From: Matt

Sent: Wednesday, 6 December 2017 10:37 AM

To:

Subject: Longreach Waterhole Flora and Fauna Survey

Hi

Could this report that I have just received from Desert Wildlife Services be added to reference material for your enquiry please.

Cheers

Matt

Matthew J Bolam BVSc(Hons) PhD MB Consulting (NT) Pty Ltd

A Biological Survey of Longreach Waterhole Conservation Reserve, Newcastle Waters Station



A Report to Consolidated Pastoral Company



October 2017

Disclaimer:

The views and opinions expressed in this report reflect those of the authors and do not necessarily reflect those of Consolidated Pastoral Company Pty Ltd. The material presented in this report is based on sources that are believed to be reliable. Whilst every care has been taken in the preparation of the report, the authors cannot guarantee that all information presented is correct, complete or current and accept no responsibility for any resultant errors contained herein or any damages or loss whatsoever caused or suffered by any individual or corporation.

Front Cover: Longreach Waterhole at sunset, July 2017

Prepared by Steve Eldridge and Andrew Schubert

Desert Wildlife Services PO Box 4002 Alice Springs NT 0871 ABN: 78 771 770 276

Executive Summary

A biodiversity survey of Longreach Conservation Reserve was undertaken in the early dry season of 2017 to assess the current state of flora, fauna and land condition in relation to the results of similar survey work carried out in 1990, soon after the reserve was established.

A range of standard flora and fauna sampling techniques were used, including Elliott traps, pitfall traps, funnel traps, camera traps, active searching and photopoint monitoring. A total of 142 animal species were captured or observed during the survey, including 39 native species which were not previously known from the reserve. The total includes several species of conservation significance due to declining populations across parts of their range. It also includes several migratory bird species listed under international conservation agreements. Water bodies within the reserve supported a diverse range of waterbirds and surrounding habitats contained a healthy variety of mammals, reptiles and amphibians. Few feral animals were observed and no significant impacts were observed.

The number of plant species recorded during the survey totalled 246, a substantial increase on the 147 species recorded in 1990. While this is indicative of the favourable climatic conditions in 2017, an observed overall increase in ground layer vegetation cover suggests an improvement in land condition. However, changes in vegetation cover between 1990 and 2017 varied considerably between sites. In general, survey sites could be largely grouped into the following categories of change between 1990 and 2017:

- 1. Sites that showed good improvement in palatable perennial grass cover;
- 2. Sites with a moderate improvement in palatable perennial grass cover and significant increases in annual grass cover compared with forbs;
- 3. Sites with moderate to large differences in composition (likely due to different seasonal conditions), especially a greater presence of annual and short-lived forbs;
- 4. Sites showing little change since 1990 with evidence of continued grazing impacts;
- 5. Sites that were inundated for long periods over the 2016/17 wet season resulting in much-reduced species richness and containing only plants tolerant to prolonged waterlogging.

Parkinsonia was the most significant weed recorded in the reserve. However, the population has been reduced dramatically since 1990 with sustained control effort. No other serious weeds were recorded.

The reserve is capable of supporting livestock grazing, provided that a sustainable stocking rate is maintained. This is currently difficult due to damaged fences in continually inundated areas. Additional fencing within the reserve may help to control stocking rate. If cattle are to be excluded from the reserve, strategic early dry season burning may be advisable to promote plant diversity and enhance land condition.

Contents

Executive Summary3
Introduction5
Study Area6
Methods
Data access
Survey timing8
Site Selection
Fauna sampling10
Results and Discussion12
Climatic Conditions12
Fauna16
Flora20
Fire impacts25
Weeds25
Conclusions
Acknowledgements
References
Appendix A. Updated fauna checklist for Longreach Conservation Reserve
Appendix B. Updated plant checklist for Longreach Waterhole Conservation Reserve
Appendix C 2017 vegetation sampling pro forma48
Appendix D Site photographs

Introduction

Background

Longreach Waterhole is a permanent or near-permanent water body located in the lower reaches of Newcastle Creek, near the northern tip of Lake Woods on Newcastle Waters Station. It provides important refuge habitat for flora and fauna in an environment that is typically hot and very dry for at least 6 months of the year. In the mid 1980s, a joint management agreement under the provisions of Section 73 of the Territory Parks & Wildlife Act was negotiated with the pastoral leaseholder over a 9378-hectare parcel of land incorporating the waterhole and the northern part of Lake Woods. The area was fenced to limit grazing pressure and the Conservation Commission of the Northern Territory became co-managers with a view to preserving the biodiversity values of the waterhole and its surrounding habitats. Soon after the Agreement was ratified, baseline studies of flora and fauna were undertaken. However, despite the ecological significance of Longreach Waterhole, subsequent biodiversity work on the reserve has been infrequent and largely *ad hoc*, and there is no regular Government-led biodiversity or land condition monitoring program currently in place. However, in their endeavour to effectively manage the reserve, Consolidated Pastoral Company (CPC) Pty Ltd is keen to establish such a program.

In May/June 1990, a network of 58 vegetation sampling sites was established throughout the Reserve by the Conservation Commission of the Northern Territory in order to map plant communities and land units (Pitts 1990). The detailed floristic and geomorphological information collected at each site represents an important baseline data set indicative of land condition at the time. Logically, it follows that these sites should be the foundation of future biodiversity and land condition monitoring on the reserve to enable the current situation to be compared with the historical baseline.

In late 2016, CPC enlisted the help of Desert Wildlife Services (DWS) to re-locate the original sampling sites from 1990 and re-survey them using similar methodology. The project aimed to assess the current state of flora, fauna and land condition in relation to the historical situation, with a view to commencing regular biodiversity monitoring on the reserve potentially involving members of the local Elliott community.



Above: A feeding flotilla of Australian Pelicans (Pelecanus conspicillatus) on Longreach Waterhole

Study Area

Longreach Waterhole Conservation Reserve is located approximately 7km south-west of Elliott (Fig 1). It lies within the internationally significant Lake Woods wetland complex, regarded as one of the largest temporary freshwater lakes in tropical Australia. Lake Woods is recognised by the Northern Territory Government as a Site of Conservation Significance owing to its wildlife aggregations and wetland values. The wetland can at times support over 100,000 waterbirds and is an important stop-over for migratory waders. Lake Woods is the only known inland breeding location in the Northern Territory for Great Egrets, and is listed by Birdlife Australia as an Important Bird Area.

The reserve lies at the north-west margin of the Mitchell Grass Downs bioregion and is characterised by low Coolibah woodland habitat with heavy clay soils. The area's climate can be described as sub-tropical with a summer-dominated rainfall pattern. Mean annual rainfall is 601.8mm (median 564mm), but can be highly variable. Mean daytime maximum temperature ranges between 28°C (July) and 38 °C (December) and mean night-time minimum temperature ranges between 11 °C (July) and 24 °C (January).



Left: Stimson's Pythons (*Antaresia stimsoni*) were commonly seen foraging on coolibah trees in search of frogs, geckoes and birds during the April survey trip.

A Biological Survey of Longreach Waterhole Conservation Reserve



Fig 1. Land type map of Longreach Waterhole Conservation Reserve, showing sites sampled during the 2017 biodiversity survey. Land type data originate from Pitts (1994).

Land Type

Red Gum open forest over P. spinescens open grassland on creek channels, banks and inundated areas, on black and grey clay with some sand and gravel or alluvium.
 Coolibah very low open woodland over Aristida pruinosa sparse grassland on sand.
 Coolibah very low open woodland over sparse herbs and grasses on alluvium with some black soil.

- Coolibah very low open woodland with sparse herbs and Leptochloa neesii grassland on alluvium with some black soil.
- Coolibah very low woodland over Cyperus bifax and Eulalia aurea sparse grassland on alluvium with some black soil.

Coolibah, Excoecaria very low open woodland over Aristida pruinosa / Dichanthium fecundum open grassland on black and grey clay with some sand and gravel.

Coolibah, Excoecaria very low open woodland over sparse herbs and Aristida pruinosa grassland on black and grey clay with some sand and gravel.
Coolibah, Excoecaria very low open woodland with sparse herbs and grasses, on black and grey clay with some sand and gravel alluvium and some black soil.

Coolibah, Excoecaria very low Open Water / Channel

Methods

Data access

Access to the 1990 survey data collected by Brenda Pitts and Debbie Randell was granted by the Department of Environment and Natural Resources in early 2017. Spatial data and species lists were collated for each site and digital maps of vegetation communities were produced to facilitate on-site navigation.

Survey timing

Flora and fauna sampling in the northern Barkly Tablelands is best undertaken in the early dry season when plant growth and animal activity are at their peak. At this time, species identification is easier as plants are actively growing and reproducing, and the likelihood of encountering animals at survey sites is at its annual maximum. As the dry season progresses, plants complete their breeding cycles and many either die off or become dormant. Animal activity declines with diminishing availability of food resources and many species retreat to underground refuges where they aestivate until favourable conditions return. The duration and extent of this flush period differs each year, dependent upon the magnitude and timing of wet season rainfall. However, the period between April and June is generally most conducive to biodiversity survey. The 2017 survey was conducted in two separate trips; April 16-24 and July 18-30.

Site Selection

Flooding associated with above-average rainfall in the 2016/17 wet season significantly restricted access to survey sites and even in late July, much of the southern portion of the reserve remained inundated. In total, 21 of the original 1990 survey sites could not be reached and survey activities in 2017 were restricted to the remaining 37 accessible sites. Four additional sites were established to ensure adequate representation of the range of habitat types existing within the Reserve. Thus, a total of 41 sites were surveyed in 2017 (Table 1, Fig 1).



Above: The Brolga (*Antigone rubicunda*) was one of the many abundant waterbirds recorded during the survey. Groups of up to 30 individuals were common.

Site	Latitude GDA94 (°S)	Longitude GDA94 (°E)	Northing (MGA53)	Easting (MGA53)	Surveyed (2017)	Surveyed (1990)
LR01	17.6182	133.4598	8051390	336587	April	Yes
LR02	17.61737	133.45973	8051481	336579	July	Yes
LR03	17.61594	133.45992	8051640	336598	April	Yes
LR04	17.61463	133.46434	8051789	337066	July	Yes
LR05	17.61241	133.46823	8052038	337476	April	Yes
LR06	17.61133	133.46716	8052156	337362	April	Yes
LR07	17.60675	133.48015	8052674	338736	April	Yes
LR08	17.60633	133.48231	8052722	338965	No	Yes
LR09	17.616	133.464	8051637	337031	July	Yes
LR10	17.5988	133.50381	8053574	341240	April	Yes
LR11	17.60002	133.50386	8053439	341246	No	Yes
LR12	17.6022	133.50679	8053200	341559	April	Yes
LR13	17.60369	133.50706	8053035	341589	No	Yes
LR14	17.60606	133.51857	8052783	342813	April	Yes
LR15	17.60884	133.51784	8052475	342738	April	Yes
LR16	17.61291	133.53438	8052038	344497	July	Yes
LR17	17.62386	133.53857	8050830	344951	July	Yes
LR18	17.62613	133.53981	8050579	345084	No	Yes
LR19	17.64312	133.54320	8048702	345458	No	Yes
LR20	17.65977	133.54583	8046861	345751	No	Yes
LR21	17.66216	133.54539	8046597	345706	No	Yes
LR22	17.67216	133.53799	8045484	344930	July	Yes
LR23	17.67682	133.53668	8044967	344796	July	Yes
LR24	17.67003	133.54289	8045724	345448	July	Yes
LR25	17.67175	133.54819	8045538	346012	July	Yes
LR26	17.68826	133.54819	8043711	346027	No	Yes
LR27	17.68946	133.55144	8043580	346372	No	Yes
LR28	17.70899	133.55429	8041422	346690	No	Yes
LR29	17.71378	133.54920	8040887	346155	No	Yes
LR30	17.72390	133.53758	8039758	344931	No	Yes
LR31	17.72118	133.51244	8040038	342262	No	Yes
LR32	17.70950	133.49247	8041314	340134	No	Yes
LR33	17.70256	133.48108	8042072	338920	No	Yes
LR34	17.69749	133.48573	8042637	339409	No	Yes
LR35	17.69436	133.49225	8042989	340097	No	Yes
LR36	17.69575	133.49504	8042838	340394	No	Yes
LR37	17.68256	133.50599	8044306	341544	No	Yes
LR38	17.66989	133.5201	8045721	343031	July	Yes
LR39	17.63773	133.52579	8049284	343607	July	Yes

Table 1. Location coordinates of Longreach Waterhole survey sites, indicating those sampled in 2017.

