Government of **Western Australia**

REPORT ON STAGE 2(d) OF THE 'CHRISTMAS ISLAND CAT AND BLACK RAT MANAGEMENT PLAN'

Prepared by

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REPORT OUTLINE

The purpose of this program was to continue Stage 2 of the 'Christmas Island Cat and Rat Management Plan' (Algar and Johnston 2010). Drafting the Management Plan was funded by the (then) Attorney Generals Department (later Department of Infrastructure and Regional Development) in 2009/10. Following acceptance of the suggested revisions to the current local cat management laws (*Shire of Christmas Island Local Law for the Keeping and Control of Cats 2004*) under the Local Government Act 1995 (WA) (Ci) Stage 1 of the Management Plan which involved de-sexing, micro-chipping and registration of all domestic (owned) cats on the island commenced in October 2010 and the final program was conducted in May 2012 (Algar and Hamilton 2012; Algar *et al*. in press).

The primary aim of Stage 2 of the plan was to remove all stray cats within the residential, commercial and light industrial zones of Christmas Island. This also included cats at the Immigration Detention Centre (IDC), both at North West Point (NWP) and Phosphate Hill precinct. Without implementation of Stage 2 a significant source of cats, particularly natal recruits, would be available to disperse into or reinvade territories vacated across the rest of the island (i.e. the national park and Unallocated Crown Land). Rat management was also incorporated into Stage 2. Stage 2 was required before an island-wide control program (Stage 3) could be implemented. Stage 2 has been subsequently divided into a series of sub-stages [Stage 2(a), (b), (c) and (d)] because of funding issues:

Stage 2(a)—occurred in May to June 2011 funded by Parks Australia which included a contract with the Western Australian Department of Parks and Wildlife (formerly Department of Environment and Conservation). The results of Stage 2(a) are documented in Algar *et al*. (2011a), Algar *et al*. (2011b) and Algar *et al*. (in press).

Stage 2(b)—commenced implementation from 1 July 2011 and was to be completed by the end of the 2011/12 financial year. Unfortunately the funding application for commencement of Stage 3, sent to the Commonwealth (Caring for our Country, DSEWPaC) was not granted. Following this decision, at a meeting of the various agencies involved, it was decided that it was imperative that Stage 2(b) should also include an intensive baiting program outward from the residential area. This would remove the majority of individual animals adjacent to the residential area and provide a buffer zone into which dispersing cats would move. This control effort would, to a large extent,

protect the significant investment and gains achieved in controlling stray cats until a new source of funding could be obtained the following financial year. The results of Stage 2(b) are documented in Algar and Hamilton (2012) and Algar *et al*. (in press).

Stage 2(c)—unfortunately in 2013/14, the funding application for commencement of Stage 3 was also not granted. The various land management agencies on the island each contributed funds to cover the costs of a short-term control program that would once again protect the significant investment and gains achieved in controlling stray cats until a new source of funding could be obtained. Stage 2(c) was conducted over the period 9 August–19 September 2013 and is reported in Algar and Hamilton (2013).

Stage 2(d)—the funding application for commencement of Stage 3 was granted in June 2014. A total of $1.35 million over a six year-period became available for the 'Christmas Island Feral Cat Eradication Program' as part of an environmental offset condition to Phosphate Resources Limited for Phosphate Mining in South Point, Christmas Island (EPBC 2012/6653); a decision made under sections 130(1) and 133 of the *Environmental Protection and Biodiversity Act* 1999. It was decided that Stage 3 would commence in 2015. In the interim, a short-term control program, as in Stage 2c, would be undertaken to once again protect the significant investment and gains achieved in controlling stray cats. Stage 2(d) was conducted over the period 14 October to 6 November.

The scope of works over the Stage 2(d) period was essentially the same as Stage 2(b and c) and therefore focused on: -

- continued removal of stray/feral cats in the residential, commercial and light industrial area that particularly focused on the landfill site;
- continued removal of stray/feral cats at the red-tailed tropicbird (*Phaethon rubricauda*) colonies located at the Sitting Room and Rumah Tinggi along the Settlement shoreline as recommended by Beeton *et al*. (2010);
- baiting outward from the residential area to remove the majority of cats adjacent to the residential area and provide a buffer zone into which dispersing cats would move.

