setosum</i>	B C	.	MP K2 C&E G&M	291884

Common Name	Scientific Name	NT Status	National Status	Other Status	ID
Mossman River Grass	<i>Cenchrus echinatus</i>	B C	.	NSW	289124
Mother-In-Law's Tongue	<i>Sansevieria trifasciata</i>	.	.	C&E CYP	292384
Nutgrass	<i>Cyperus rotundus</i>	.	.	DEU SA	289844
Paddy's Lucerne	<i>Sida rhombifolia</i>	B C	.	MP G&M DEU	292604
Para Grass	<i>Urochloa mutica</i>	.	.	MP G&M	293304
Parkinsonia	<i>Parkinsonia aculeata</i>	B C	WONS	MP K2 WA1 WA4 Q2 G&M CYP DEU NSW SA	114160
Pink Periwinkle	<i>Catharanthus roseus</i>	.	.	C&E	289064
Purpletop Chloris	<i>Chloris barbata</i>	.	.	DEU	289314
Rangoon Creeper	<i>Quisqualis indica</i>	.	.	C&E	292204
Red Natal Grass	<i>Melinis repens</i>	.	.	DEU	291224
Rhodes Grass	<i>Chloris gayana</i>	.	.	DEU	289334
Roadside Leafbract	<i>Malachra fasciata</i> var. <i>lineariloba</i>	.	.	CYP	361325
Sabi Grass	<i>Urochloa mosambicensis</i>	.	.	DEU	293294
Shoe-button	<i>Ardisia elliptica</i>	.	.	C&E	288544
Shrubby Stylo	<i>Stylosanthes scabra</i>	.	.	G&M DEU	292994
Sicklepod	<i>Senna obtusifolia</i>	B C	.	WA1 WA2 Q2 G&M CYP DEU	131903
Singapore Daisy	<i>Sphagneticola trilobata</i>	.	.	Q3 C&E CYP	292884
Siratro	<i>Macroptilium atropurpureum</i>	.	.	C&E	291024
Soft Lovegrass	<i>Eragrostis pilosa</i>	.	.	DEU	372338
Spearpod	<i>Ruellia tuberosa</i>	.	.	C&E	292314
Spiny Amaranth	<i>Amaranthus spinosus</i>	.	.	WA1 WA2	288384
Spiny Sida	<i>Sida spinosa</i>	.	.	DEU	292614
Spiny-head Sida	<i>Sida acuta</i>	B C	.	WA1 G&M	292584
Starburr	<i>Acanthospermum hispidum</i>	B C	.	.	288214
Townsville Lucerne	<i>Stylosanthes humilis</i>	.	.	DEU	292984

Status Codes:

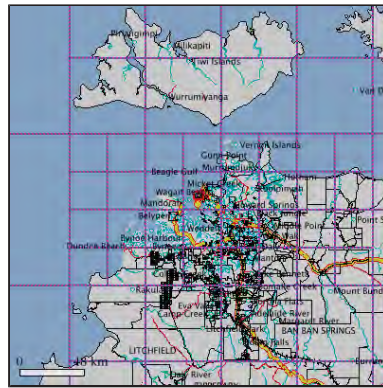
1. NATIONAL STATUS CODES
WONS, Weeds of National Significance
Alert, Alert List for Environmental Weeds (Please call Exotic Plant Pest Hotline 1800 084 881 if you think you have seen this weed)
Sleeper, National Sleeper Weed
Target, Targeted for eradication. (www.landmanager.com.au/view/index.aspx?id=449837)

2. NT STATUS CODES
A, NT Class A Weed (to be eradicated)
B, NT Class B Weed (growth & spread to be controlled)
C, NT Class C Weed (not to be introduced) (www.landmanager.com.au/view/index.aspx?id=449869)