Site	Latitude GDA94 (°S)	Longitude GDA94 (°E)	Northing (MGA53)	Easting (MGA53)	Surveyed (2017)	Surveyed (1990)
LR40	17.64075	133.52452	8048949	343474	July	Yes
LR41	17.64259	133.52229	8048743	343239	July	Yes
LR42	17.62816	133.50195	8050323	341069	July	Yes
LR43	17.62904	133.50626	8050230	341527	July	Yes
LR44	17.62433	133.51476	8050758	342425	July	Yes
LR45	17.62423	133.51166	8050766	342095	July	Yes
LR46	17.62187	133.5062	8051023	341514	July	Yes
LR47	17.62274	133.50844	8050929	341752	July	Yes
LR48	17.61921	133.51126	8051322	342049	July	Yes
LR49	17.6288	133.46857	8050224	337527	July	Yes
LR50	17.60466	133.42708	8052859	333102	July	Yes
LR51	17.5657	133.44009	8057182	334447	April	Yes
LR52	17.56902	133.4426	8056817	334717	July	Yes
LR53	17.58611	133.45131	8054933	335657	April	Yes
LR54	17.59796	133.48474	8053651	339216	April	Yes
LR55	17.58233	133.42894	8055332	333279	July	Yes
LR56	17.6015	133.42733	8053209	333126	July	Yes
LR57	17.71843	133.50866	8040339	341859	No	Yes
LR58	17.65717	133.54343	8047147	345494	No	Yes
LR100	17.61894	133.49576	8051338	340404	July	No
LR101	17.61482	133.4973	8051796	340563	July	No
LR102	17.64041	133.50171	8048967	341054	July	No
LR103	17.61768	133.45374	8051442	335943	July	No

Fauna sampling

Intensive fauna sampling was conducted by a team of two fauna ecologists at 14 sites selected on the basis of habitat type (Table 2), but with vehicle accessibility a secondary consideration as each site had to be visited multiple times each day to check traps, conduct active searches and release captured animals. Most of the original survey sites could no longer be easily reached via the existing track network within the Reserve, and it was necessary to establish 4 additional fauna survey sites with easier access to achieve adequate representation of habitat types (LR100-103, see Table 1 and Fig 1).

At each site, fauna sampling was conducted in a 50m X 50m quadrat centred on the point coordinate given in Table 2. Within each quadrat, a single pitfall/funnel trap line was established which consisted of a 30 m drift fence, four evenly spaced 20L pitfall buckets and four funnel traps set midway between pitfalls. Twenty-five medium-sized Elliott traps (type B) were distributed at 10-15m intervals around the perimeter of each quadrat. Traps were baited with standard mammal bait (a combination of oats and peanut butter) and Permethrin (Coopex) dusting powder was used to deter ants. Three nights/days of trapping were undertaken at each site. All traps were checked as soon as possible after sunrise, then several times throughout each trapping day. Elliott traps were closed during the day to

avoid inadvertent reptile deaths.

Active searching was undertaken at each survey site during the day and at night to detect additional species. Opportunistic observations were recorded across a range of additional sites within the general survey area.

Captured animals were identified in the field and then released at point of capture. Basic morphological information including gender, weight, snout-vent length and tail length was recorded for each captured animal. All fauna data were entered into the NT Fauna Atlas Database held by the Department of Environment and Natural Resources, Darwin.

Site	Latitude (°S)	Longitude (°E)	No. Elliott nights	No. Pit Nights	No. pit davs	No. Funnel davs	No. Bird Surveys
LR01	17.61820	133.45980	75	48	48	12	3
LR05	17.61241	133.46823	75	48	48	12	3
LR07	17.60675	133.48015	75	48	48	12	3
LR10	17.59880	133.50381	75	48	48	12	3
LR49	17.62880	133.46857	75	48	48	12	3
LR50	17.60466	133.42708	75	48	48	12	3
LR53	17.58611	133.45131	75	48	48	12	3
LR54	17.59796	133.48474	75	48	48	12	3
LR55	17.58233	133.42894	75	48	48	12	3
LR56	17.60150	133.42733	75	48	48	12	3
LR100	17.61894	133.49576	75	48	48	12	3
LR101	17.61482	133.49730	75	48	48	12	3
LR102	17.64041	133.50171	75	48	48	12	3
LR103	17.61768	133.45374	75	48	48	12	3

Table 2. Location details and survey effort for each fauna sampling site.

Flora

At most sites, flora was sampled within a 50m radius of the point coordinate given in Table 1. At sites LR09 and LR22, however, this method was not possible due to flooding, and sampling took place along a 200m linear transect. Data were collected using the standard pro forma presented in Appendix C. The name and growth form of every plant species occurring within the sampling area was recorded. For tree species and other upper storey species, structural information including crown separation ratio, height, crown diameter and diameter at breast height was also gathered. A range of additional biophysical attributes relating to feral animal and livestock activity, erosion, fire impacts and soil surface conditions were also measured. Each site was photographed as a further record of site condition. Flora surveys were conducted by a team of two plant ecologists.

Plant species observed outside survey sites were recorded as incidental records. A specimen of each species was vouchered and dried for later verification and retention at the Northern Territory Herbarium. All collected plant specimens were recorded in the NT Herbarium Database located in the Department of Land Resource Management, Darwin.

Results and Discussion

Climatic Conditions

The 2017 survey took place after an above-average wet season which resulted in major flows in Newcastle Creek, filling Lake Woods and inundating much of the reserve (Fig 2). Between July 2016 and April 2017, Elliott township (approximately 7km north-east of the Reserve) received a total of 881mm of rain, 90% of which fell between the months of December and February. Newcastle Waters, (approximately 23km north-west of Elliott) received 802mm from July 2016. As a result, a significant proportion of the reserve remained inundated at the time of the survey, particularly in the south where Newcastle Creek enters Lake Woods.



Fig. 2 Wet season (Oct – Mar) rainfall since 1982/83 at Elliott, approximately 7km north-east of Longreach Waterhole. Rainfall preceding the survey was well above average.

In contrast, conditions leading up to the original 1990 vegetation survey were much drier (Fig 2). Rainfall from July 1989 to May 1990 totalled 401mm at Elliott and 247mm at Newcastle Waters. Comparison of Landsat imagery from March 14th 1990 (Fig 3) and March 24th 2017 (Fig 4) highlights the large differences in seasonal conditions between the two surveys. In 1990, the only areas with surface water were sections of the main channel of Newcastle Creek, with the greater floodplain and Lake Woods dry.



Fig 3. Landsat 5 image captured on March 14th, 1990. The only areas with surface water are sections of the main channel of Newcastle Creek, with the greater floodplain and Lake Woods dry. Imagery source: US Geological Survey.



Fig 4. Landsat 8 image captured on March 24th, 2017. The main Newcastle Creek channel along with numerous back channels are flooded. Lake Woods is full and the southern portion of the Reserve is completely inundated. Imagery source: US Geological Survey

The activity of reptiles and, to some degree, small mammals is affected by temperature and humidity. Night-time minimum temperature during the April survey trip hovered around 20°C and 9am relative humidity averaged over 60% (Table 3). Consequently, reptile activity and the number of reptile captures was relatively high. During the July trip, night time temperatures were significantly lower (approximately 10°C) and 9am relative humidity averaged less than 40%. Thus, reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly reptile activity and the number of reptile captures were significantly replaced during this trip.

Data	Dav	Tempera	ature	RH	Rain
Date	Day	Min (°C)	Max (°C)	(%)	(mm)
Survey 1					
16/04/2017	Su	19.8	36.6	66	0
17/04/2017	Мо	21.5	36.1	60	0
18/04/2017	Tu	21.5	35.9	67	0
19/04/2017	We	21	35.3	69	0
20/04/2017	Th	20.5	36.1	62	0
21/04/2017	Fr	21.2	35.8	69	0
22/04/2017	Sa	20.2	35.7	65	0
23/04/2017	Su	20.2	36.2	65	0
24/04/2017	Мо	20.1	36.3	61	0
<u>Survey 2</u>					
18/07/2017	Tu	9.5	30.7	34	0
19/07/2017	We	11.2	28.8	38	0
20/07/2017	Th	10.4	26.1	35	0
21/07/2017	Fr	6.7	27.3	37	0
22/07/2017	Sa	8.5	27.8	33	0
23/07/2017	Su	13	28.8	29	0
24/07/2017	Мо	13.8	29.5	17	0
25/07/2017	Tu	11	32.2	23	0
26/07/2017	We	14.7	31.7	35	0
27/07/2017	Th	14.2	30.7	31	0
28/07/2017	Fr	14.5	30.6	33	0
29/07/2017	Sa	11.4	31.4	49	0

Table 3. Weather observations over the two survey periods.

Fauna

A total of 142 fauna species were recorded during the survey, 41 (29%) of which had not previously been recorded in Longreach Waterhole Conservation Reserve (Appendix A). A general lack of previous biodiversity survey work is the likely explanation for the relatively high number of new records (particularly for mammals, reptiles and amphibians). Conversely, 52 species previously known from Longreach Waterhole were not recorded in this survey (Appendix A). Many of these are migratory wader birds which are not present in Australia during the winter months.

Mammals

Eleven mammal species were recorded including 2 predators (Dingo *Canis familiaris* and Feral Cat *Felis catus*) 3 macropods (Agile Wallaby *Notamacropus agilis*, Northern Nailtail Wallaby *Onychogalea unguifera* and Red Kangaroo *Macropus rufus*), 2 rodents (Long-haired Rat *Rattus villosissimus*, and House Mouse *Mus musculus*) and 2 dasyurid marsupials (Long-tailed Planigale *Planigale ingrami* and Stripe-faced Dunnart *Sminthopsis macroura*). A single specimen of the Little Red Flying fox *Pteropus scapulatus* was found entangled in a fence near Site LR53. The Horse (*Equus caballus*) was the only large feral herbivore observed.

Two of the mammals recorded are considered to be of conservation significance. The Longhaired Rat is classified as Near Threatened in the Northern Territory due to an apparent decrease in the frequency of population irruptions across its range in recent years (Woinarski & Aplin 2008). The Mitchell Grass Downs bioregion is regarded as the core of its range in the Northern Territory. The Northern Nailtail Wallaby is also classified as Near Threatened in the Northern Territory due to declines in the southern parts of its range thought to be associated with the spread of foxes into these areas (Woinarski *et al.* 2008).