This report documents the control effort for Stage 2(d) and also includes are the fifth survey for domestic cats conducted in May 2014. During May this year, the control effort also recommenced albeit limited for the month and was focussed on the removal of stray/feral cats. Cage trapping

was the primary control technique employed to remove these cats. A baiting program along the roadsides/tracks that surrounded the residential and light industrial area was also conducted from 16 October–2 November 2014.

1 BACKGROUND

There is extensive evidence that the introduction of domestic cats (*Felis catus*), to both offshore and oceanic islands around the world can have deleterious impacts on endemic land vertebrates and breeding bird populations (see Ratcliffe *et al*. 2009; Bonnaud *et al*. 2010). Feral cats have been known to drive numerous extinctions of endemic species on islands and have contributed to at least 14% of all 238 vertebrate extinctions recorded globally by the IUCN (Nogales *et al*. 2013). In addition, predation by feral cats currently threatens 8% of the 464 species listed as critically endangered (Medina *et al*. 2011; Nogales *et al*. 2013). Island faunas that have evolved for long periods in the absence of predators are particularly susceptible to cat predation (Dickman 1992). Christmas Island—a high biodiversity island—is no exception.

Four of the five mammal species that were present on the island at settlement in 1888 have since become extinct. The diurnal native bulldog rat (*Rattus nativitatus*), for example, was reportedly common at the time of settlement; while the nocturnal Maclear's rat (*R. macleari*) was extremely abundant. The Christmas Island shrew (*Crocidura attenuata trichura*) has not been seen since 1985 and is believed extinct and, most recently, the Christmas Island pipistrelle (*Pipistrellus murrayi*) is thought to have become extinct in 2009 (Martin *et al*. 2012). While several factors are likely to have contributed to the demise of these native animals including disease, habitat destruction (land clearing and natural catastrophes such as cyclones) and the proliferation of the exotic yellow crazy ant (*Anoplolepsis gracilipes*), the introduction of exotic competitors and predators such as the cat and black rat (*R. rattus*) are also crucial factors.

In addition, several extant Christmas Island species are listed as being species likely to be adversely affected by cats and/or rats. These include the endemic Christmas Island emerald dove (*Chalcophaps indica natalis*) (listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as endangered) and the red-tailed tropicbird (*Phaethon rubricauda*) (an EPBC listed marine species). This year, the EPBC listing of the white-tailed tropicbird (*P. lepturus*) has been upgraded from threatened to endangered. The forest skink (*Emoia nativitatis*) and blue-tailed skink (*Cryptoblepharus egeriae*) were listed as critically endangered in early 2014. Lister's gecko (*Lepidodactylus listeri*) was upgraded to critically endangered from vulnerable in early 2014 and the giant gecko (*Cyrtodactylus sadleiri*) listed as endangered 2014.

This impact of cats in particular, and also rats on the biodiversity of Christmas Island was of significant concern to land management agencies and the broader community. As a consequence, a 'Management Plan for Cats and Black Rats on Christmas Island' (see Algar and Johnston 2010) was commissioned that would mitigate the environmental and social impacts of cats and black rats across all land tenures (shire-managed lands, Crown land including mine leases and Christmas Island National Park). A strategy was recommended that provided a staged approach to cat and black rat management and control leading to eradication of one or both target species. This document reports on the continuation of Stage 2, [Stage 2(d), see above Report Outline].

2 METHODOLOGY

2.1 Site Description

A site description for Christmas Island is provided in detail in previous reports and publications (Algar and Hamilton 2012; Algar *et al*. in press). The location of work conducted during this current program was primarily confined to the north-east corner of the island within the residential, commercial and light industrial areas. The baiting program was also conducted along roads surrounding this area.

