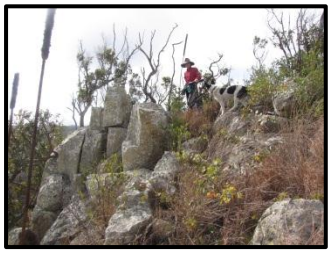
Appendix 22

Preliminary detection dog survey for Northern Quoll *Dasyurus hallucatus* on Mt Emerald, Mareeba Queensland

Prepared by Saddler Springs Education Centre Pty Ltd

Report
2012



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October 2012

Preliminary detection dog survey for northern quoll *Dasyurus hallucatus* on Mt Emerald, Mareeba Queensland

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Front page photographs: (Bottom left to right)
'Sparky' and Amanda Hancock search Boulder pile on ridgeline; northern quoll (photo taken by Dr Scott Burnett); Amanda Hancock & 'Sparky'; Ridgeline B site Mt Emerald and Amanda Hancock & 'Kuna' find quoll odour in creekline

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1. SUMMARY

Between 22nd to 25th October 2012, a northern quoll *Dasyurus hallucatus* (Endangered nationally, *Environment Protection and Biodiversity Conservation Act 1999*), preliminary survey using detection dog methodology was completed by Amanda and Lloyd Hancock and detection dogs 'Sparky' and 'Kuna' (Carnarvon Canines) of Saddler Springs Education Centre (SSEC) Pty Ltd (Injune) for RPS Group and University of Sunshine Coast (USC) at the Mt Emerald Turbine study area, Mareeba, Queensland.

Systematic surveys completed previously by RPS Group and USC have located quolls within the Mt Emerald Turbine study area, however some of the ridgeline and creekline areas targeted within the previous studies were inconclusive to determining quoll presence or absence. Therefore, the SSEC detection dog surveys were implemented as a preliminary search for the following outcomes:

(i) a comparative study of positive quoll indication sites between ridgelines and creeklines, with the site selection consisting of one ridgeline and creekline within an area of no quoll records and one ridgeline and associated creekline within an area of known quoll records.
(ii) to identify presence or absence of northern quoll odour in these areas, especially likely den sites, which may assist to streamline the placement of remote cameras and future intensive fauna trapping programs within the Mt Emerald study area.

The quoll detection dog is trained to locate the target odour of northern quoll scat (faeces) and live odour. The methodology with the detection dog consisted of searches by dog and handler/ecologist along the stratified critical quoll habitat areas of the selected creek lines and ridgelines at the Mt Emerald turbine study area (*Appendix A*), with the defined areas divided into search transects (sites) where required for larger areas.

Target searches within each transect were, potential den/refuge sites such as hollow logs, trees with hollows, termite mounds, rock boulders with crevices and caves. Visual observations by both handler/ecologists for quoll scats were completed.

During all searches at the Mt Emerald turbine study area, SSEC 'Carnarvon Canines' quoll detection dogs showed 'positive indications for quoll target odour at 47 different locations'. At some of these locations scats were identified and collected for further analysis.

On the basis of the detection dog results and visual ecological assessment during the survey, it is evident that the Mt Emerald study area contains critical quoll habitat, evidence of quoll presence by odour detection dog results, and evidence of likely dens and active den use, especially in the ridgeline sites surveyed with good quoll den habitat and the strongest dog indications (Appendix A).

2. PROJECT BRIEF AND CONTEXT

Between 22nd to 25th October 2012, a northern quoll *Dasyurus hallucatus* (Endangered nationally, *Environment Protection and Biodiversity Conservation Act 1999*), preliminary survey using detection dog methodology was completed by Amanda and Lloyd Hancock and detection dogs 'Sparky' and 'Kuna' (Carnarvon Canines) of Saddler Springs Education Centre (SSEC) Pty Ltd (Injune) for RPS Group and University of Sunshine Coast (USC) at the Mt Emerald Turbine study area, Mareeba, Queensland.

Saddler Springs Education Centre Pty Ltd was contracted to implement the use of quoll odour detection dogs as a new fauna survey methodology to assist to determine presence or absence of northern quoll within the environs of the Mt Emerald study area.

This survey forms only one part of a broader environmental impact assessment by RPS Group and USC for a proposed wind turbine development project on Mt Emerald. The detection dog methodology implemented by SSEC is considered a preliminary survey of an area for presence/absence of the target species (northern quoll), which allows ecologists to then concentrate further fauna survey effort such as, camera and cage traps to sites of positive target odour indication, within the study area.

The results of this survey will provide the basis for development of more targeted surveys, where presence is identified. Where survey results show an absence of quolls, this may be considered inconclusive due to limitations of time and extent of survey within the Mt Emerald study area.

The northern quoll, *Dasyurus hallucatus*, is the smallest of this family of Australian native carnivorous marsupial and are listed nationally as *Endangered* under the *Environment Protection and Biodiversity Conservation Act 1999*. Northern quolls are solitary with home ranges of up to 1000ha. Female home ranges are generally much smaller than this, though still several hundred hectares in size.

Habitat critical to the survival of the northern quoll as defined by the EPBC Act policy statement 3.25, relevant to the Mt Emerald study area includes:

- Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines.
- Structurally diverse woodland or forest areas containing large diameter trees, termite mounds and/or hollow logs and/or with rocky areas nearby.

The northern quoll species distribution has declined nationally with a number of threats, either directly or in combination with each other, thought to contribute to the species decline. These threats include mortality caused by poisoning by cane toads, predation by feral predators, inappropriate fire regimes and removal, degradation and fragmentation of critical habitat to the survival of the species as well as foraging/dispersal habitat, as a result of development, mining and pastoralism.

However, ecological studies to date on Mt Emerald, indicate this may be a strong northern quoll population, with further research continuing into 2013 to determine population dynamics and extent of home ranges and foraging areas.

3. METHODOLOGY

The fauna survey techniques implemented are in accordance with Queensland Government Animal Ethics requirements and the code of practice for the use of animals, as well as QPWS scientific purposes permit requirements and the Regulation of Animal Care during Wildlife Surveys.