Rates of small mammal capture were relatively low during the survey (Elliott trap success <0.5%), which is fairly typical of the Mitchell Grass Downs bioregion.

Reptiles

Thirteen reptile species were recorded during the survey, nine of which had not been previously recorded in the reserve. The most commonly captured reptile was *Ctenotus robustus*, a large diurnal skink found in a wide variety of habitats across northern and eastern Australia. Another common species was the Northern Dtella (*Gehyra australis*). Interestingly, the individuals of this species examined did not quite match the species-specific characters indicated in the identification key (Cogger, 2014). Longreach individuals had atypical body patterning with distinct bands, and the rostral area differed considerably from the type specimen. Several tail tips were collected and sent away for DNA analysis to confirm the species identification, but results of the analysis were not available at the time of writing.

A notable reptile record was the Northern Snake-necked Turtle (*Chelodina oblonga*) which has rarely been seen as far south as Longreach Waterhole. An intact shell of this species was found at the water's edge during the July survey trip. The shell may have floated into the waterhole with floodwaters and its exact origin is therefore uncertain. No other evidence of this species was detected during the survey. Numerous Stimson's Pythons (*Antaresia*)

stimsoni) were observed at night during the April survey trip, foraging on hollow Coolibah trees in search of frogs, geckoes and hollow-nesting birds.

Several Agamid (Dragon) species were captured during the April survey but this family of lizards were absent by the July sampling trip when climatic conditions were less favourable.

Amphibians

Seven frog species were recorded, most of which had not been recorded previously on the reserve. This included the Cane Toad, which was prevalent during the survey, particularly close to water and in areas with elevated levels of soil moisture. The presence of cane toads is the likely explanation for the absence of goannas and large pythons from the 2017 species list. Species such as the Black-headed Python (*Aspidites melanocephalus*) and Yellow-spotted Monitor (*Varanus panoptes*) would have once been common throughout the reserve.

Left: These Geckoes were commonly observed on Coolibahs throughout the reserve. They were identified as Northern Dtellas (Gehyra australis), but the distinct banding is atypical of this species. Tail tips were collected for DNA analysis for confirmation of identification

Birds

A total of 111 bird species were observed during the survey including 19 that had not been previously recorded on the reserve (Appendix A). A further 40 bird species are known from the reserve but were not observed in 2017. Flooding prevented access to a number of habitats (e.g. Lignum) that only exist in the southern portion of the reserve. Thus, species occupying these habitats (e.g. Yellow Chats) are likely to have gone undetected during the survey.

Above: Northern Nailtail Wallaby (*Onychogalea unguifera*)

Above: Green Tree Frog (Litoria caerulea)

Above: Lally's Two-lined Dragon (*Diporiphora lalliae*)

Above: Stripe-faced Dunnart (Sminthopsis macroura)

Above: Long-tailed Planigale (Planigale ingrami)

Above: A Rainbow Bee-eater (Merops ornatus)

Large numbers of waterbirds were occupying the reserve at the time of the survey and many species were breeding. Terrestrial species were also abundant. Two species considered to be of conservation significance in the Northern Territory were recorded; the Australian Bustard (*Ardeotis australis*) and the Bush Stone-curlew (*Burhinus grallarius*). Both of these species are classified as Near Threatened in the Northern Territory due to declining numbers across much of their range.

Pest Animals

The only introduced pest animals observed during the survey were the Feral Cat (*Felis catus*) and the Horse (*Equus caballus*). The abundance of Feral Cats was of some concern, with dozens observed over the survey duration. Only a relatively small number of Horses (<20) appeared to be occupying the reserve.

Several house mice were captured during the survey. This species is now naturalised in Australia and occurs across the entire country. They are unlikely to be having a significant environmental impact at Longreach Waterhole

Livestock

Free-roaming cattle were present on the reserve during the survey due to fence damage resulting from continual flooding. Moderate grazing impacts were evident in localised areas on the southern side of Newcastle Creek and in the vicinity of South Bore.

Above: Cattle grazing on the southern bank of Longreach Waterhole

Flora

A total of 246 plant species was collected during the survey (Appendix B). In comparison to the 1990 survey which recorded 147 species, this represented an overall increase in species richness of almost 70%. The increase is indicative of the relatively good seasonal conditions in 2017 relative to 1990. However, the trend was not consistent across sites and appeared to be largely associated with the degree of inundation prior to and during the 2017 survey. Heavily inundated sites tended to contain fewer species due to the absence of species unable to tolerate long periods of inundation or with a preference for drier conditions. Several sites which had been inundated for a shorter period prior to the survey contained a dense cover of annual species that favour prolonged wet conditions and may therefore be absent in drier years (such as 1990). For example, many sites nearer to Lake Woods had a dense cover of Budda Pea (*Aeschynomene indica*) which was absent or sparse in 1990.

The greatest increases in species richness were recorded on drier sites on the northern and eastern sides of Newcastle Creek, largely due to a greater variety of annual species. Notably, at similar sites on the opposite side of the watercourse this trend was either less evident or not apparent. The absence of fire could possibly have contributed to this result, as no visible signs of fire were evident at any of these sites and regional fire history information indicated that western and southern parts of the reserve had not burnt since at least 2000 (North Australia and Rangelands Fire Information 2000-2017; Fig 5). Also, several of these sites showed evidence of continuing disturbance from cattle grazing (e.g. LR045, LR046, LR047, LR048) and had relatively low overall plant cover

Table 4. Mean ground cover per site for a range of vegetation types, indicating broad recovery of ground layer vegetation since 1990. Percentage cover was determined from Crown Separation Ratios using the formula: Cover = $80.6/(1+CSR)^2$ (National Committee on Soil and Terrain 2009)

Growth Form	Mean cover per site – 1990 (%)	Mean cover per site – 2017 (%)
Annual grasses	<0.79	6.0
Forbs/low shrubs	7.7	6.1
Forbs/low shrubs (proportion of total ground cover)	51.6	26.4
Perennial grass	5.6	7.6
Perennial grasses (palatable species only)*	1.0	1.75
Perennial grass (<i>Aristida</i> spp. – Wire Grass) [#]	1.8	0.8
TOTAL ground cover	15	23.3

* includes Dichanthium fecundum, Panicum decompositum, Eulalia aurea, Bothriochloa ewartiana, Sehima nervosum, Astrebla spp., Digitaria brownii, Digitaria divaricatissima var. divaricatissima.

[#] perennial Aristida includes A. latifolia, A. inaequiglumis and A. pruinosa

Ground cover at most sites was much higher in 2017, with mean ground cover per site increasing to 23.3% from 15% in 1990 (Table 4). The largest increases were observed in the cover of annual grasses such as *Eragrostis cumingii*, *Iseilema* spp., *Panicum laevinode*, *Eragrostis tenellula* and *Dichanthium sericeum* subsp. *polystachyum* (Table 4). This is mainly indicative of the good seasonal conditions in 2017 relative to 1990. However, other changes were more indicative of a broad recovery in ground layer vegetation since 1990. For example, there was a general decline in the cover of unpalatable perennial grass species, in particular wire grasses (*Aristida* spp.) and a moderate increase in palatable perennial grass species such as *Dichanthium fecundum*, *Bothriochloa ewartiana*, *Eulalia aurea* and *Panicum decompositum* (Table 4). Furthermore, a general decrease was observed in the dominance of disturbance-loving forbs and low shrubs (e.g. *Neptunia* spp., *Portulaca* spp., *Tribulus eichlerianus*, *Dactyloctaenium radulans*, *Sida fibulifera*, *Polymeria longifolia*), although it should be noted that little change was observed at some sites on the western side of Newcastle Creek (e.g. LR045, LR046, LR047, LR048).

Tree cover remained similar to 1990 levels across the reserve, although some increase in young Guttapercha (*Excoecaria parvifolia*), River Cooba (*Acacia stenophylla*) and Candelabra Wattle (*Acacia holosericea/Acacia colei*) was evident at some sites.

Species seen in 1990, but not recorded 2017, mostly include species of wetter habitats which may have been located at sites around the northern end of Lake Woods which could not be accessed during the 2017 survey because they were still underwater. Although Lignum (*Duma florulenta*) and *Dinebra neesii* were recorded at site 38 in 1990, they were uncommon then (CSR = 100), and were possibly still present in 2017 as this site was still mostly underwater at the time of survey and thus was only surveyed superficially. Also not recorded in 2017 were several species which are common on the adjacent Ashburton Range but occur more as isolated individuals on the Reserve (e.g. *Senna venusta, Triodia pungens*).

Species identification discrepancies

A number of discrepancies were revealed in the identification of certain plant species between the 1990 and 2017 surveys. Some of these reflect recent advances in plant taxonomy and others were likely misidentifications attributable to the prevailing dry conditions in 1990, which would have affected the quality of collected specimens and severely reduced the availability of reproductive structures which are often necessary for positive identification. Following is an annotated list of species for which discrepancies were identified.

Acacia holosericea

1990 records of this species include both *Acacia holosericea* (which in 2017 was mostly confined to the banks of Newcastle Creek) and the closely related *Acacia colei* which is more widespread and occurs in more sandy country within the reserve.

Aristida pruinosa

In many cases this species appears to have been misidentified in 1990. While *A. pruinosa* does occur at Longreach Waterhole, it was not dominant on any site surveyed

in 2017. The most abundant perennial *Aristida* species were *Aristida latifolia* (on clay soils) and *Aristida inaequiglumis* (on sandier and sometime gravelly soils).

Bonamia linearis

This species does not occur in the southern Northern Territory. The species recorded in 1990 was probably *B. deserticola*, which was also recorded in 2017.

Bergia barklyana and Bergia trimera

Both of these species were recorded in 1990. One specimen collected in 2017 may have been *B. barklyana*, but all other 2017 *Bergia* specimens were *Bergia* pedicellaris.

Cenchrus echinatus

This species was recorded in 1990 at sites LR005 and LR050. In 2017, the closely related *C. biflorus* was quite abundant at site LR050, and only buffel grass (*Cenchrus ciliaris*) was recorded at site LR005. Thus 1990 records were almost certainly of *C. biflorus*.

Corchorus tridens

Corchorus tridens was recorded at a number of sites in 1990, but only the closely related *C. fascicularis* was recorded at multiple sites in 2017. Thus, the 1990 records are most likely misidentifications.

Crinum flaccidum

This species was recorded in 1990, but these records are likely to refer to *C. angustifolium* which is the *Crinum* species found across the northern Barkly region. *C. flaccidum* is found further south.

Dichanthium fecundum

Dichanthium fecundum was recorded at a number of sites in both 1990 and 2017 surveys. However, *Bothriochloia ewartiana*, which is close in appearance and difficult to separate from *D. fecundum* in the absence of inflorescences was also common at a number of sites in 2017, with the two species sometimes co-occurring. Thus, it appears that *B. ewartiana* was overlooked in the 1990 surveys. This species appears to favour the sandier soils in the northern part of the reserve, with *D. fecundum* more often found on heavier clay soils including the banks of Newcastle Creek.

Dichanthium sericeum

Both subspecies of *Dichanthium sericeum* (*polystachyum* and *humilius*) were recorded in the 2017 survey. However, only *Dichanthium sericeum polystachyum* was recorded in 1990.

Dodonaea oxyptera

This species was recorded in 1990, but it does not occur in the southern Northern Territory, Records of this species probably refer to *D. physocarpa* which was recorded in 2017 on sandier soils within the reserve.