2.2 Domestic Cat Surveys

The `Management Plan for Cats and Black Rats on Christmas Island' (Algar and Johnston 2010) proposed a strategy to eradicate cats entirely from the island as the de-sexed domestic population died out. This was based on four actions:

1) to register and de-sex all domestic cats;
2) to destroy all non-domestic (i.e. stray and feral) cats;
3) to establish a 'cat prohibited area' along the Settlement shoreline to include the red-tailed tropicbird rookeries; and,
4) to prohibit the importation of new cats.

Cat registration was an essential first stage to two of these outcomes as it would: (i) ensure the release rather than destruction of domestic cats during trapping campaigns for stray and feral cats

and (ii) to ensure the de-sexing of all domestic cats, preventing potential natal recruitment into the domestic, stray and feral populations.

To ensure that all domestic cats were registered it was necessary to conduct a survey for domestic cats (Algar *et al*. 2011a), across the entire residential area, before the commencement of the veterinary program. The veterinary program is described in detail in Algar *et al*. (2011b).

Surveys for domestic cats were conducted prior to veterinary programs in October 2010 at the commencement of the cat management program and again in May 2011 (Algar *et al*. 2011b). The final veterinary program was conducted in May 2012 following the survey that year (Algar *et al*. 2012; Algar *et al*. in press). Subsequent surveys have been conducted in May 2013 (Algar *et al*. 2013) and May this year.

2.3 Trapping Program

The registration and de-sexing of domestic cats was the first stage of the management plan (Algar and Johnston 2010), with the second stage—the control of stray and feral cats in the residential, commercial and light industrial area—then able to proceed. The trapping program in 2014 was conducted over the period in 4–27 May. Results from the previous cat control programs (Algar and Hamilton 2012, 2013; Algar *et al*. in press) have defined areas preferred by stray cats which were targeted during the trapping program. In addition, the community continued their unrelenting support for the program and would inform us of areas where stray cats were present which were also targeted. Traps were strategically located within these sites, typically in areas likely to be food sources and thoroughfares.

Cats were captured using Sheffield wire cage traps (60x20x20 cm) with treadle plates (Sheffield Wire Products, Welshpool Western Australia). These traps were generally operated over five-day periods. All traps were covered with a hessian sack to provide shelter and protection to the captured animals until they could be collected. The traps were usually baited with cooked chicken wings (occasionally with fresh mulies (pilchards) which were treated with the insecticide Coopex to maintain the longevity of the bait by deterring insects from consuming or spoiling the bait. The baits were cable-tied to the back of the cage to reduce trap failures by increasing the time animals

spent inside a cage, thus increasing the likelihood of activating the treadle mechanism. Baits were replaced as necessary.

Trapped feral cats were euthanized by a head-shot from a 0.22 calibre air rifle. All animals captured were sexed, weighed and a broad estimation of age (as either kitten, juvenile or adult) was recorded according to their weight as a proxy for age. In addition, the pregnancy status of females was also used to determine whether the animal was an adult. The smallest weight recorded for a female that had recently given birth, at a time when sexually mature females had bred, was 2.0 kg and this was used as the minimum adult weight for female cats (see Algar and Hamilton 2012). The weight groupings for the cat age classes are provided in Table 1

Table 1. The weight groups for the cat age classes of the trapped population

Category	Male	Female
Kitten	< 1.0 kg	< 1.0 kg
Juvenile	1.0–2.4 kg	1.0–1.9 kg
Adult	2.5+ kg	2.0+ kg

2.4 Baits and the Baiting Program

The feral cat baits used (*Eradicat*®, see detailed description in Algar and Burrows 2004; Algar *et al*. 2007) were manufactured at Parks and Wildlife's Bait Manufacturing Facility at Harvey, Western Australia. Baits were transported to Christmas Island and then kept in frozen storage. Toxic feral cat baits are dosed at 4.5 mg of sodium monofluoroacetate (compound 1080) per bait. Consistent with previous baiting programs, baits were suspended from 'Bait Station Devices' (BSDs) (see Algar and Brazell 2008; Algar and Hamilton 2012, 2013; Algar *et al*. in press).