The quoll detection dog survey was completed following the recommended guidelines of the '*Environment Protection and Biodiversity Conservation Act 1999 (EPBC) Survey guidelines for Australia's threatened mammals'*. That is:

(i) Characterise the study area

Habitat features of significance to the northern quoll within the Mt Emerald Turbine study area, were identified by GIS mapping provided by RPS & University of the Sunshine Coast, as well as from on-site visual inspection.

Habitat critical to the survival of the northern quoll relevant to the Mt Emerald study area, as defined by the Department of Environment and Heritage (*EPBC Act policy statement 3.25*):

- Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields
- Major drainage lines or treed creek lines and/or with rocky areas nearby
- Structurally diverse woodland or forest areas containing large diameter trees, termite mounds and/or hollow logs

Therefore, the search areas were defined as the treed and rocky creek lines with rocky areas nearby, hills with boulders, large boulder outcrops and large rocky ridgelines (Appendix A).

(ii) Identify those threatened mammals that are known to, likely or may occur in the region

The focus of this survey was on the northern quoll *Dasyurus hallucatus* which is listed as *Vulnerable* in Queensland (*Nature Conservation Act 1992*) and is *Endangered* nationally (*Environment Protection and Biodiversity Conservation (EPBC)Act 1999*).

- The EPBC Protected matters search tool identifies that northern quolls are known/likely to occur on Mt Emerald.
- Previous ecological research completed by RPS and University of the Sunshine Coast have confirmed records of Northern quoll within the Mt Emerald study area

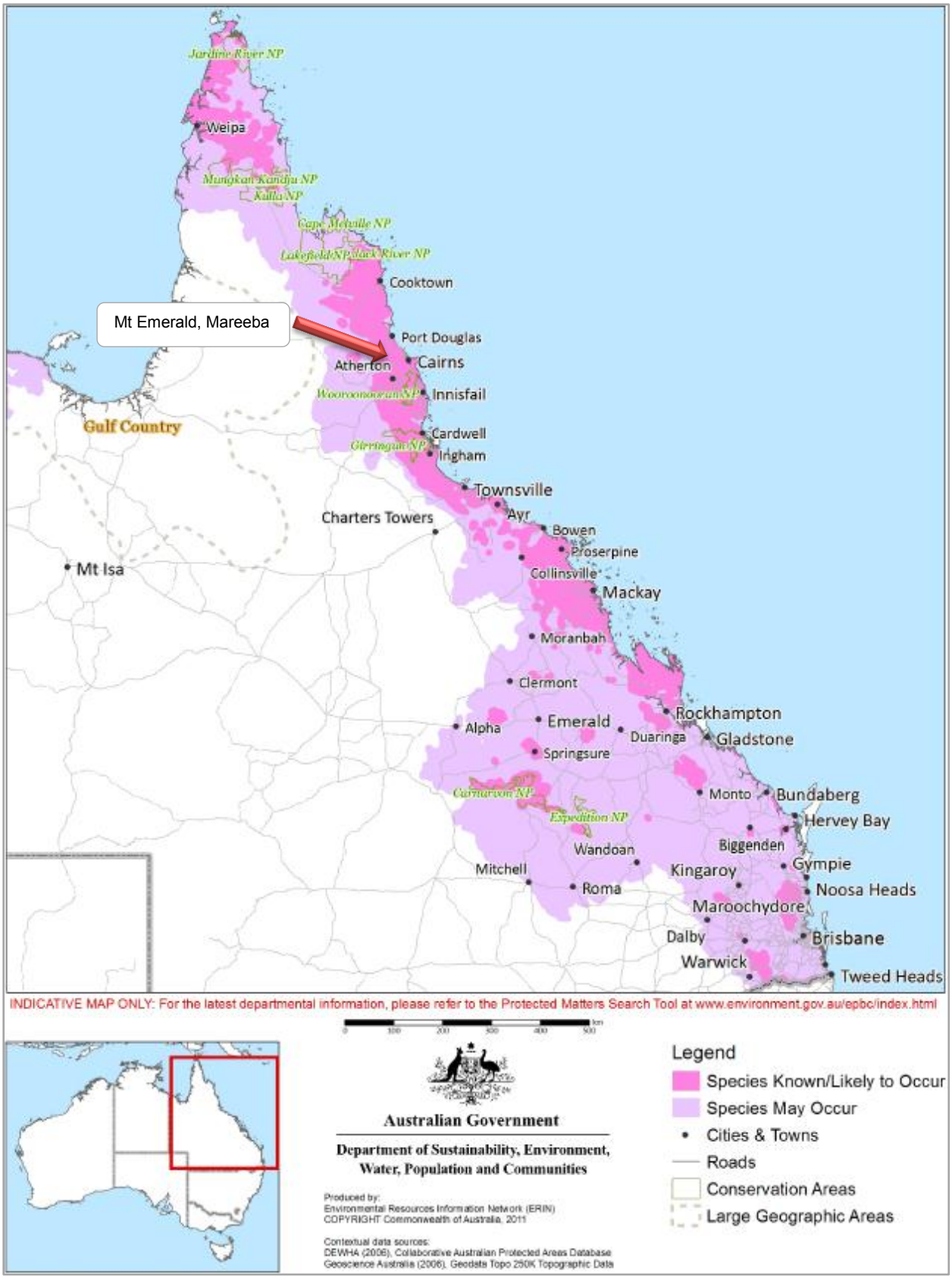


Figure 1. Edited map of the modelled distribution of Northern quoll *Dasyurus hallucatus* for Queensland as @ February 2009 www.environment.gov.au.

(iii) Determine optimal location of surveys

Habitat stratification was completed at the study area with the following defined search areas:

- A comparative study was requested to review quoll detection results between ridgelines and creeklines. Due to inconclusive quoll records in some sites previously surveyed, it was agreed to define the the search areas as Ridgeline A & Creekline A (sites with known quoll records), and Ridgeline B and Creekline B (sites with no quoll records to date).
- Due to the extent and quoll den habitat to survey on Ridgeline B, the search area was was stratified (divided) into 4 different transect search sites (Appendix A) with focus on sections with good quoll den habitat defined previously.

All landscape assessment data relevant to the transect search site area was recorded on the Carnarvon Canines – Quoll Detection Dog Proforma (*Appendix D*)

Figure 2. Examples of areas defined by critical quoll habitat features and positive dog indications within the 6 sites (transect search areas) surveyed.