Eragrostis falcata

Eragrostis falcata was recorded in both 1990 and 2017. However, at some sites where this species was recorded in 1990 only the closely related *E. setifolia* was observed.

Thus, some 1990 records probably refer to this species. *E. setifolia* is more common on heavy clay soils, while *E. falcata* often favours somewhat saline soils, including sands and heavier clay soils.

Gomphrena lanata

G. lanata was the only native *Gomphrena* recorded in 1990. Two additional species (*G. brevifolia* and *G. leptophylla*) were recorded in 2017, with the latter being common on sandier or gravelly sites in the northern part of the reserve and the former on heavier clay soils. *G. leptophylla* in particular could have been included within 1990 records of *G. lanata*.

Goodenia lunata

Goodenia lunata was the only Goodenia species recorded in 1990, occurring at a number of sites. This species was not recorded in 2017, and appears to have been a mis-identification. The most common *Goodenia* in 2017 was *G. strangfordii*, but *G. lamprosperma* was also common and *G. facscicularis* (which is the closest relative to *G. lunata*) was also recorded but uncommon.

Heliotropium tenuifolium

Records of this species from 1990 most likely refer to *H. tanythrix*, which was the most common species of this group in 2017. *Heliotropium* taxonomy has undergone a major revision since 1990, and most records of *H. tenuifolium* in the southern N.T. now refer to other species.

Iseilema vaginiflorum

1990 and 2017 records of this species possibly also include *I. macratherum*. These species are closely related, and some specimens appeared to fall between descriptions of the two. Aromatic smelling plants (with a citrus-like smell) with sparse glands on spathe keels could possibly be assigned to *I. macratherum*, and such specimens were found at a number of sites.

Marsilea sp.

Specimens identified as *Marsilea* sp. in 1990 are mostly or all *M. exarata*, as this was the only species of *Marsilea* identified to species level in 2017.

Neptunia dimorphantha

Records of this species from 1990 probably include some *N. monosperma* as well as *N. dimorphantha*, as both were present within the reserve in 2017.

Polymeria affin. longifolia / P. longifolia

These taxa recorded in 1990 are two separate forms (narrow-leaved and broad leaved) currently included within *Polymeria longifolia*, which is regarded as a highly variable species.

Pterocaulon serrulatum

1990 records of this species may also include *Sphaeranthus indicus*, particularly on more flood-prone sites with clay soils. The latter species was common on many clay

sites in 2017, but was not recorded in 1990. *P. serrulatum* was more commonly confined to sandier or gravelly soils rather than heavy clays.

Sesbania cannabina

S. cannabina records from 1990 probably also include *S. brachycarpa*, as these species cannot be readily separated in the absence of flowers, and both were recorded in 2017.

Solanum esuriale

1990 records of this species almost certainly refer to *S. tumulicola*, as this common species of clay soils was the only *Solanum* recorded in 2017.

Trianthema turgidifolia

In all likelihood, 1990 records of this species refer to *T. pilosa*. This was the only Trianthema species observed in 2017, occuring on sandier soils whereas *T. turgidifolia* prefers saline soils.

Tribulus terrestris s.lat.

1990 records of this species probably refer to *T. eichlerianus*, which was the only *Tribulus* species recorded in 2017.

Triodia pungens

T. pungens records from 1990 may in fact be *T. bitextura*, as this was the only *Triodia* species recorded on the reserve in 2017. However *T. pungens* is common in the region, especially on the Ashburton Range adjacent to the eastern side of the reserve, and so is likely to also occur on the reserve.

Muehlenbeckia cunninghamii

Now known as Duma florulenta

Pennisetum basedowii Now known as Cenchrus basedowii

Portulaca pilosa ssp. pilosa Now known as *Portulaca filifolia*

Fire impacts

Evidence of fire impacts was variable across the reserve. Late season wildfires had affected the northern portion of the reserve (where some areas had burnt as often as every second year since 2000), yet fire had been absent over the same period in areas south and west of Newcastle Creek (Fig 5). There was little indication that fire had detrimentally affected plant or animal communities within the reserve. There may have been some loss of hollow-bearing tree limbs in some areas (e.g. in Coolibah) but there was little evidence of this at survey sites.

Notably, the largest increases in species richness in relation to the 1990 survey were observed at survey sites in fire-affected parts of the reserve. It was not possible to readily identify species that may be lacking at sites where fire impacts were absent. However, in the absence of grazing disturbance, some herbaceous species may become significantly less common if fire is excluded from the reserve. Strategic early dry season burning may be advisable if stock are to be excluded from the reserve.

Weeds

The most significant weed in the reserve was Parkinsonia (*Parkinsonia aculeata*). However, the abundance of this species had been substantially reduced by recent control efforts. In 2017, Parkinsonia was recorded at only 4 of the 37 sites surveyed in both 1990 and 2017, compared with 19 sites in 1990. At three of the sites where Parkinsonia was recorded in 2017, most or all individuals were dead and live individuals were few or represented by seedlings only.

A small infestation of Gallon's Curse (*Cenchrus biflorus*) was recorded at survey site 50 in 2017. In 1990, this species was also recorded at site LR05 but it was not present here in 2017. Although not declared in the Northern Territory, this species has the potential to spread rapidly and its burrs are capable of injuring stock.

Buffel Grass (*Cenchrus ciliaris*) appeared to have spread within the reserve since 1990. Of the 37 sites surveyed in both 1990 and 2017, buffel grass was only recorded at site LR09 in 1990 (where it was rare), compared with three sites in 2017. Interestingly, the species appeared to have disappeared from site LR09 in 2017.

Rubber bush (*Calotropis procera*) was recorded as an incidcental observation only, and was very uncommon on the reserve.

Other introduced species recorded in the survey are widespread and naturalised and not considered to be significant weeds.

Fig 5. The frequency of late-season fires in Longreach Waterhole Conservation Reserve between 2000 and 2016. Impacts of past fire are restricted to the northern portion of the Reserve, on the northern side of Newcastle Creek.

Conclusions

Results of the 2017 survey indicate an overall improvement in land condition within the reserve in comparison to 1990 survey results. However, this trend was not consistent across all sites. In general, survey sites could be largely grouped into the following categories of change between 1990 and 2017;

- 1. Sites that show good improvement in palatable perennial grass cover (e.g. *Dichanthium fecundum, Eulalia aurea, Panicum decompositum, Chrysopogon fallax),* grass cover generally, and a lower prevalence of forbs and annual grasses encouraged by disturbance (includes LR01, LR10, LR12 and LR51). Many of these sites also showed a major increase in species richness, much of which may be attributed to the much better seasonal conditions in 2017.
- 2. Sites with a moderate improvement in palatable perennial grass cover and generally large increases in annual grass cover compared with forbs, with variable changes in species richness from neutral to large increase on some sites (e.g. LR54). Such sites include sandy (e.g. LR05, LR06, LR07) and gravelly sites (e.g. LR54) with probably less historical grazing pressure than richer clay sites.
- 3. Sites with moderate to large differences in composition likely due to different seasonal conditions, especially a greater presence of annual and short-lived forbs (e.g. LR03, LR14, LR15, LR16, LR41, LR50, LR52, LR53, LR55, LR56).
- 4. Sites with little change since 1990 with evidence of continued grazing impacts (e.g. LR42, LR43, LR44, LR45, LR46, LR47, LR48, LR49).
- 5. Sites that were inundated for long periods over the 2016/17 wet season and still waterlogged in July 2017; these sites had much reduced species richness, with ground cover dominated by plants tolerant of prolonged waterlogging. These sites included low-lying channels adjacent to Newcastle Creek (e.g. LR02, LR04, LR09) and sites towards the northern end of Lake Woods (LR17, LR22, LR23, LR24,-LR25, LR38, LR39, LR40).

The reserve continues to provide important habitat resources for native fauna. Water bodies within the reserve support a variety of waterbirds and surrounding habitats contain a healthy diversity of mammals, reptiles and amphibians. The presence of Long-haired Rats in the reserve supports the assertion that the area is an important wildlife refuge.

On-going monitoring of biodiversity within the reserve will help to ensure that land condition continues to improve. The sites selected for intensive survey in 2017 represent a broad range of habitat types, were all easily accessible by vehicle and are suitable for future monitoring purposes. Sites with poor vehicle access or in more frequently inundated areas were found not to be suitable for intensive monitoring. Many of these were accessed on foot during the 2017 survey. Although access is more difficult, continued monitoring of these sites is important. Vegetation sampling, photographic monitoring and less intensive fauna survey techniques such as active searching and point counts could be employed at these sites during future monitoring exercises.

The reserve is capable of supporting livestock grazing, provided that a sustainable stocking rate is maintained. Although grazing impacts in the reserve are less than in 1990, stocking of the reserve is currently difficult to control due to damaged fences in continually inundated areas. As a result, moderate grazing impacts are evident in some parts of the reserve. Greatest grazing pressure was noted at some sites on the western side of Newcastle Creek on heavy clay soils where Sensitive Plant (*Neptunia* spp.) and Wild Tomato (*Solanum tumulicola*) were more prevalent (LR045-LR048).

Additional fencing located in less-frequently inundated country may help to improve stock management within the reserve.

Acknowledgements

We thank Matt Bolam (MB Consulting Pty Ltd) and Nathan (Jak) and Jade Andrews (Consolidated Pastoral Company Pty Ltd) for facilitating this project. Confirmation of fauna species identification was provided by the NT Department of Environment and Natural Resources (Peter McDonald).

References

Cogger H.G. (2014). *Reptiles and Amphibians of Australia*. CSIRO Publishing, Collingwood VIC.

- National Committee on Soil and Terrain (2009) *Australian Soil and Land Survey Handbook 3*rd *Edition.* CSIRO Publishing, Collingwood VIC.
- Pitts, B. (1990). Longreach Waterhole Vegetation Survey and Mapping. A consultancy report to the Northern Territory Branch of the Australian Heritage Commission. Conservation Commission of the Northern Territory, Alice Springs.
- Pitts, B. (1994). Vegetation Communities of Longreach Waterhole. A consultancy report to the Northern Territory Branch of the Australian Heritage Commission. Conservation Commission of the Northern Territory, Alice Springs.
- Woinarski, J. & Aplin, K. (2008). *Rattus villosissimus*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. < >.
- Woinarski, J., Winter, J. & Burbidge, A. (2008). *Onychogalea unguifera*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <<u>www.iucnredlist.org</u>>.

Appendix A. Updated fauna checklist for Longreach Conservation Reserve.

N.B. Species identifed with a "Y" in the 2017 column were recorded in the 2017 survey. Species not previously known from inside the Reserve are in bold text. Introduced species are marked with an asterisk (*).