The baiting program in 2014 adopted recommendations provided in an earlier report (Algar *et al*. 2011a). In the current program only toxic baits were used, baiting along major roads was conducted over ten consecutive days. A network of BSDs was established along approximately 22 km of roadsides/tracks that surrounded the residential and light industrial area. BSDs were located at 100 m intervals on both sides of the road/track, staggered at 50 m intervals across the road/track. This year, no BSDs were established along the eastern side of Irvine Hill Rd. because of phosphate dust issues with passing vehicles. A bait, comprising two *Eradicat*® sausages tied at the link, was suspended at a height of about 400 mm from each BSD using 6–8 lb fishing line. All BSDs were inspected daily over the baiting period to assess whether baits had been removed. Bait

removal from the BSDs was used to determine the efficacy of the baiting program. Baits were replaced when taken and also routinely as required if phosphate dust raised by passing vehicles adhered to the baits and was considered likely to reduce palatability. The locations of BSDs are presented in Figure 1.

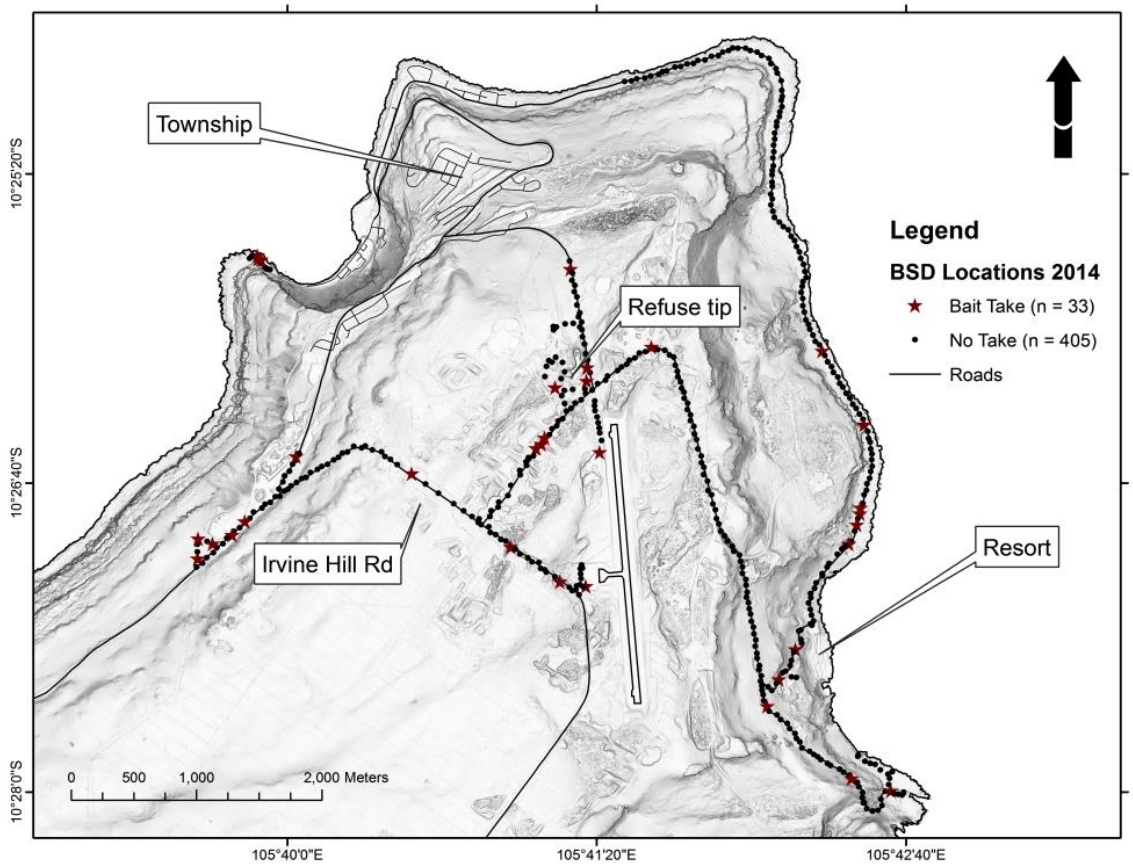

Figure 1. Network of Bait Suspension Devices surrounding the residential and light industrial area in 2014. Figure produced by D. Maple (CINP)

As bait station activity cannot be ascribed to individual feral cats, a value for the maximum and minimum number of cats poisoned was determined. The total number of toxic baits removed was considered to indicate the maximum number of individuals poisoned. The minimum number of individuals poisoned was calculated by ascribing bait removals from consecutive BSDs to the same animal, even if ten or more stations were involved. The actual number of feral cats poisoned during these programs would be between these two extremes. It was considered likely that some cats would visit multiple BSDs given the delay between bait consumption and onset of symptoms.