Site 1 – Ridgeline A (wpt102)

Site 2 – Creekline A (wpt 113)

Site 3 – Ridgeline B (wpt 117)

Site 4 – Ridgeline B (wpt 125)

Figure 2. Continued. Examples of areas defined by critical quoll habitat features and positive dog indications within the 6 sites (transect search areas) surveyed.

Site 5 – Ridgeline B (wpt 136)

Site 6 – Creekline B (wpt 156)

(iv) Target searches

During all detection dog searches, any potential quoll den/refuge sites such as rocky boulders with crevices, caves, hollow logs, termite mounds, trees with hollows, or large burrows in creek banks were targeted (*Figure 3*). Visual observations for quoll scats or tracks were completed by the detection dog handler/ecologist.

iv.1. Scat voucher specimens

Where evidence of quolls, such as scats were detected during target searches, these were collected as voucher specimens and coded and recorded on the *Carnarvon Canines – Quoll Detection Dog Proforma* (Attachment A). These records matched the duplicate coding on the voucher specimen bag.

Figure 3. Examples of target searches with quoll detection dog of boulder piles (left) on ridgeline and rocky areas (right) along creek lines

(v) Direct detections survey methods

v.1. Odour detection dogs

Although the use of odour detection dogs is currently outside the scope of the EPBC survey guidelines for Australia's threatened mammals, SSEC is working towards a review of these guidelines - results of further tentatively proposed comparative field studies with GPS collared quolls in research in 2013 conducted by Dr Scott Burnett (Quoll expert) will be critical to this end.

Methods used for the Mt Emerald study area involved daytime searches with an odour detection dog which is trained to locate both northern quoll scat (faeces) and live odour. Daytime searches eliminated potential disturbance to live quolls, as the quolls are nocturnal and most likely within dens during daytime searches. On a rare occasion that a quoll is outside a den and detected by the dog, SSEC dogs are under the management of the handler at all times and are trained not to disturb any wildlife. Their focus is on the reward (tennis ball) once the target odour is located.

SSEC have completed full Animal Ethics approval for 'the use of odour detection dogs to locate target fauna'. SSEC have Qld Government scientific permits for non-protected areas Queensland and specified protected areas, as well a letter of approval for dogs on park for research purposes.

Positive indication by our detection dogs is a sit and bark response on the target odour with reward of a tennis ball play. Through previous field studies and during this survey, it is evident that the detection dogs natural prey behaviour and trained indication response becomes more highly animated when a den site is active with live quoll odour. Future studies with GPS collared quolls will confirm detection dog response and accuracy to active den location.

All positive dog indications were GPS recorded and visual observations completed by field staff for evidence of scat, track, den, fur or live quoll. Photo records and voucher specimens of quoll evidence were completed. All detection dog search data, quoll evidence, photo numbers, voucher specimens and GPS locations were recorded on the *Carnarvon Canines – Quoll Detection Dog Proforma* (*Appendix D*).

Location details of positive dog indications were in Google Earth file to RPS Group and University of the Sunshine Coast to be used to review further targeted quoll survey effort to these locations.

v.2. Remote camera trapping

Camera trapping for the Mt Emerald study area is being completed by University of the Sunshine Coast, with methodologies and approvals by Dr Scott Burnett. SSEC were not involved with camera trapping at this time. Key hotspots for quoll indication by the dogs were provided which may assist future camera trapping locations.

4. LIMITATIONS

(i) Optimal timing for surveys of 'target' taxa

A limitation to this survey was the timing of the searches being potentially affected by seasonal changes in abundance and detectability of the quoll. The Mt Emerald survey due to project requirements was delayed and completed in Mid-October, which is outside the time recommended by Dr Scott Burnett (Quoll Expert) for quoll activity during their breeding season May – July.

An important note on detectability regarding the use of odour detection dogs which may assist addressing this survey limitation is that SSEC's detection dogs have been tested in both simulated training and in-situ field survey results, with the dogs recorded finding quoll scats from the previous breeding season (previous year). Therefore confirming the timing may not be a limitation to the presence and absence of quoll odour.

However, the timing may determine if quolls are still in the den sites identified by the dogs or have retreated or died after the breeding season. The timing therefore is a potential limitation to the camera trapping, especially if the population is in low numbers across an extensive area. Future GPS collar research will assist confirmation of accuracy of detection dog indications to active quoll dens.

(ii) Further Limitations

Survey Time – SSEC were contracted for five days only, and handlers have to work within the ability of the dog and conditions during surveys. Daytime temperatures also affected the timing and extent of searches.

Detection Dogs can become fatigued quickly (nasal fatigue) due to the concentrated effort of scenting over long periods as well as physical fatigue over large areas. Surveys during the cooler months of the quoll breeding season, May – July would assist daytime searches.

And more time to active search for quoll scats and further time to explore the large rocky ridgelines more extensively with the dogs may have been beneficial for the survey.

5. FINDINGS

(i) Primary Findings

The detection dog survey consisted of 6 sites (Transects) (*Figure 2* & *Appendix A*) that met the key quoll habitat criteria. The results were 47 positive quoll odour indications by the dogs, with the highest concentration of positive indications, good quoll den habitat and likely active dens being at Ridgeline B.

The comparison of ridgeline transects surveyed versus creek lines, identified the ridgelines had the higher quoll detection results and a higher number of likely quoll den habitat. With the sections of creek line surveyed still providing results of positive dog indications for quoll odour, however, they had minimal quoll den/refuge habitat features, within the extent surveyed and dog behaviour and indications did not suggest active quoll dens.

Six voucher specimens of scat were collected at some of the sites of positive indication visually identified as Northern quoll scat, however they will be sent for further ID analysis by Dr Scott Burnett, University of the Sunshine Coast.

The dogs and ecologists did locate a range of non-target animal evidence including dog scats, scent trails of dog, macropods, bird kill carcass. However, the detection dog gave no false indication response for quoll.

During all searches at the Mt Emerald study area, SSEC 'Carnarvon Canines' quoll detection dogs showed 'positive indications for quoll target odour at 47 different locations'.
A table of the Primary findings - positive dog indications is presented in Appendix A.
At some of these locations scats were identified as quoll scat and collected.