	Family	Scientific Name	Common Name	2017	Most recent record
	MAMMALS				
1	Canidae	Canis lupus dingo	Dingo	Y	2017
2	Dasyuridae	Planigale ingrami	Long-tailed Planigale	Y	2017
3	Dasyuridae	Sminthopsis macroura	Stripe-faced Dunnart	Y	2017
4	Equidae	*Equus caballus	Horse	Y	2017
5	Felidae	*Felis catus	Feral Cat	Y	2017
6	Macropodidae	Macropus rufus	Red Kangaroo	Y	2017
7	Macropodidae	Notamacropus agilis	Agile Wallaby	Y	2017
8	Macropodidae	Onychogalea unguifera	Northern Nailtail Wallaby	Y	2017
9	Muridae	*Mus musculus	House Mouse	Y	2017
10	Muridae	Rattus villosissimus	Long-haired Rat	Y	2017
11	Pteropidae	Pteropus scapulatus	Little Red Flying Fox	Y	2017
	<u>REPTILES</u>				
1	Agamidae	Diporiphora benettii	Robust Two-lined Dragon	Y	2017
2	Agamidae	Diporiphora lalliae	Lally's Two-lined Dragon	Y	2017
3	Agamidae	Lophognathus gilberti	Gilbert's Dragon	Y	2017
4	Agamidae	Ctenophorus isolepis	Military Dragon		1986
5	Agamidae	Ctenophorus isolepis	Military Dragon		1986
6	Boidae	Antaresia stimsoni	Stimson's Python	Y	2017
7	Chelodoniidae	Chelodina oblonga	Northern Snake-necked Turtle	Y	2017

	Family	Scientific Name	Common Name	2017	Most recent record
8	Elapidae	Suta punctata	Little Spotted Snake		1986
9	Gekkonidae	Gehyra australis	Northern Dtella	Y	2017
10	Gekkonidae	Heteronotia binoei	Bynoe's Gecko	Y	2017
11	Pygopodidae	Delma tincta	Excitable Delma	Y	2017
12	Scincidae	Cryptoblepharus metallicus	Metallic Snake-eyed Skink	Y	2017
13	Scincidae	Ctenotus robustus	Robust Ctenotus	Y	2017
14	Scincidae	Lerista labialis	Southern Sandslider	Y	2017
15	Scincidae	Menetia greyii	Common Dwarf Skink	Y	2017
16	Scincidae	Cryptoblepharus plagiocephalus	Aboreal Snake-Eyed Skink		1978
17	Scincidae	Ctenotus greeri	Greer's Ctenotus		1986
18	Scincidae	Ctenotus pulchellus	Pretty Ctenotus		1986
19	Scincidae	Ctenotus schomburgkii	Schomburk's Ctenotus		1986
20	Scincidae	Carlia munda	Striped Rainbow Skink		1986
21	Scincidae	Cryptoblepharus plagiocephalus	Aboreal Snake-Eyed Skink		1978
22	Typhlopidae	Ramphotyphlops unguirostris	Claw-snouted Blind Snake	Y	2017
	AMPHIBIANS				
1	Bufonidae	Rhinella marinus	Cane Toad	Y	2017
2	Hylidae	Litoria caerulea	Green Tree Frog	Y	2017
3	Hylidae	Litoria pallida	Pale Frog	Y	2017
4	Hylidae	Litoria rothii	Roth's Tree Frog	Y	2017
5	Hylidae	Litoria rubella	Brown Tree Frog	Y	2017
6	Hylidae	Litoria maculosa	Daly Waters Frog		2008
7	Hylidae	Cyclorana australis	Giant Frog		2008
8	Limnodynastidae	Notaden nichollsi	Desert Spadefoot Toad	Y	2017
9	Myobatrachidae	Uperoleia trachyderma	Blacksoil Toadlet	Y	2017

BIRDS

	Family	Scientific Name	Common Name	2017	Most recent record
1	Corcoracidae	Struthidea cinerea	Apostlebird	Y	2017
2	Anhingidae	Anhinga novaehollandiae	Australasian Darter	Y	2017
3	Podicipedidae	Tachybaptus novaehollandiae	Australasian Grebe	Y	2017
4	Motacillidae	Anthus novaeseelandiae	Australasian Pipit	Y	2017
5	Otididae	Ardeotis australis	Australian Bustard	Y	2017
6	Falconidae	Falco longipennis	Australian Hobby	Y	2017
7	Artamidae	Gymnorhina tibicen	Australian Magpie	Y	2017
8	Aegothelidae	Aegotheles cristatus	Australian Owlet-nightjar	Y	2017
9	Pelicanidae	Pelecanus conspicillatus	Australian Pelican	Y	2017
10	Glareolidae	Stiltia isabella	Australian Pratincole	Y	2017
11	Acrocephalidae	Acrocephalus australis	Australian Reed-Warbler		1993
12	Psittaculidae	Barnardius zonarius	Australian Ringneck	Y	2017
13	Threskiornithidae	Threskiornis moluccus	Australian White Ibis	Y	2017
14	Anatidae	Chenonetta jubata	Australian Wood Duck	Y	2017
15	Meliphagidae	Cissomela pectoralis	Banded Honeyeater		1995
16	Meliphagidae	Ramsayornis fasciatus	Bar-breasted Honeyeater		1984
17	Columbidae	Geopelia humeralis	Bar-shouldered Dove		2000
18	Accipitridae	Milvus migrans	Black Kite	Y	2017
19	Accipitridae	Hamirostra melanosternon	Black-breasted Buzzard	Y	2017
20	Meliphagidae	Melithreptus gularis	Black-chinned Honeyeater	Y	2017
21	Campephagidae	Coracina novaehollandiae	Black-faced Cuckoo-shrike	Y	2017
22	Artamidae	Artamus cinereus	Black-faced Woodswallow	Y	2017
23	Charadriidae	Elseyornis melanops	Black-fronted Dotterel	Y	2017
24	Ciconiidae	Ephippiorhynchus asiaticus	Black-necked Stork		2006
25	Rallidae	Tribonyx ventralis	Black-tailed Native-hen	Y	2017
26	Climacteridae	Climacteris melanura	Black-tailed Treecreeper		2000
27	Recurvirostridae	Himantopus leucocephalus	Black-winged Stilt	Y	2017
28	Meliphagidae	Entomyzon cyanotis	Blue-faced Honeyeater		2000

	Family	Scientific Name	Common Name	2017	Most recent record
29	Gruidae	Antigone rubicunda	Brolga	Y	2017
30	Falconidae	Falco berigora	Brown Falcon	Y	2017
31	Accipitridae	Accipiter fasciatus	Brown Goshawk	Y	2017
32	Meliphagidae	Lichmera indistincta	Brown Honeyeater	Y	2017
33	Phasianidae	Synoicus ypsilophora	Brown Quail	Y	2017
34	Psittaculidae	Melopsittacus undulatus	Budgerigar	Y	2017
35	Burhinidae	Burhinus grallarius	Bush Stone-curlew	Y	2017
36	Laridae	Hydroprogne caspia	Caspian Tern	Y	2017
37	Cacatuidae	Nymphicus hollandicus	Cockatiel	Y	2017
38	Accipitridae	Accipiter cirrocephalus	Collared Sparrowhawk	Y	2017
39	Columbidae	Phaps chalcoptera	Common Bronzewing	Y	2017
40	Scolopacidae	Tringa nebularia	Common Greenshank		1996
41	Laridae	Gelochelidon nilotica	Common Gull-billed Tern		2000
42	Scolopacidae	Actitis hypoleucos	Common Sandpiper		1995
43	Columbidae	Ocyphaps lophotes	Crested Pigeon	Y	2017
44	Columbidae	Geopelia cuneata	Diamond Dove	Y	2017
45	Estrildidae	Taeniopygia bichenovii	Double-barred Finch	Y	2017
46	Tytonidae	Tyto javanica	Eastern Barn Owl		1982
47	Casuariidae	Dromaius novaehollandiae	Emu		1999
48	Rallidae	Fulica atra	Eurasian Coot	Y	2017
49	Hirundinidae	Petrochelidon ariel	Fairy Martin	Y	2017
50	Columbidae	Phaps histrionica	Flock Bronzewing		1996
51	Apodidae	Apus pacificus	Fork-tailed Swift		1985
52	Anatidae	Stictonetta naevosa	Freckled Duck		1993
53	Cacatuidae	Eolophus roseicapilla	Galah	Y	2017
54	Threskiornithidae	Plegadis falcinellus	Glossy Ibis	Y	2017
55	Phalacrocoracidae	Phalacrocorax carbo	Great Cormorant	Y	2017
56	Podicipedidae	Podiceps cristatus	Great Crested Grebe	Y	2017

	Family	Scientific Name	Common Name	2017	Most recent record
57	Ardeidae	Ardea alba	Great Egret	Y	2017
58	Pachycephalidae	Colluricincla harmonica	Grey Shrike-thrush		2000
59	Anatidae	Anas gracilis	Grey Teal	Y	2017
60	Pomatostomidae	Pomatostomus temporalis	Grey-crowned Babbler	Y	2017
61	Campephagidae	Coracina maxima	Ground Cuckoo-shrike	Y	2017
62	Anatidae	Aythya australis	Hardhead	Y	2017
63	Podicipedidae	Poliocephalus poliocephalus	Hoary-headed Grebe	Y	2017
64	Petroicidae	Melanodryas cucullata	Hooded Robin		1999
65	Cuculidae	Chalcites basalis	Horsfield's Bronze-cuckoo	Y	2017
66	Alaudidae	Mirafra javanica	Horsfield's Bushlark	Y	2017
67	Ardeidae	Ardea intermedia	Intermediate Egret	Y	2017
68	Petroicidae	Microeca fascinans	Jacky Winter	Y	2017
69	Phalacrocoracidae	Phalacrocorax sulcirostris	Little Black Cormorant	Y	2017
70	Turnicidae	Turnix velox	Little Button-quail	Y	2017
71	Cacatuidae	Cacatua sanguinea	Little Corella		1996
72	Corvidae	Corvus bennetti	Little Crow	Y	2017
73	Scolopacidae	Numenius minutus	Little Curlew		1995
74	Accipitridae	Hieraaetus morphnoides	Little Eagle		2000
75	Ardeidae	Egretta garzetta	Little Egret	Y	2017
76	Meliphagidae	Philemon citreogularis	Little Friarbird	Y	2017
77	Phalacrocoracidae	Microcarbo melanoleucos	Little Pied Cormorant	Y	2017
78	Phalacrocoracidae	Microcarbo melanoleucos	Little Pied Cormorant	Y	2017
79	Anseranatidae	Anseranas semipalmata	Magpie Goose		1995
80	Monarchidae	Grallina cyanoleuca	Magpie-lark	Y	2017
81	Scolopacidae	Tringa stagnatilis	Marsh Sandpiper		2000
82	Charadriidae	Vanellus miles	Masked Lapwing	Y	2017
83	Artamidae	Artamus personatus	Masked Woodswallow	Y	2017
84	Dicaeidae	Dicaeum hirundinaceum	Mistletoebird	Y	2017