3 RESULTS

3.1 Domestic Cat Survey

Since October 2010, 166 cats have been registered following the three veterinary programs. The total number of domestic cats registered each year, the sex structure, the number of new registrations and number deregistered are presented in Table 2. The survey for domestic cats conducted in May 2014 revealed that of the 111 domestic cats registered in 2013 only 101 were still present. One female cat reported dead by the owner in 2013 had been located alive at a different residence in the 2014 survey and one female cat reported missing had subsequently returned to its owner. Ten cats (5 females, 5 males) were deregistered at the conclusion of this latest survey; in addition, a further two cats have been missing for at least six months and are presumed dead. Deregistered cats had either died from natural causes, were road fatalities, or destroyed as the owners had moved off island.

Table 2. Total number of domestic cats registered each year, the sex structure, the number of new registrations and number deregistered

Date	No. registered			New registers			De-registers		
	Total	**Female**	**Male**	**Total**	**Female**	**Male**	**Total**	**Female**	**Male**
October 2010	N/A	N/A	N/A	136	66	70	N/A	N/A	N/A
May 2011	138	69	69	18	10	8	16	7	9
May 2012	135	66	69	12	5	7	15	8	7
May 2013	111	53	58	0	0	0	24	13	11
May 2014	101	50	51	0	0	0	10	5	5

3.2 Trapping Program

In 2014, 517 cage trap-nights were conducted across the residential, commercial and light industrial areas. The trapping program resulted in the removal of 12 stray/feral cats (4 females, 8 males), a biomass of 31.9 kg. In addition to these cats, an unregistered male cat was relieved from its owner and destroyed. Several other cats were captured by the general public or Shire Ranger

prior to our arrival and were euthanized by CINP Rangers. Unfortunately records of these animals were not maintained and the actual number is unknown.

The general location of all trap points, trap numbers and dates of commissioning and decommissioning are presented in Appendix 1. The age classes of the trapped population are provided in Table 3 and the general location of captures in Table 4.

Table 3. The age classes of the trapped population

Category	Male	Female	Total
Kitten	0	1	1
Juvenile	2	1	3
Adult	6	2	8

Table 4. The location of captures and number of cats removed

Location	Number of cats
Trax Tavern/construction site Drumsite	5
Tip, Rec. Centre, IDC (Phosphate Hill)	4
Airport	2
Old Airport Rd.	1

Of the two adult females destroyed in 2014, one was pregnant and the other lactating.

While conducting the trapping program, no registered cats were captured.

3.3 Baiting Program

In 2014, bait removal was recorded at 33 of the 430 BSDs (7.7%) over the 10-day baiting period (only a five-day period along Smith Point Rd.). The location of bait takes are shown in Figure 1. Of these, baits were removed at four BSDs on two separate occasions giving a total of 37 baits taken (see Figure 2).