On the basis of the detection dog results and visual ecological assessment on the survey, it is evident that the search areas defined in this report, within the Mt Emerald Turbine study area have the following:

- northern quoll habitat critical to the survival of the species, as defined by the EPBC guidelines.
- evidence of quoll odour presence, from the preliminary detection dog survey results.
- Very likely active quoll den sites, from the detection dog strong indications and behaviours
- evidence of quoll scats

The voucher specimens will be sent to Dr Scott Burnett, University of the Sunshine Coast for further analysis.

(ii) Secondary Observations

During this preliminary survey day, other ecological observations of note and details of scat voucher specimens were recorded and are presented in Appendix B.

Figure 4. Examples of incidental observations recorded

Site 5: 8 x Sarrus Cranes flying over

Site 6: Carlia jarnoldae

Site 6: unidentified beetles

Site 6: Nobbi Dragon

6. RECOMMENDATIONS

Based on evidence from this preliminary survey, the key recommendations to be reviewed by Dr Scott Burnett (USC) and Jeff Middleton (RPS Group), which may assist the Mt Emerald Turbine study area, regarding impacts to the northern quoll and habitat critical to the survival of the species are the following:

A. To implement some of the camera trapping program to the locations of high quoll odour indications by the detection dogs during the October survey.

B. Address the implementation of further surveys of the Mt Emerald stud area with more than one survey methodology, as per EPBC guidelines, including the use of odour detection dogs, early in the quoll breeding season (May) 2013.

C. To have a trapping program compliment closely the detection dog positive indication sites early in the breeding season (May) 2013.

D. Further benefit to active quoll den location, would be testing the dog indication response to dens with GPS collared quolls (tentatively proposed research for 2013). This will provide behavioural response and accuracy confirmation of the detection dogs to active quoll dens, which will be beneficial to future quoll research, and may also indicate active dens of potential uncollared quolls at the Mt Emerald study area.

7. ACKNOWLEDGEMENTS

Thanks to Dr Scott Burnett, University of the Sunshine Coast and Jeff Middleton, RPS Group for actioning the use of odour detection dogs within the quoll survey, as well as their local knowledge and advice during the field work.

And we are very grateful to our Carnarvon Canines ‘Sparky’ and ‘Kuna’ for their enthusiasm and hard work and for teaching us all more about quolls.

8. REFERENCES

Australian Government, 2011. ‘*Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the endangered northern quoll, Dasyurus hallucatus*’, EPBC Act policy statement 3.25.

Simpson, K. and Day, N. 2010. ‘Birds of Australia, Eighth Edition’, Penguin Group (Australia)

Wilson, S. 2009. ‘A Field Guide to Reptiles of Queensland’, Reed New Holland (Australia).

9. **APPENDIX A - Primary findings: Quoll detection dog results - <u>positive</u> indication at each Site (Transect search area)**.

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
Ridgeline A Site 1 Start: 17° 9'39.20"S 145°23'29.30"E End: 17° 9'17.60"S 145°23'21.40"E											
1	23/10	095	Scattered boulders, rocky outcrop on hill of dense grass and grass trees.	17° 9'36.40"S 145°23'29.70"E	Strong	Sparky	Rocks, boulders, crevices. Good refuge. Positive dog behaviour to odour all over rocks.	Dog indication & quoll den habitat			2865-2866
2	23/10	096	Medium rock outcrop.	17° 9'34.10"S 145°23'30.05"E	Strong	Sparky	Boulders, crevices. Strong dog indication to crevices.	No scats found. Dog indication & quoll den habitat only			2867-2868
3	23/10	097	Medium rock outcrop.	17° 9'34.80"S 145°23'30.20"E	Strong	Sparky	Boulders, crevices. Very strong dog indication. Dog showed indication at site of scats, then zig zagged to a crevice and very strong indication into crevice.	Scats collected. Dog indication & quoll den habitat only.		CC001	2870-2869
4	23/10	099	Large rocky outcrop with small boulder patches/crevices.	17° 9'31.80"S 145°23'29.40"E	Strong	Sparky	There appears saturated with quoll odour. boulders, crevices. Strong dog indication.	Dog indication & quoll den habitat only			2871
5	23/10	100	Medium boulder pile.	17° 9'31.20"S 145°23'31.30"E	Strong	Sparky	Boulders, crevices. Numerous potential dens. Very strong dog indication of live odour.	Dog indication & quoll den habitat only.			2872-2873
6	23/07	002	Medium rock outcrop with good	17° 9'30.90"S 145°23'29.20"E	Strong	Sparky	Rocks, boulders, crevices. Strong dog indication. Good	Dog indication & quoll den habitat			2874-2875

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
			size crevices.				potential dens.	only.			
7	23/10	102	Large rock outcrop with boulders, crevices, tunnels.	17° 9'29.30"S 145°23'29.20"E	Strong	Sparky	Boulders, crevices, tunnels. Numerous potential dens. Strong dog indication.	Scats collected near rock tunnel. Dog indication & quoll den habitat		CC002	2876-2878
8	23/10	103	Large rock outcrop with small overhang.	17° 9'28.70"S 145°23'27.70"E	Strong	Sparky	Large rock outcrop with crevices. Good dog indication at overhang.	Scats collected under overhang. Dog indication & quoll den habitat		CC003	2879
9	23/10	104	Rocky boulders - highest point on ridge towards Nth face.	17° 9'25.80"S 145°23'28.20"E	Strong	Sparky	Med to Lge boulders. numerous potential crevices as dens. Very strong dog indication.	Dog indication & quoll den habitat			2880-2882
10	23/10	105	Same area as wpt 104 - top of Boulder pile outcrop.	17° 9'25.60"S 145°23'28.70"E	Strong	Sparky	Boulders, crevices. Numerous potential dens. Strong dog indication.	Scats collected from on top of large flat boulder to Nthn edge of boulder pile. Dog indication & quoll den habitat		CC004	2883
11	23/10	106	Boulder piles - edge of drop off (Bluff?)	17° 9'24.00"S 145°23'31.50"E	Strong	Sparky	Boulders, crevices. Numerous potential dens. Strong dog indication.	Dog indication & quoll den habitat			2884
12	23/10	107	Large flat rock outcrop with small	17° 9'22.50"S	Strong	Sparky	Boulders, some crevices -	Dog indication&			2885-