	Family	Scientific Name	Common Name	2017	Most recent record
85	Falconidae	Falco cenchroides	Nankeen Kestrel	Y	2017
86	Ardeidae	Nycticorax caledonicus	Nankeen Night-heron	Y	2017
87	Oriolidae	Oriolus sagittatus	Olive-backed Oriole	Y	2017
88	Glareolidae	Glareola maldivarum	Oriental Pratincole		1996
89	Anatidae	Anas superciliosa	Pacific Black Duck	Y	2017
90	Cuculidae	Heteroscenes pallidus	Pallid Cuckoo	Y	2017
91	Columbidae	Geopelia placida	Peaceful Dove	Y	2017
92	Falconidae	Falco peregrinus	Peregrine Falcon		1986
93	Artamidae	Cracticus nigrogularis	Pied Butcherbird	Y	2017
94	Phalacrocoracidae	Phalacrocorax varius	Pied Cormorant	Y	2017
95	Anatidae	Malacorhynchus membranaceus	Pink-eared Duck	Y	2017
96	Anatidae	Dendrocygna eytoni	Plumed Whistling-duck	Y	2017
97	Rallidae	Porphyrio porphyrio	Purple Swamphen	Y	2017
98	Meropidae	Merops ornatus	Rainbow Bee-eater	Y	2017
99	Maluridae	Malurus melanocephalus	Red-backed Fairy-wren	Y	2017
100	Alcedinidae	Todiramphus pyrrhopygius	Red-backed Kingfisher	Y	2017
101	Pardalotidae	Pardalotus rubricatus	Red-browed Pardalote	Y	2017
102	Charadriidae	Charadrius ruficapillus	Red-capped Plover	Y	2017
103	Petroicidae	Petroica goodenovii	Red-capped Robin	Y	2017
104	Turnicidae	Turnix pyrrhothorax	Red-chested Button-quail	Y	2017
105	Psittaculidae	Trichoglossus rubritorquis	Red-collared Lorikeet	Y	2017
106	Charadriidae	Erythrogonys cinctus	Red-kneed Dotterel	Y	2017
107	Recurvirostridae	Recurvirostra novaehollandiae	Red-necked Avocet		1995
108	Cacatuidae	Calyptorhynchus banksii	Red-tailed Black-cockatoo	Y	2017
109	Psittaculidae	Aprosmictus erythropterus	Red-winged Parrot		2000
110	Monarchidae	Myiagra inquieta	Restless Flycatcher	Y	2017
111	Threskiornithidae	Platalea regia	Royal Spoonbill	Y	2017
112	Locustellidae	Cincloramphus mathewsi	Rufous Songlark	Y	2017

	Family	Scientific Name	Common Name	2017	Most recent record
113	Pachycephalidae	Pachycephala rufiventris	Rufous Whistler	Y	2017
114	Meliphagidae	Conopophila rufogularis	Rufous-throated Honeyeater	Y	2017
115	Alcedinidae	Todiramphus sanctus	Sacred Kingfisher		2000
116	Scolopacidae	Calidris acuminata	Sharp-tailed Sandpiper		1985
117	Laridae	Chroicocephalus novaehollandiae	Silver Gull	Y	2017
118	Meliphagidae	Lichenostomus virescens	Singing Honeyeater		2000
119	Strigidae	Ninox boobook	Southern Boobook	Y	2017
120	Meliphagidae	Acanthagenys rufogularis	Spiny-cheeked Honeyeater		1984
121	Accipitridae	Circus assimilis	Spotted Harrier	Y	2017
122	Eurostopodidae	Eurostopodus argus	Spotted Nightjar	Y	2017
123	Threskiornithidae	Threskiornis spinicollis	Straw-necked Ibis	Y	2017
124	Pardalotidae	Pardalotus striatus	Striated Pardalote	Y	2017
125	Accipitridae	Circus approximans	Swamp Harrier		1993
126	Scolopacidae	Gallinago megala	Swinhoe's Snipe		1995
127	Podargidae	Podargus strigoides	Tawny Frogmouth	Y	2017
128	Corvidae	Corvus orru	Torresian Crow	Y	2017
129	Hirundinidae	Petrochelidon nigricans	Tree Martin		2000
130	Psittaculidae	Psitteuteles versicolor	Varied Lorikeet		1995
131	Neosittidae	Daphoenositta chrysoptera	Varied Sittella	Y	2017
132	Maluridae	Malurus lamberti	Variegated Fairy-wren	Y	2017
133	Anatidae	Dendrocygna arcuata	Wandering Whistling-Duck		1996
134	Accipitridae	Aquila audax	Wedge-tailed Eagle	Y	2017
135	Acanthizidae	Smicrornis brevirostris	Weebill	Y	2017
136	Laridae	Chlidonias hybrida	Whiskered Tern	Y	2017
137	Accipitridae	Haliastur sphenurus	Whistling Kite	Y	2017
138	Accipitridae	Haliaeetus leucogaster	White-bellied Sea-eagle		1995
139	Artamidae	Artamus leucorynchus	White-breasted Woodswallow	Y	2017
140	Artamidae	Artamus superciliosus	White-browed Woodswallow	Y	2017
	Family	Scientific Name	Common Name	2017	Most recent record
-----	-------------------	--------------------------	--------------------------	------	-----------------------
141	Ardeidae	Egretta novaehollandiae	White-faced Heron	Y	2017
142	Ardeidae	Ardea pacifica	White-necked Heron	Y	2017
143	Meliphagidae	Ptilotula penicillata	White-plumed Honeyeater	Y	2017
144	Laridae	Chlidonias leucopterus	White-winged Black Tern		1995
145	Campephagidae	Lalage tricolor	White-winged Triller	Y	2017
146	Rhipiduridae	Rhipidura leucophrys	Willie Wagtail	Y	2017
147	Scolopacidae	Tringa glareola	Wood Sandpiper		1992
148	Threskiornithidae	Platalea flavipes	Yellow-billed Spoonbill		2000
149	Meliphagidae	Manorina flavigula	Yellow-throated Miner	Y	2017
150	Meliphagidae	Lichenostomus flavescens	Yellow-tinted Honeyeater		2000
151	Estrildidae	Taeniopygia guttata	Zebra Finch	Y	2017

Appendix B. Updated plant checklist for Longreach Waterhole Conservation Reserve

N.B. Species identified with a "Y" in the 2017 column were recorded in the 2017 survey. Likewise, species identified with a "Y" in the 1990 column were recorded in the 1990 vegetation survey. Species identified with a "Y" in the New Collection Column have not previously been collected from the reserve according to the NT Herbarium database. Introduced species are marked with an asterisk (*).

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
1	Acanthaceae	Hygrophila angustifolia	Hygrophila	Y		Y
2	Acanthaceae	Rostellularia adscendens	Pinktongues, Purple Pipe-cleaner	Y		Y
3	Aizoaceae	Trianthema pilosa	Trianthema	Y	Υ	Υ
4	Amaranthaceae	Alternanthera angustifolia	Narrow-leaf Joyweed	Y	Υ	Y
5	Amaranthaceae	Alternanthera nana	Hairy Joyweed		Υ	Y
6	Amaranthaceae	Alternanthera nodiflora	Common Joyweed	Y	Υ	Y
7	Amaranthaceae	Amaranthus cochleitepalus	Amaranthus	Y	Υ	Υ
8	Amaranthaceae	Amaranthus interruptus	Native Amaranth	Y	Υ	Y
9	Amaranthaceae	Gomphrena breviflora	Gomphrena	Y		Υ
10	Amaranthaceae	Gomphrena canescens	Batchelors Buttons, Pink Everlasting	Y		Y
11	Amaranthaceae	Gomphrena lanata	Gomphrena	Y	Υ	Y
12	Amaranthaceae	Gomphrena leptophylla	Gomphrena	Y		Y
13	Amaranthaceae	Ptilotus fusiformis	Skeleton Plant, Pom-pom Bottlebrush	Y		Y
14	Amaranthaceae	Ptilotus spicatus	Ptilotus	Y		Y
15	Amaranthaceae	Salsola australis	Buckbush, Tumbleweed,	Y		Y
16	Amaryllidaceae	Crinum arenarium	Crinum Lily, Field Lily	Y		Y
17	Apocynaceae	*Calotropis procera	Rubber Bush	Y		Y
18	Apocynaceae	Carissa lanceolata	Conkerberry, Conkle Berry	Y	Υ	Y
19	Apocynaceae	Cynanchum viminale subsp. australe	Caustic Vine	Y	Υ	Y
20	Apocynaceae	Marsdenia australis	Bush Banana	Y	Υ	Y
21	Apocynaceae	Marsdenia viridiflora subsp. tropica	Bush Banana			Ν
22	Apocynaceae	Secamone elliptica	Secamone	Y		Υ

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
23	Asteraceae	Blumea saxatilis	Blumea	Υ		Υ
24	Asteraceae	Blumea tenella	Blumea	Υ		Υ
25	Asteraceae	Centipeda minima subsp. minima	Centipeda	Υ	Y	Υ
26	Asteraceae	Gnaphalium diamantinensis	Gnaphalium			Ν
27	Asteraceae	Gnephosis eriocarpa	Low Billybuttons, Native Camomile	Υ		Υ
28	Asteraceae	Pluchea ferdinandi-muelleri	Pluchea	Υ		Υ
29	Asteraceae	Pseudognaphalium luteoalbum	Pseudognaphalium	Υ		Υ
30	Asteraceae	Pterocaulon serrulatum	Fruit-salad Bush, Apple Bush	Υ	Y	Υ
31	Asteraceae	Pterocaulon sphacelatum	Apple Bush, Fruit Salad Plant		Y	Υ
32	Asteraceae	Siemssenia capillaris	Wiry Podolepis		Y	Y
33	Asteraceae	Sphaeranthus indicus	Minty Pom-poms	Y		Y
34	Asteraceae	Streptoglossa bubakii	Mintbush	Y	Y	Y
35	Asteraceae	Streptoglossa odora	Aromatic Daisy, Mintbush	Y		Y
36	Asteraceae	*Tridax procumbens	Tridax Daisy	Y		Y
37	Boraginaceae	Coldenia procumbens	Coldenia	Y	Y	Υ
38	Boraginaceae	Ehretia saligna	Peachwood	Y		Y
39	Boraginaceae	Heliotropium ovalifolium	Heliotropium	Υ	Y	Υ
41	Boraginaceae	Heliotropium tanythrix	Heliotropium	Υ	Y	Υ
42	Capparaceae	Capparis lasiantha	Split-arse-jack, Wait-a-while	Υ		Υ
43	Capparaceae	Capparis loranthifolia	Wild Orange		Y	Y
44	Capparaceae	Capparis spinosa	Caper Bush, Wild Passionfruit		Y	Y
45	Capparaceae	Capparis umbonata	Wild Orange	Y	Y	Y
46	Capparaceae	Cleome tetrandra	Cleome	Y	Y	Y
47	Capparaceae	Cleome viscosa	Tickweed	Y	Y	Y
48	Caryophyllaceae	Polycarpaea corymbosa	Polycarpaea	Y	Y	Y
49	Combretaceae	Macropteranthes kekwickii	Bullwaddy	Y	Y	Y
50	Combretaceae	Terminalia canescens	Winged Nut Tree	Y		Y
51	Combretaceae	Terminalia volucris	Rosewood, Yellow Wood	Y		Y