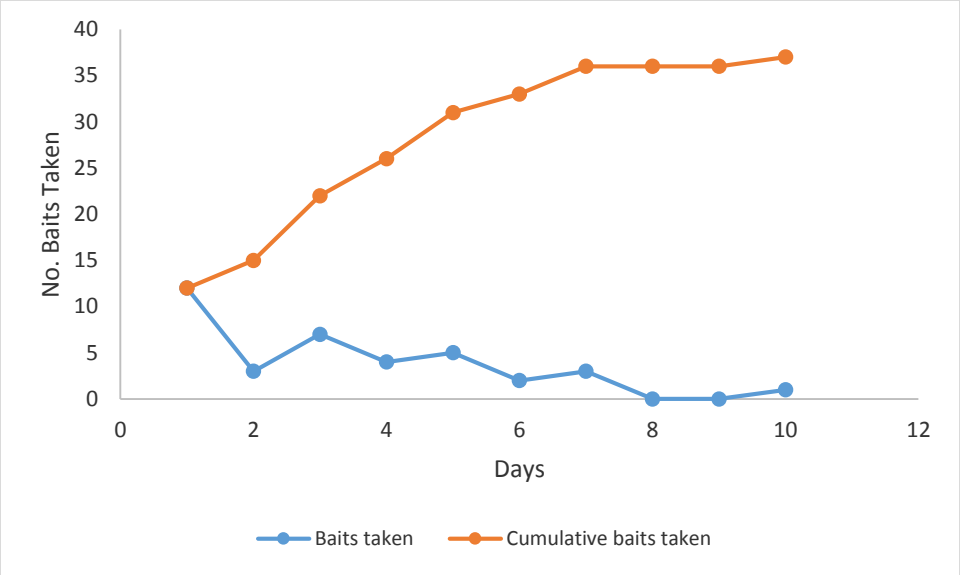

Figure 2. Number of baits removed from BSDs by feral cats in 2014

The total number of baits removed, and by inference the maximum number of individual feral cats poisoned, was 37. The minimum number of cats poisoned was 35 (Figure 3), allowing for individual cats that may have consumed baits from multiple BSDs. There were only two occurrences when consecutive baits were removed from adjoining BSDs on the same day. On one of these occasions bait removal occurred on both sides of the road (3 BSDs visited) and on the other occasion, bait removal was restricted to one side of the road only.

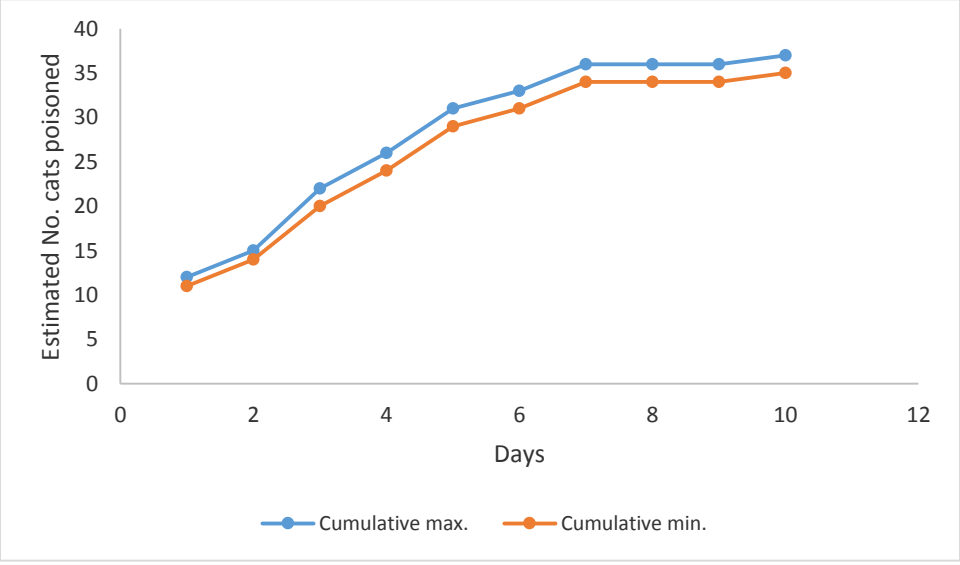

Figure 3. Estimated cumulative minimum and maximum number of feral cats poisoned following consumption of toxic *Eradicat* bait(s) in 2014

4 DISCUSSION

One hundred and sixty six domestic cats have been registered since October 2010 to the present day. Of these registered animals, 65 (39%) are now deregistered within this four-year period. The surveys for domestic cats conducted over the past four years suggest that the 'model of domestic cat decrease over time', based on an average lifespan of 15 years, is underestimated. The model indicated that domestic cats would no longer be present on Christmas Island by 2024 (Algar *et al*. 2011b) however, the attrition rate is higher than predicted, particularly because of road fatalities, and the island is likely to be free of domestic cats much earlier.