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
			boulders.	145°23'29.70"E			potential overnight den cover.	quoll den habitat			2886
13	23/10	108	Rocky boulders on grassy hill.	17° 9'22.10"S 145°23'28.60"E	Strong	Sparky	Small boulder pile, crevices. Strong dog indication in crevices.	Dog indication & quoll den habitat			2887
14	23/10	109	Large flat rock outcrop with crevices on edge.	17° 9'20.30"S 145°23'26.50"E	Strong	Sparky	Crevices between rock faces. (crevices the only shelter on flat boulder outcrops)	Dog indication & quoll den habitat			2888-2889
Creek line A Site 2 Start: 17° 9'18.20"S 145°23'19.50"E End: 17° 9'38.90"S 145°23'27.40"E											
15	23/10	112	2 x Rock Boulders edge of creek line. (where rocks above have more relief changes)	17° 9'22.30"S 145°23'20.80"E	Strong	Sparky	Boulders with tunnels underneath in creek bank. Good potential dens. Strong dog indication.	Dog indication & quoll den habitat			2890-2891
16	23/10	113	Rock boulders in creek bank.	17° 9'23.30"S 145°23'21.60"E	Strong	Sparky	Boulders with burrows underneath in creek bank. Numerous potential dens - 4 entrances. Scat on boulder above burrows. Strong dog indication.	Dog indication & quoll den habitat		CC005	2892-2896
17	23/10	114	Small boulder pile on creek bank	17° 9'25.70"S 145°23'24.30"E	Strong	Sparky	Boulders -minimal good crevices, but enough potential refuge during travel. No other boulders or ideal refuge between wpt 114 & end of transect search wpt 115.	Dog indication & quoll den habitat			2897

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
Ridgeline B Site 3 Start: 17°10'31.10"S 145°22'5.30"E End: 17°10'30.90"S 145°22'5.40"E											
18	23/10	117	Rocky boulder pile 80m from road and 100m from camera trap.	17°10'33.80"S 145°22'2.40"E	Strong	Kuna	Highly likely - numerous crevices as dens Very strong dog indications. **key site for trapping program	Dog indication & quoll den habitat Strong dog indications of live quoll.	Sparky was tested on this site as well with 100% accuracy to Kuna's indication location. Both dogs tested twice.		2898-2903
19	23/10	118	Large rock outcrop (single rock) with rock tunnel at base.	17°10'34.40"S 145°22'4.30"E	Strong	Kuna	Rock outcrop with rock tunnel for refuge/den. Strong dog indication directly at rock tunnel.	Dog indication & quoll den habitat			2904-2905
20	23/10	119	Fallen tree stump/rocks/dirt with tunnels.	17°10'36.50"S 145°22'1.50"E	Strong	Kuna	Rock boulders nearby, tunnels at base of stump. Likely den. Strong dog indication.	Dog indication & quoll den habitat			2906-2907
21	23/10	120	Large flat rock outcrop.	17°10'38.50"S 145°22'2.10"E	Moderate	Kuna	No obvious likely crevices/dens. Quoll odour was saturated over rock from dog's indications.		Not flagged or photographed.		
22	23/10	121	Rocks and boulders all over dense grassy hill with grass trees.	17°10'39.30"S 145°22'4.20"E	Strong	Kuna	Rocks, boulders, numerous crevices - highly likely dens. Very strong dog indication	Dog indication & quoll den habitat			2908

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
							**Key site for trapping program				
Ridgeline B Site 4 Start & End: 17°10'36.00"S 145°22'13.20"E											
23	24/10	124	Start of Boulders. One small rock outcrop with crevices, grass trees and dense grass.	17°10'43.20"S 145°22'9.10"E	Strong	Kuna	Boulders, good crevices for dens. Highly likely active den by very strong dog indication. **Key site for trapping program	Dog indication & quoll den habitat			2917-2920
24	24/10	125	Large rock outcrop with scattered boulders/rocks, hollow logs.	17°10'46.70"S 145°22'11.70"E	Strong	Kuna	Boulders, crevices, hollow logs. Highly likely dens. Very strong dog indication.	Dog indication & quoll den habitat			2921-2924
25	24/10	126	Rock piles on large rock outcrop.	17°10'48.30"S 145°22'11.60"E			Boulders, crevices. Numerous potential dens. Strong odour all over.	Dog indication & quoll den habitat			2925
26	24/10	127	Rock outcrop with large boulder pile/crevices.	17°10'48.70"S 145°22'10.90"E	Strong	Kuna	Boulders, numerous crevices. Highly likely dens. Very strong dog indication.	Dog indication & quoll den habitat	(Same area as wpt 126 but different boulders and indication site).		2925
27	24/10	128	Rock boulder piles continuing along outcrop.	17°10'50.30"S 145°22'11.90"E	Moderate	Kuna	Boulders, crevices	Dog indication & quoll den habitat			2926
28	24/10	129	Large rock outcrop with boulders and	17°10'51.40"S	Strong	Kuna	Boulders, crevices.	Dog indication &	2 x independent positive		2927

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
			crevices.	145°22'16.60"E				quoll den habitat	indications at the same site.		
29	24/10	130	Rock piles and boulders on dense grassy hill with grass trees.	17°10'52.00"S 145°22'19.90"E	Strong	Kuna	good crevices - highly likely dens. Strong dog indications. **Key site for trapping program	Dog indication & quoll den habitat	Sparky tested as well with 100% accuracy to Kuna's crevice indication.		2929-2936
Ridgeline B Site 5 Start: 17°10'46.60"S 145°22'27.70"E End: 17°11'12.80"S 145°22'39.10"E											
30	25/10	134	Boulder pile & large rock outcrop 200m from Camera trap on Road edge.	17°10'50.10"S 145°22'27.10"E	Strong	Sparky	Boulders, crevices - highly likely den & strong dog indication	Dog indication & quoll den habitat			2939
31	25/10	135	Boulder pile 20m behind wpt 134.	17°10'51.10"S 145°22'27.40"E	Moderate	Sparky	Boulders, crevices - good day dens	Dog indication & quoll den habitat			2940
32	25/10	136	Large rocky outcrop with boulders, broken rock and large and small crevices.	17°10'53.90"S 145°22'27.00"E	Strong	Sparky	Boulders, rocks, numerous crevices - Very strong dog indication of live odour. Highly likely active dens. **Key site for trapping program	Scats collected from rock near crevice. Dog indication & quoll den habitat	Prioritize camera trapping – dogs behaviour indicated active den	CC006	2941 - 2943
33	25/10	138	Large to med boulder pile at spur.	17°10'59.00"S 145°22'24.60"E	Strong	Sparky	Boulders/crevices - highly likely dens.	Dog indication & quoll den habitat			2944-2946