	FAMILY	SPECIES	Common Name	2017	1990	New Collection
52	Commelinaceae	Commelina ensifolia	Wandering Jew	Y		Y
53	Commelinaceae	Murdannia graminea	Pink Swamp Lily	Y		Y
54	Convolvulaceae	Bonamia alatisemina	Bonamia		Υ	Y
55	Convolvulaceae	Bonamia deserticola	Creep Weed	Y	Υ	Y
56	Convolvulaceae	Bonamia media	Common Bonamia	Y		Ν
57	Convolvulaceae	Evolvulus alsinoides var. decumbens	Blue Periwinkle		Υ	Y
58	Convolvulaceae	Evolvulus alsinoides var. villosicalyx	Blue Periwinkle	Y	Υ	Y
59	Convolvulaceae	Ipomoea coptica	Ipomoea	Y		Y
60	Convolvulaceae	Ipomoea diamantinensis	Desert Cow Vine	Y	Υ	Y
61	Convolvulaceae	Ipomoea polymorpha	Silky Cow Vine	Y	Υ	Y
62	Convolvulaceae	Ipomoea racemigera	Ipomoea	Y		Y
63	Convolvulaceae	Polymeria longifolia	Erect Bindweed	Y	Υ	Y
64	Cucurbitaceae	Citrullus colocynthis	Bitter Paddy Melon		Y	Y
65	Cucurbitaceae	*Citrullus lanatus	Paddy Melon, Pie Melon	Y	Y	Y
66	Cyperaceae	Bulbostylis barbata	Short-leaved Rush, Dainty Sedge	Y		Y
67	Cyperaceae	Cyperus bifax	Downs Nutgrass, Nutgrass	Y	Y	Y
68	Cyperaceae	Cyperus difformis	Variable-leaf Sedge, Nutgrass	Y		Y
69	Cyperaceae	Cyperus iria	Variable Sedge, Nutgrass	Y	Y	Y
70	Cyperaceae	Cyperus pygmaeus	Dwarf Sedge, Nutgrass	Y	Y	Y
71	Cyperaceae	Eleocharis atropurpurea	Eleocharis	Y		Ν
72	Cyperaceae	Eleocharis pallens	Pale Spike-rush	Y		Y
73	Cyperaceae	Fimbristylis aestivalis	Summer Fringe-rush	Y		Y
74	Cyperaceae	Fimbristylis dichotoma	Eight Day Grass	Y	Y	Y
75	Cyperaceae	Fimbristylis littoralis var. littoralis	Fringe-rush			Ν
76	Cyperaceae	Fimbristylis microcarya	Fringe-rush	Y		Y
77	Cyperaceae	Fimbristylis phaeoleuca	Water Grass	Y		Y
78	Cyperaceae	Fimbristylis rara	Salt Fringe-rush	Y		Y
79	Cyperaceae	Schoenoplectiella dissachantha	Schoenoplectus	Y		Ν

	FAMILY	SPECIES	Common Name	2017	1990	New Collection
80	Elatinaceae	Bergia barklyana	Bergia		Y	Y
81	Elatinaceae	Bergia pedicellaris	Bergia	Y	Y	Υ
83	Euphorbiaceae	Euphorbia biconvexa	Euphorbia	Y		Y
84	Euphorbiaceae	Euphorbia schultzii var. comans	Euphorbia	Y		Υ
86	Euphorbiaceae	Excoecaria parvifolia	Guttapercha	Y	Y	Υ
87	Euporbiaceae	Euphorbia drummondii	Caustic Weed		Y	Υ
88	Fabaceae	Acacia ancistrocarpa	Fitzroy Wattle	Y		Υ
89	Fabaceae	Acacia colei	Wattle	Y	Y	Υ
90	Fabaceae	Acacia hemignosta	Club-leaf Wattle	Y		Υ
91	Fabaceae	Acacia holosericea	Candelabra Wattle, Soap Bush	Y	Y	Υ
92	Fabaceae	Acacia lysiphloia	Turpentine	Y		Υ
93	Fabaceae	Acacia monticola	Hill Turpentine	Y		Υ
94	Fabaceae	Acacia sp. Urandangie	Wattle	Y		Υ
95	Fabaceae	Acacia stenophylla	River Cooba	Y	Y	Υ
96	Fabaceae	Achyranthes aspera	Chaff-flower	Y	Y	Υ
97	Fabaceae	Aeschynomene indica	Budda Pea	Y	Y	Υ
98	Fabaceae	Alysicarpus muelleri	Rough Chain-pea		Y	Υ
99	Fabaceae	Bauhinia cunninghamii	Bauhinia, Bean Tree	Y	Y	Υ
100	Fabaceae	Chamaecrista symonii	Dwarf Cassia			Ν
101	Fabaceae	Crotalaria medicaginea	Clover-leaf Rattlepod, Trefoil Rattlepod	Y	Y	Υ
102	Fabaceae	Crotalaria montana	Rattlepod	Y		Υ
103	Fabaceae	Crotalaria ramosissima	Rattlepod	Y		Υ
104	Fabaceae	Cullen australasicum	Tall Verbine			Ν
105	Fabaceae	Cullen cinereum	Annual Verbine, Native Lucerne	Y	Y	Υ
106	Fabaceae	Desmodium filiforme	Narrow Necklace Pea	Y		Υ
107	Fabaceae	Desmodium muelleri	Mueller's Necklace Pea	Y	Y	Υ
108	Fabaceae	Dichrostachys spicata	Chinese Lantern	Y	Y	Y
109	Fabaceae	Flemingia pauciflora	Fleming's Bush	Y		Y

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
110	Fabaceae	Glycine falcata	Fringed Glycine	Y	Υ	Υ
111	Fabaceae	Indigofera colutea	Sticky Indigo	Y	Υ	Υ
112	Fabaceae	Indigofera hirsuta	Hairy Indigo	Y	Υ	Υ
113	Fabaceae	Indigofera linifolia	Native Indigo, Round-pod Indigo	Y	Υ	Y
114	Fabaceae	Indigofera linnaei	Birdsville Indigo	Y		Y
115	Fabaceae	Indigofera trita	Pale Indigo	Y	Υ	Y
116	Fabaceae	Neptunia dimorphantha	Sensitive Plant	Y	Υ	Y
117	Fabaceae	Neptunia monosperma	Tall Sensitive Plant	Y		Y
118	Fabaceae	*Parkinsonia aculeata	Parkinsonia	Y	Υ	Y
119	Fabaceae	Rhynchosia minima	Native Pea	Y	Υ	Y
120	Fabaceae	Senna artemisioides subsp. oligophylla	Oval-leaf Cassia, Limestone Cassia	Y		Y
121	Fabaceae	Senna costata	Senna	Y		Y
122	Fabaceae	Senna notabilis	Cockroach Bush	Y		Y
123	Fabaceae	Senna venusta	Graceful Cassia		Υ	Ν
124	Fabaceae	Sesbania brachycarpa	Purple Sesbania Pea	Y		Y
125	Fabaceae	Sesbania cannabina	Yellow Pea-bush, Sesbania Pea	Y	Υ	Υ
126	Fabaceae	*Stylosanthes hamata	Stylo	Y		Υ
127	Fabaceae	Tephrosia brachyodon var. longifolia	Narrow-leaved Tephrosia	Y		Υ
128	Fabaceae	Tephrosia lasiochlaena	Tephrosia	Y		Y
129	Fabaceae	Tephrosia leptoclada	Slender Tephrosia	Y		Y
130	Fabaceae	Tephrosia stuartii	Tephrosia	Y		Y
131	Fabaceae	Vachellia farnesiana var. farnesiana	Mimosa Bush		Y	Y
132	Fabaceae	Zornia albiflora	Zornia	Y		Y
133	Gentianaceae	Schenkia australis	Schenkia			Ν
134	Goodeniaceae	Goodenia cylindrocarpa	Goodenia	Y		Y
135	Goodeniaceae	Goodenia fascicularis	Silky Goodenia	Y		Y
136	Goodeniaceae	Goodenia lamprosperma	Goodenia	Y		Y
138	Goodeniaceae	Goodenia strangfordii	Wide-leaved Goodenia	Υ		Y

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
139	Lamiaceae	Premna acuminata	Premna	Y		Y
140	Lamiaceae	Teucrium integrifolium	Green Germander	Y	Y	Y
141	Lauraceae	Cassytha capillaris	Snotty Gobble	Y		Y
142	Loranthaceae	Amyema sp.	Mistletoe	Y		Y
143	Loranthaceae	Lysiana spathulata subsp. spathulata	Flat-leaved Mistletoe	Y		Υ
144	Loranthaceae	Lysiana subfalcata	Mistletoe	Y		Υ
145	Lythraceae	Ammannia multiflora	Jerry Jerry	Y	Y	Y
146	Lythraceae	Rotala diandra	Rotala	Y		Υ
147	Malvaceae	Abelmoschus ficulneus	Native Rosella	Y		Υ
148	Malvaceae	Abutilon fraseri	Dwarf Lantern-bush	Y	Y	Υ
149	Malvaceae	Abutilon hannii	Lantern-flower		Y	Y
150	Malvaceae	Abutilon leucopetalum	Desert Lantern-bush			Ν
151	Malvaceae	Corchorus fascicularis	Grubweed	Y	Y	Ν
152	Malvaceae	Corchorus olitorius	Jute	Y		Υ
153	Malvaceae	Corchorus walcottii	Woolly Corchorus	Y		Y
154	Malvaceae	Gossypium australe	Native Cotton, Tall Desert Rose	Y	Y	Y
155	Malvaceae	*Herissantia crispa	Bladdermallow, Curly Abutilon	Y	Y	Y
156	Malvaceae	Hibiscus pentaphyllus	Five-leaflet Hibiscus	Y		Y
157	Malvaceae	Hibiscus sturtii var. campylochlamys	Sturt's Hibiscus, Hill Hibiscus	Y		Υ
158	Malvaceae	Hibiscus verdcourtii	Hibiscus	Y		Y
160	Malvaceae	*Malvastrum americanum	Spiked Malvastrum	Y	Y	Y
161	Malvaceae	Melhania oblongifolia	Velvet Hibiscus	Y	Y	Y
162	Malvaceae	Sida fibulifera	Silver Sida, Pin Sida	Y	Y	Y
163	Malvaceae	Sida platycalyx	Lifesaver Burr, Teddy Bears Arsehole	Y		Y
164	Malvaceae	Sida rohlenae	Shrub Sida	Y		Y
165	Malvaceae	Sida spinosa	Spiny Sida	Y	Y	Y
166	Malvaceae	Triumfetta appendiculata	Triumfetta	Y	Y	Y
167	Malvaceae	Waltheria indica	Waltheria	Y	Y	Υ

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
168	Marsileaceae	Marsilea exarata	Little Nardoo	Y	Y	Y
170	Menispermaceae	Tinospora smilacina	Snake Vine	Y	Υ	Y
171	Molluginaceae	Glinus lotoides	Hairy Carpet Weed	Y	Υ	Y
172	Molluginaceae	Mollugo molluginis	Mollugo	Y		Y
173	Myoporaceae	Myoporum montanum	Desert Boobialla		Υ	Y
174	Myrtaceae	Corymbia dichromophloia	Small-fruited Bloodwood	Y		Y
175	Myrtaceae	Corymbia ferruginea	Rusty Bloodwood			Ν
176	Myrtaceae	Eucalyptus barklyensis	Eucalyptus	Y		Ν
177	Myrtaceae	Eucalyptus camaldulensis subsp. obtusa	River Red Gum	Y		Ν
178	Myrtaceae	Eucalyptus microtheca	Coolabah	Y	Υ	Y
179	Myrtaceae	Lophostemon grandiflorus	Northern Swamp Box	Y	Y	Y
180	Myrtaceae	Melaleuca nervosa	Yellow-barked Paperbark			Ν
181	Nyctiginaceae	Boerhavia coccinea	Tar Vine	Y		Y
182	Nytaginaceae	Boerhavia paludosa	Black-soil Tar Vine	Y	Υ	Y
183	Onagraceae	Ludwigia perennis	Upright Primrose	Y	Υ	Y
184	Orobanchaceae	Buchnera linearis	Dainty Bush Flower	Y		Y
185	Phyllanthaceae	Flueggea virosa	White Currant	Y	Υ	Ν
186	Phyllanthaceae	Phyllanthus maderaspatensis	Spurge	Y	Y	Y
188	Phyllanthaceae	Synostemon trachyspermus	Synostemon	Y		Y
189	Plantaginaceae	Bacopa floribunda	Васора	Y		Y
190	Plantaginaceae	Stemodia florulenta	Blue-rod	Y		Y
191	Plantaginaceae	Stemodia glabella	Smooth Blue-rod	Y		Y
192	Plantaginaceae	Stemodia sp. Manners Creek	Stemodia	Y		Ν
193	Plantaginaceae	Stemodia tephropelina	Stemodia	Y		Y
194	Poaceae	Aristida contorta	Bunched Kerosene Grass	Y	Υ	Y
195	Poaceae	Aristida holathera	Erect Kerosene Grass, Wiregrass	Y	Y	Y
196	Poaceae	Aristida hygrometrica	Northern Kerosene Grass	Y	Y	Y
197	Poaceae	Aristida inaequiglumis	Curly Wiregrass	Y	Y	Y