3. OTHER STATUS CODES
C&E, Csurhes, S. & Edwards, R. (1998) Potential Environmental Weeds in Australia. Candidate Species for Preventative Control. Environment Australia, Canberra (www.landmanager.com.au/view/index.aspx?id=394504)
CYP, Draft Cape York Peninsula Pest Management Plan 2006-2011 (www.landmanager.com.au/view/index.aspx?id=371200)
DEU, Plants listed as environmental weeds by the Desert Uplands Strategic Land Resource Assessment (www.landmanager.com.au/view/index.aspx?id=332123)
G&M, Grice AC, Martin TG. 2005. The Management of Weeds and Their Impact on Biodiversity in the Rangelands. Cooperative Research Centre (CRC) for Australian Weed Management and CSIRO Sustainable Ecosystems. Commonwealth Australia (www.landmanager.com.au/view/index.aspx?id=163572)
Gr, Groves et al. 2003. Weed categories for natural and agricultural ecosystem management. Bureau of Rural Sciences (www.landmanager.com.au/view/index.aspx?id=388018)
K0, High Priority Weeds not yet established in the Katherine region
K1, High Priority Weeds posing environmental threats in the Katherine region
K2, High Priority Weeds posing existing threats in the Katherine region, as described in the Katherine Regional Weed Management Strategy 2005-2010 (www.landmanager.com.au/view/index.aspx?id=130286)
MP, Northern Territory Parks & Conservation Masterplan (www.landmanager.com.au/view/index.aspx?id=144141)
NAQS, North Australian Quarantine Strategy Target List (www.landmanager.com.au/view/index.aspx?id=449416)
NSW, Declared Noxious Weed in NSW (www.landmanager.com.au/view/index.aspx?id=449983)
Q1, QLD Class 1 Weed (not to be introduced, kept or supplied)
Q2, Class 2 Weed (eradicate where possible, not to be introduced, kept or supplied)
Q3, Qld Class 3 Weed (to be controlled near environmentally sensitive areas- not to be supplied/sold without a permit) (www.landmanager.com.au/view/index.aspx?id=190714)
SA, Declared Plant in South Australia (www.landmanager.com.au/view/index.aspx?id=449996)
WeedsAus, Listed as a significant weed by Weeds Australia (www.landmanager.com.au/view/index.aspx?id=14576)
WA1, WA Weed Class P1 (movement prohibited)
WA2, WA Weed Class P2 (aim to eradicate)
WA3, WA Weed Class P3 (control infestations)
WA4, WA Weed Class P4 (prevent spread)
WA5, WA Weed Class P3 (control infestations on public land) (www.landmanager.com.au/view/index.aspx?id=449884).

More species info: Go to www.landmanager.org.au/view/index.aspx?id=####
where #### is the ID number from the tables above for the species of interest.

Plants listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Dick Ward Drive



Dick Ward Drive Pest and Potential Pest Animals

Animals with pest potential recorded in the bioregion(s) in which Dick Ward Drive occurs. Occurrence based on Department of Natural Resources, Environment and The Arts databases.

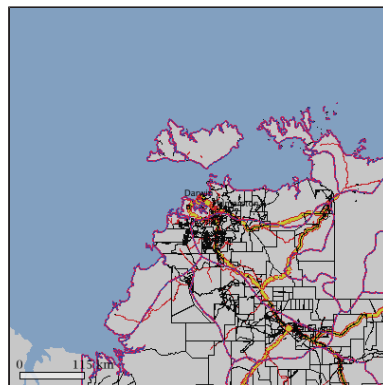
Common Name	Scientific Name	NT Status	National Status	ID
Cane Toad	<i>Chaunus marinus</i>	P	.	183252
Asian House Gecko	<i>Hemidactylus frenatus</i>	P	.	188964
Flower-pot Blind Snake	<i>Ramphotyphlops braminus</i>	P	.	189084
King Quail	<i>Excalfactoria chinensis</i>	P	.	450567
Rock Dove	<i>Columba livia</i>	P	.	183336
Red-tailed Black-Cockatoo	<i>Calyptrorhynchus banksii</i>	N	.	223765
Sulphur-Crested Cockatoo	<i>Cacatua galerita</i>	N	.	223772
Common Starling	<i>Sturnus vulgaris</i>	P	.	188980
House Sparrow	<i>Passer domesticus</i>	P	.	183322
Eurasian Tree Sparrow	<i>Passer montanus</i>	P	.	450580
Agile Wallaby	<i>Macropus agilis</i>	N	.	223786
House Mouse	<i>Mus musculus</i>	P	.	187720
Black Rat	<i>Rattus rattus</i>	P	.	183236
Dingo / Wild dog	<i>Canis lupus</i>	N	.	183280
Cat	<i>Felis catus</i>	P	.	183259
Donkey	<i>Equus asinus</i>	P	.	183287
Horse	<i>Equus caballus</i>	P	.	183315
Pig	<i>Sus scrofa</i>	P	.	183329
Swamp Buffalo	<i>Bubalus bubalis</i>	P	.	183245
Cattle	<i>Bos indicus</i> / <i>Bos taurus</i>	P	.	183266

NT STATUS CODES:

P, Prohibited species (all exotic vertebrates except those listed as non-prohibited (www.landmanager.com.au/view/index.aspx?id=450509)
Int, Introduced species (all non-prohibited vertebrates, and all other exotic species (www.landmanager.com.au/view/index.aspx?id=280771)
N, Native species with pest potential.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=####
where #### is the ID number from the tables above for the species of interest.

Potential pest animals listed in the table above were recorded from the bioregions shown below (red/blue line) that overlap Dick Ward Drive



Generated from NT Infonet (<http://www.infonet.cdu.edu.au/nrm>) Mon Jun 06 09:26:06 CST 2011

Soils and vegetation graphs and tables refer to area of soils and vegetation only. Fire graphs and tables refer to entire selected area including sea if present. Calculations are derived from map images or vector data, and should be taken as a guide only. Accuracy cannot be guaranteed. For small areas, figures should be rounded to the nearest whole number.