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
34	25/10	139	Large flat rock outcrop with rocks and boulder piles on spur of ridge	17°11'3.80"S 145°22'25.40"E	Strong	Sparky	Boulders, crevices, hollow logs - good hollow logs and crevices as dens. Strong dog indication	Dog indication & quoll den habitat			2947
35	25/10	140	Boulder pile Nth East facing spur	17°11'2.90"S 145°22'26.90"E	Strong	Sparky	Boulders, crevices - Highly likely dens. Very strong dog indication **Key site for trapping program	Dog indication & quoll den habitat			2948
36	25/10	141	2nd Boulder pile Nth East spur.	17°11'3.70"S 145°22'27.30"E	Strong	Sparky	Boulders, crevices - Highly likely dens, very strong dog indication Edge of spur has boulder piles all along & down face of slope - all good den areas - good shelter on ridge edge **Key site for trapping program	Dog indication & quoll den habitat	High dog interest across area & down ridge slope at wpt 140 & 141 Small water pools regularly on large flat rock outcrops on top of ridge.		2949-2955
37	25/10	143	Boulder pile top of ridge	17°11'4.90"S 145°22'26.50"E	Strong	Sparky	Boulders, crevices, termite mounds - Likely dens - shelter on ridge top. Strong dog indication	Dog indication & quoll den habitat			2956-2957
38	25/10	144	Same boulder piles area as 143 - just behind with deep crevices under boulders - ideal	17°11'5.20"S 145°22'26.40"E	Strong	Sparky	Boulders, deep crevices - Highly likely dens. Very Strong dog indication	Dog indication & quoll den habitat			2956-2957

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
			dens.								
39	25/10	145	Large boulder pile with numerous crevices - Eastern end of spur adjacent to powerline & near small tower.	17°11'10.70"S 145°22'30.60"E	Strong	Sparky	Boulders, crevices, termite mounds nearby. Highly likely dens - deep crevices. Very strong dog indication over area. **Key site for trapping program (Directly behind boulder pile is Large flat/rounded rock outcrop with rock dips in middle that form large pools of water & several small pools of water over the outcrop. (large pool has extensive moss). (Below large outcrop is hairy oak, paperbark, grass tress and several termite mounds).	Dog indication & quoll den habitat	Highest Prioritize site for camera trapping – dog behaviour indicated active den& strong odour all over area		2958-2964
Creek line B Site 6 Start: 17°10'29.80"S 145°23'9.70"E End: 17°10'32.00"S 145°23'8.10"E											
40	25/10	150	Large rocks - start of creekline	17°10'28.30"S 145°23'7.80"E	Moderate	Kuna	No obvious crevices - but small rock overhang as potential quick shelter.	Dog quoll odour indication. Minimal good dens.			2972
41	25/10	151	Large rock in creekbank.	17°10'28.10"S 145°23'6.80"E	Moderate	Kuna	Not likely den, no crevices - definitely quoll odour over site by dog indication	Dog quoll odour indication.			2973

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
42	25/10	152	Large rock outcrop with rock tunnel and small rockpiles/crevices.	17°10'26.60"S 145°23'4.00"E	Strong	Kuna	Rock tunnel, crevices. Limited as dens but rock tunnel could provide quick refuge. (Where there is very limited dens along creekline). Large flat rock outcrop collects small pools of water.	Dog indication.			2974-2975
43	25/10	154	Log piles.	17°10'24.20"S 145°23'2.40"E	Strong	Kuna	Log piles with burrow. Good potential refuge under length of log.	Dog indication.	(no other likely refuge to shelter in between wpt 152 & 154)		2978
44	25/10	155	Boulder piles above creek bank.	17°10'23.30"S 145°22'60.00"E	Strong	Kuna	Potential dens/refuge along a poor refuge section of creek. Boulders, crevices, burrow under boulder & shelter under fallen tree. Very strong dog indication.	Dog indication & quoll den habitat			2979
45	25/10	156	Large tree in creek with hollow with dead tree with hollow and burrow under tree roots & log piles.	17°10'19.70"S 145°22'57.20"E	Strong	Kuna	Tree hollows, burrows, log piles. Highly likely dens. Dog sat and strongly indicated at entrance to burrow under tree roots.	Dog indication & quoll den habitat			2983-2988
46	25/10	157	Boulder pile against creekbank near large bare rock with small water pools.	17°10'19.80"S 145°22'55.60"E	Strong	Kuna	Boulders, crevices - good potential dens. Strong dog indication.	Dog indication & quoll den habitat			2991

No	Date 2012	Wpt No	Location Description	GPS Location Latitude Longitude	Dog indication Response for Quoll odour	Carnarvon Canine	Quoll den habitat features	Quoll evidence collected	Comments	Scat voucher no.	SSEC photo no.
47	25/10	158	Large tree with rocks and hollow around roots.	17°10'37.04"S 145°22'53.80"E	Strong	Kuna	Tree hollows - good refuge in hollow where refuge is very limited.	Dog indication & quoll den habitat			2992-2994

10. **APPENDIX B - Secondary findings: Incidental observations**.