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
198	Poaceae	Aristida latifolia	Feathertop Wiregrass	Y	Y	Y
199	Poaceae	Aristida pruinosa	Gulf Feathertop Wiregrass	Y	Y	Y
200	Poaceae	Astrebla elymoides	Hoop Mitchell Grass, Weeping Mitchell Grass	Y	Y	Y
201	Poaceae	Astrebla pectinata	Barley Mitchell Grass		Y	Y
202	Poaceae	Bothriochloa ewartiana	Desert Bluegrass	Y		Y
203	Poaceae	Brachyachne convergens	Native Couch, Spider Grass	Y	Y	Y
204	Poaceae	Cenchrus basedowii	Asbestos Grass	Y	Y	Y
205	Poaceae	*Cenchrus biflorus	Gallons Curse	Y	Y	Y
206	Poaceae	*Cenchrus ciliaris	Buffel Grass	Y	Y	Υ
207	Poaceae	Chloris pectinata	Comb Windmill Grass	Y	Y	Y
208	Poaceae	Chrysopogon fallax	Golden Beard Grass, Ribbon Grass	Y	Y	Y
209	Poaceae	Cymbopogon bombycinus	Lemon-scented Grass	Y		Y
210	Poaceae	Dactyloctenium radulans	Button Grass, Finger Grass	Y	Y	Y
211	Poaceae	Dichanthium fecundum	Curly Bluegrass	Y	Y	Υ
212	Poaceae	Dichanthium sericeum subsp. humilius	Dwarf Bluegrass	Y		Y
213	Poaceae	Dichanthium sericeum subsp. polystachyum	Tassel Bluegrass	Y		Y
214	Poaceae	*Digitaria bicornis	Finger Grass	Y		Y
215	Poaceae	Digitaria brownii	Cotton Panic Grass	Y		Y
216	Poaceae	Digitaria divaricatissima var. divaricatissima	Finger Panic Grass		Y	Y
217	Poaceae	Dinebra neesii	Swamp Grass		Y	Y
218	Poaceae	*Echinochloa colona	Awnless Barnyard Grass	Y	Y	Y
219	Poaceae	Echinochloa elliptica	Echinochloa			Ν
220	Poaceae	Ectrosia scabrida	Hares-foot Grass	Y	Y	Y
221	Poaceae	Elytrophorus spicatus	Spike Grass	Y		Ν
222	Poaceae	Enneapogon avenaceus	Native Oat-grass		Y	Y
223	Poaceae	Enneapogon pallidus	Pale Bottlewasher	Y		Ν
224	Poaceae	Enneapogon polyphyllus	Woolly Oat-grass	Y	Y	Y
225	Poaceae	Enteropogon ramosus	Creek Windmill Grass, Curly Windmill Grass	Y		Y

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
226	Poaceae	Eragrostis confertiflora	Spike Lovegrass	Y		Υ
227	Poaceae	Eragrostis cumingii	Fairy Grass, Cumings Lovegrass	Y	Y	Y
228	Poaceae	Eragrostis falcata	Sickle Lovegrass	Y	Y	Υ
229	Poaceae	Eragrostis setifolia	Neverfail	Y	Y	Υ
230	Poaceae	Eragrostis tenellula	Delicate Lovegrass	Y	Y	Υ
231	Poaceae	Eriachne armittii	Longawn Wanderrie Grass, Annual Wanderrie Grass	Y		Υ
232	Poaceae	Eriachne basalis	Wanderrie Grass	Y		Y
233	Poaceae	Eriachne ciliata	Slender Wanderrie, Wanderrie Grass	Y		Y
234	Poaceae	Eriachne mucronata	Mountain Wanderrie Grass, Wanderrie Grass	Y		Y
235	Poaceae	Eriachne obtusa	Northern Wanderrie, Wanderrie Grass	Y	Y	Υ
236	Poaceae	Eriochloa crebra	Tall Cupgrass	Y		Υ
237	Poaceae	Eriochloa pseudoacrotricha	Perennial Cupgrass		Y	Υ
238	Poaceae	Eulalia aurea	Silky Browntop	Y	Y	Υ
239	Poaceae	Heteropogon contortus	Bunch Speargrass, Black Speargrass	Y		Υ
240	Poaceae	Iseilema fragile	Slender Flinders Grass, Flinders Grass	Y		Υ
241	Poaceae	Iseilema macratherum	Bull Flinders Grass, Flinders Grass	Y		Υ
242	Poaceae	Iseilema vaginiflorum	Red Flinders Grass, Flinders Grass	Y	Y	Υ
243	Poaceae	Iseilema windersii	Scented Flinders Grass, Flinders Grass	Y		Υ
244	Poaceae	Leptochloa digitata	Umbrella Canegrass		Y	Υ
245	Poaceae	Panicum decompositum	Native Millet, Native Panic	Y		Y
246	Poaceae	Panicum laevinode	Pepper Grass	Y	Y	Y
247	Poaceae	Paraneurachne muelleri	Spinifex Couch, Northern Mulga Grass	Y	Y	Y
248	Poaceae	Paspalidium rarum	Bunch Paspalidium	Y		Y
249	Poaceae	Paspalidium retiglume	Paspalidium	Y		Y
250	Poaceae	Perotis rara	Comet Grass		Y	Y
251	Poaceae	Pseudoraphis spinescens	Swamp Grass, Spiny Mudgrass	Y	Y	Y
252	Poaceae	Schizachyrium fragile	Firegrass, Red Spathe Grass	Y		Y
253	Poaceae	Sehima nervosum	Rats Tail Grass, White Grass	Y		Y

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
254	Poaceae	Sporobolus australasicus	Australian Dropseed, Fairy Grass	Y	Υ	Y
255	Poaceae	Sporobolus mitchellii	Rat-tail Couch	Y	Υ	Y
256	Poaceae	Themeda avenacea	Tall Oat Grass, Oat Kangaroo Gras	Y		Y
257	Poaceae	Tragus australianus	Small Burrgrass		Υ	Y
258	Poaceae	Triodia bitextura	Soft Spinifex, Feathertop Spinifex	Y		Y
259	Poaceae	Triodia pungens	Soft Spinifex		Υ	Y
260	Poaceae	Urochloa piligera	Hairy Armgrass	Y		Y
261	Poaceae	Urochloa praetervisa	Large Armgrass		Υ	Y
262	Poaceae	Whiteochloa cymbiformis	Native Panic	Y	Υ	Y
263	Poaceae	Yakirra australiensis	Desert Flinders Grass	Y		Y
264	Polygonaceae	Duma florulenta	Lignum		Υ	Y
265	Portulacaceae	Portulaca filifolia	Slender Pigweed	Y	Υ	Ν
266	Portulacaceae	Portulaca oleracea	Pigweed, Munyeroo	Y	Υ	Y
267	Proteaceae	Grevillea striata	Beefwood	Y		Y
268	Proteaceae	Hakea arborescens	Yellow Hakea, Tree Hakea	Y		Y
269	Proteaceae	Hakea chordophylla	Northern Corkwood	Y		Y
270	Rhamnaceae	Ventilago viminalis	Supplejack	Y		Ν
271	Rubiaceae	Dentella minutissima	Dentella	Y	Υ	Y
		Oldenlandia mitrasacmoides subsp.				
272	Rubiaceae	mitrasacmoides	Oldenlandia	Y		Y
273	Rubiaceae	Spermacoce argillacea	Spermacoce	Y		Ν
274	Rubiaceae	Spermacoce dolichosperma	Spermacoce	Y		Y
275	Rubiaceae	Spermacoce hillii	Spermacoce	Y		Y
277	Sapindaceae	Atalaya hemiglauca	Whitewood	Y	Υ	Y
278	Sapindaceae	Dodonaea physocarpa	Balloon Hopbush, Chinese Lantern Hopbush	Y	Υ	Y
279	Scrophulariaceae	Eremophila bignoniiflora	Bignonia Emu-bush	Y		Y
280	Scrophulariaceae	Eremophila goodwinii subsp. ecapitata	Purple Fuschia Bush	Y		Y
281	Scrophulariaceae	Eremophila longifolia	Emu Bush	Y		Y

						New
	FAMILY	SPECIES	Common Name	2017	1990	Collection
282	Solanaceae	Solanum tumulicola	Black-soil Wild Tomato	Y	Υ	Y
283	Violaceae	Hybanthus aurantiacus	Orange Spade Flower	Υ		Ν
284	Violaceae	Hybanthus enneaspermus	Blue Spade Flower	Υ	Υ	Y
285	Zygophyllaceae	Tribulopis angustifolia	Tribulopis	Υ	Υ	Y
286	Zygophyllaceae	Tribulus eichlerianus	Bindieye	Υ	Υ	Υ

Appendix C 2017 vegetation sampling pro forma.

Longreach Waterhole Vegetation Survey 2017

Site Number Site Coord	inates _{Lat:}	Fire impact	Last burnt:
	Long:		Observations:
Date			
Observers			

Trees

	Species	Size Class	Height (mean)	Crown Diam (mean)	CSR (mean)	DBH (mean)	% Dead (10 inc)	Observations
1.								
2.								
3.								
4.								
5.								
6.								

Shrubs

		Crown	
	Species	Diam	Observations
1.			
2.			
3.			
4.			
5.			
6.			
9.			
10.			

Herb	S			
		Growth		
	Species	Form	CSR	Observations
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
27.				

Appendix D Site photographs

Site LR01 (April 2017)



Site LR02 (July 2017)



Site LR03 (April 2017)



Site LR04 (July 2017)



Site LR05 (April 2017)



Site LR06 (April 2017)



Site LR07 (April 2017)



Site LR09 (July 2017)



Site LR10 (April 2017)



Site LR12 (April 2017)



Site LR14 (April 2017)



Site LR15 (April 2017)



Site LR16 (July 2017)



Site LR17 (July 2017)



Site LR22 (July 2017)



Site LR23 (July 2017)



Site LR24 (July 2017)



Site LR25 (July 2017)



Site LR38 (July 2017)



Site LR39 (July 2017)



Site LR40 (July 2017)



Site LR41 (July 2017)



Site LR42 (July 2017)



Site LR43 (July 2017)



Site LR44 (July 2017)



Site LR45 (July 2017)



Site LR46 (July 2017)



Site LR47 (July 2017)



Site LR48 (July 2017)



Site LR49 (July 2017)



Site LR50 (July 2017)



Site LR51 (April 2017)



Site LR52 (July 2017)



Site LR53 (April 2017)



Site LR54 (April 2017)



Site LR55 (July 2017)



Site LR56 (July 2017)



Site LR100 (July 2017)



Site LR101 (July 2017)



Site LR102 (July 2017)



Site LR103 (July 2017)