The substantial cat control effort conducted in the residential, commercial and light industrial area prior to this year, primarily through cage-trapping, has resulted in the removal of 321 stray/feral cats from the area. A further 12 animals were removed this year resulting in a total of 333 stray/feral cats having been destroyed since the program commenced. The baiting program this year resulted in the poisoning of between 35–37 feral cats along approximately 22 km of roadsides/tracks that surrounded the residential and light industrial area. In summary, as a consequence of the combined trapping and baiting programs, between 549 and 644 stray/feral cats have been removed since the commencement of the management plan (this figure does not take into account kittens *in utero* that may have survived had the female cat not been destroyed).

The intensity of control effort applied since the implementation of the 'Management Plan' is having a significant impact in reducing the feral/stray population in the residential, commercial and light industrial area. Removal of the majority of the stray/feral cat population has been noticed by much of the community who have commented on the success of the campaign and appreciate the decline in cat numbers. This population reduction is also apparent in the decline of cats removed annually following a similar level of control effort and assuming comparable vulnerability to the control techniques which is highly probable. For example, in 2013 43 animals were removed over 496 cage trap-nights; this year only 12 cats were destroyed over 517 cage trap-nights. An analogous decline in number of cats poisoned, despite similar control effort, is apparent from an examination of results from the annual baiting programs. A comparison of baiting results over the period 2012–14, along approximately the same route surrounding the residential, commercial and light industrial area, is presented in Table 5. Data are not comparable for 2011 as initially non-toxic baits were deployed until baits at individual BSDs were taken by

cats and then these were replaced with toxic baits; also the baiting program was conducted over a 20-day period.

Table 5. Comparison of baiting results over the period 2012–14

Year	No. BSDs	% BSDs where baits removed	No. cats poisoned	
			Maximum	Minimum
2012	464	12.5	74	51
2013	452	14.8	75	40
2014	430	7.7	37	35

The excellent achievements of the program are the result of a substantial effort by a number of dedicated people, made possible, in part, because of funding. Feral cat eradication programs that have failed in the past were usually attributed to lack of institutional and financial support (Campbell *et al*. 2011). This year, land management agencies on Christmas Island have secured the further funding required to see the project to its successful conclusion and ensure conservation of biodiversity. A total of $1.35 million over a six year-period has become available for the 'Christmas Island Feral Cat Eradication Program' as part of an environmental offset condition to Phosphate Resources Limited for Phosphate Mining in South Point, Christmas Island (EPBC 2012/6653); a decision made under sections 130(1) and 133 of the *Environmental Protection and Biodiversity Act* 1999.

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6 APPENDIX

6.1 Appendix 1 The general location of trap points, trap numbers and dates of commissioning and decommissioning

Location	Commissioned	Decommissioned	Trap Numbers	Trap Nights	No. Captures
Tip	4/05/2014	8/05/2014	20	100	3
Airport	9/05/2014	13/05/2014	8	40	2
Rec Centre	9/05/2014	13/05/2014	5	25	0
IDC (PH) south	9/05/2014	15/05/2014	3	18	0
22-24 J Ketam Merah	12/05/2014	19/05/2014	5	35	2
Trax tavern	12/05/2014	19/05/2014	3	21	0
57 Seaview Drive	11/05/2014	16/05/2014	3	15	0
School Bus stop	11/05/2014	16/05/2014	3	15	0
Construction Drumsite	13/05/2014	17/05/2014	5	25	2
Construction Campsite IDH	13/05/2014	19/05/2014	3	18	0
Buddah Temple Settlement, Noodle hut, supermarket	16/05/2014	22/05/2014	7	42	0
TaiJin House, Boatshed, Kampong	17/05/2014	22/05/2014	6	30	0
Old airport Rd	20/05/2014	27/05/2014	8	56	1
School	22/05/2014	26/05/2014	5	20	0
CIP Mess area end Murray Rd	19/05/2014	24/05/2014	4	20	0
Construction Drumsite	19/05/2014	24/05/2014	5	25	1
DIAC 671	16/05/2014	20/05/2014	3	12	1
Totals					