Date 2012	Site No	Site Name	Wpt No	Location Description	Species Name	Common Name	No	ID Method HE = heard SE = seen EV = evidence FO = flying over	Comments	Voucher no	SSEC photo no
23/10	1	Ridgeline A	097	Rock outcrop	Dasyurus hallucatus	Northern quoll		EV (Scat)	Scat ID to be confirmed.	CC001	
23/10	1	Ridgeline A	098	Grass tree patch between rocky outcrops wpt 097 & 099		Unidentified snail shell	1	EV	17°09'33.0"S 145°23'30.1"E Specimen collected		
23/10	1	Ridgeline A	100	Found inside crevices of boulders		Unidentified snail shell	1	EV	Specimen collected		
23/10	1	Ridgeline A	101	Found inside crevices of boulders		Unidentified snail shell	1	EV	Specimen collected		
23/10	1	Ridgeline A	102	Grass surrounding boulders		Pheasant coucal	1	SE	Flushed out of grass & flew off North of boulder site		
23/10	1	Ridgeline A	102	Near rock tunnel	Dasyurus hallucatus	Northern quoll		EV (Scat)	Scat ID to be confirmed.	CC002	
23/10	1	Ridgeline A	103	Small rock overhang on large outcrop	Dasyurus hallucatus	Northern quoll		EV (Scat)	Scat ID to be confirmed	CC003	
23/10	1	Ridgeline A	105	Top of large flat boulder to Nth edge of boulder pile	Dasyurus hallucatus	Northern quoll		EV (Scat)	Scat ID to be confirmed	CC004	
23/10	1	Ridgeline A	108	Grassy hill with rocky	*Centropus*	Pheasant coucal	1	SE	Flew of out of		

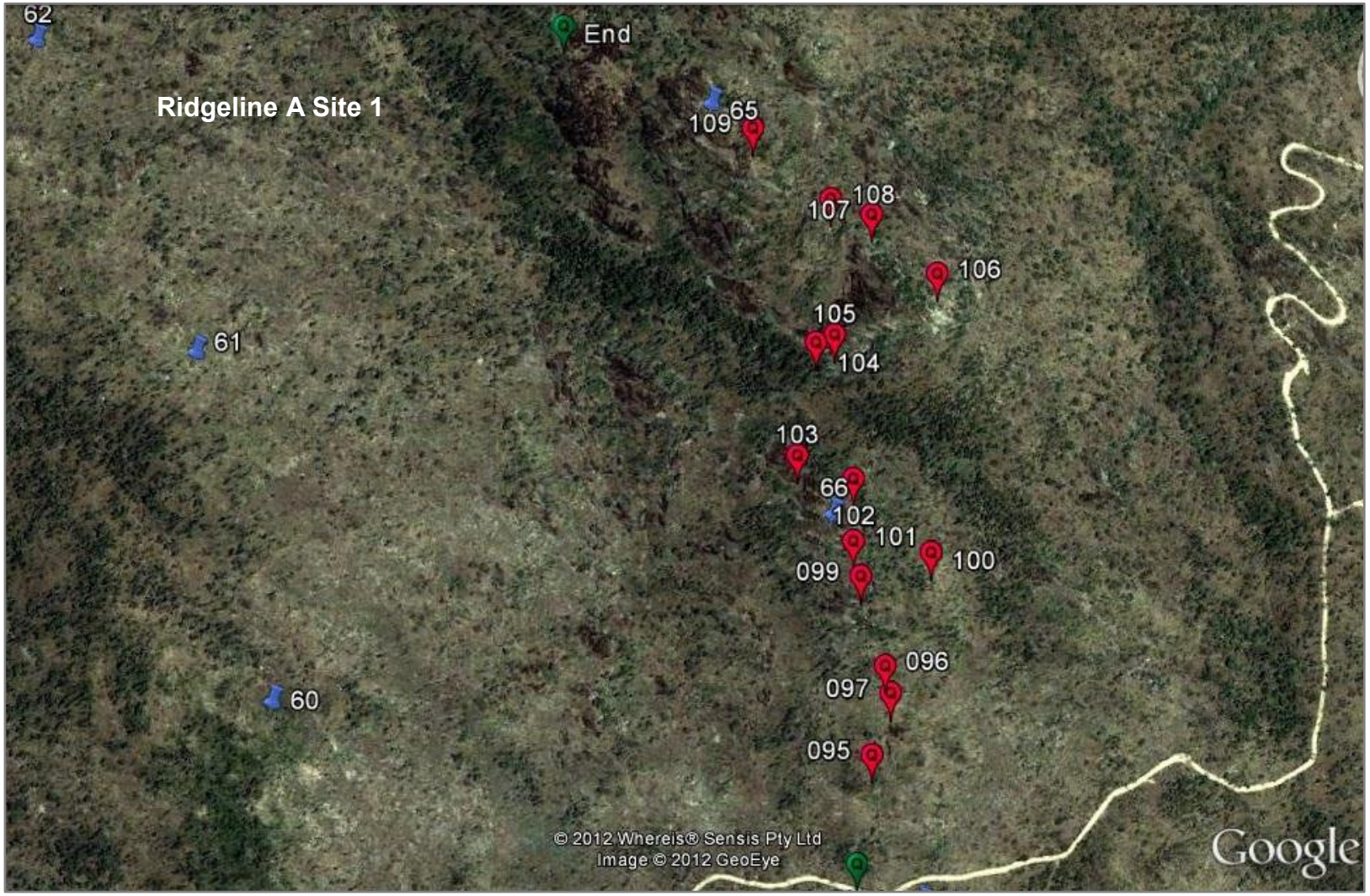
Date 2012	Site No	Site Name	Wpt No	Location Description	Species Name	Common Name	No	ID Method HE = heard SE = seen EV = evidence FO = flying over	Comments	Voucher no	SSEC photo no
				boulders	*phasianinus*				grass		
23/10	1	Ridgeline A	108	Top of very large boulder outcrop		Unidentified macropod	1	EV	Scats collected		
23/10	2	Creek line A	113	Top of boulder above burrows in creek bank	Dasyurus hallucatus	Northern quoll		EV (Scat)	Scat ID to be confirmed	CC005	
24/10	4	Ridgeline B	127	Inside a crevice of boulder pile		Cane Toad	1	EV	Cane toad head skeleton with skin, no evidence of body.		
24/10	4	Ridgeline B	127	Inside a crevice of boulder pile		Unidentified snail	1	EV	Shell collected		
25/10	5	Ridgeline B	136	Inside crevice of dog indication	Dasyurus hallucatus	Northern quoll		EV (Scat)	Scat ID to be confirmed		
25/10	5	Ridgeline B	137	Inside crevice of boulder pile		Unidentified snail	1	EV	Shell collected		
25/10	5	Ridgeline B	140	Inside crevice of boulder pile		Unidentified snail	1	EV	Shell collected		
25/10	5	Ridgeline B	142	Rock can with surveyors post? inside rock ring							
25/10	5	Ridgeline B	142	In soil at large flat boulder edges/cracks		Unidentified		EV	Numerous cone shaped diggings in soil & disturbed tubers		
25/10	5	Ridgeline B	144	Inside crevice in		Unidentified	1	EV	Shell collected		

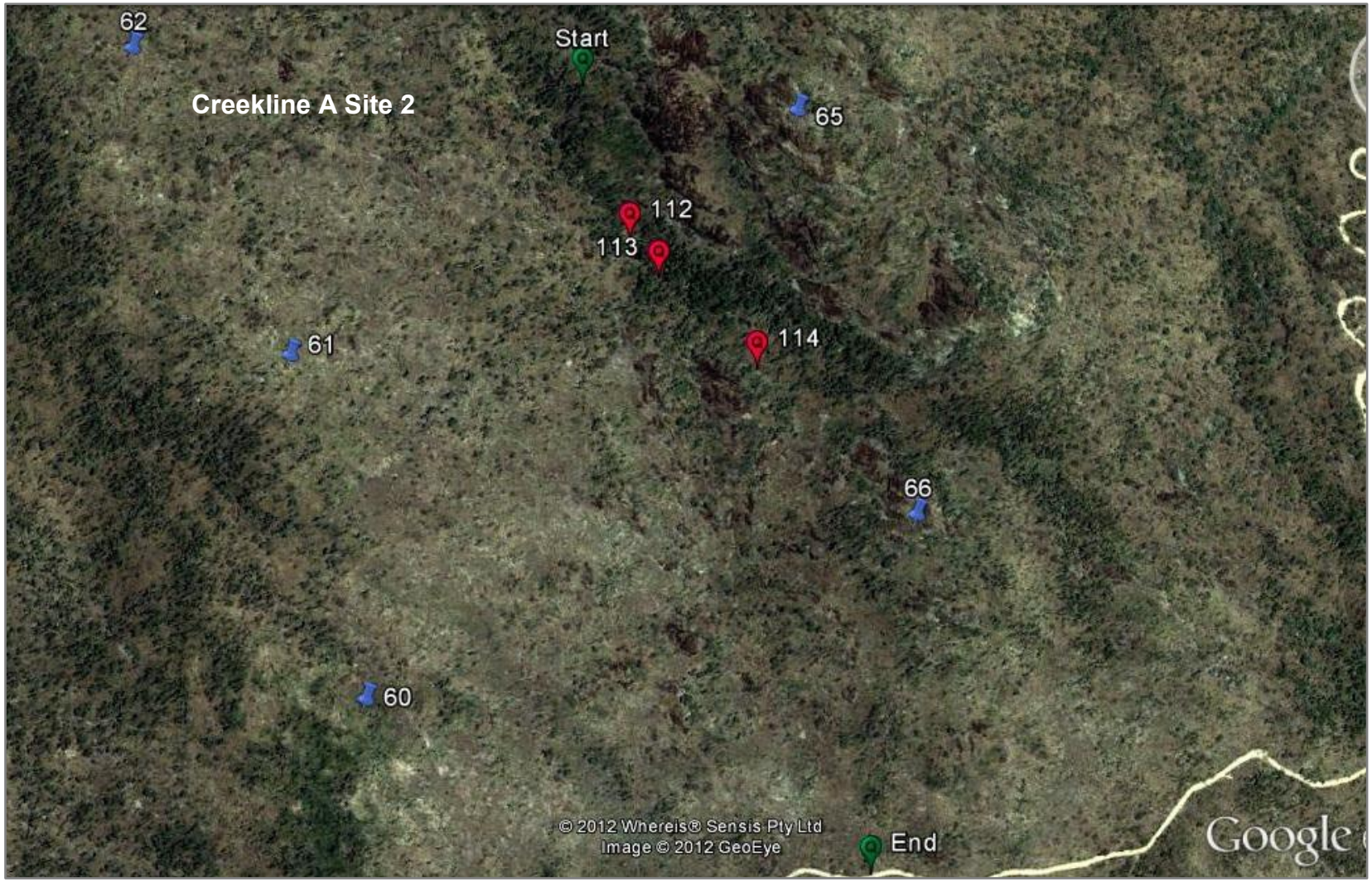
Date 2012	Site No	Site Name	Wpt No	Location Description	Species Name	Common Name	No	ID Method HE = heard SE = seen EV = evidence FO = flying over	Comments	Voucher no	SSEC photo no
				boulders		snail					
25/10	5	Ridgeline B	145	Inside crevice in boulders		Unidentified snail	1	EV	Brown shell collected		
25/10	5	Ridgeline B	145	Calling from tree nearby	*Corvus orru*	Torresian crow	1	HE			
25/10	5	Ridgeline B	145	Flying approx 10 metres above ridgeline over survey site wpt 145	*Grus antigone*	Sarrus crane	8	SE FO	Flew from NW 10 m above ridgeline then rose to still below top of highest ridgeline point, approx. 200m from track near wpt 145. Then circled ridge edge calling (high pitched trumpet call like baby elephant) then flew NE direction		2968, 2969 & 2971
25/10	5	Ridgeline B	146	Track edge		Wild Dog	1	EV	Numerous old Dog scats all along track from wpt 146 to start of Ridgeline B survey location (close to camera trap on track edge)		
25/10	5	Ridgeline B	148	On track		Unidentified bird (owl species?)	1	EV	Bird kill evidence – feathered wing remains collected		

Date 2012	Site No	Site Name	Wpt No	Location Description	Species Name	Common Name	No	ID Method HE = heard SE = seen EV = evidence FO = flying over	Comments	Voucher no	SSEC photo no
25/10	6	Creek line B	153	Creek bank		Unidentified reptile		EV (burrows)	15 x active reptile burrows in bank		2976
25/10	6	Creek line B	153	Creek bank		Unidentified spider		EV	1 x Large spider tunnel in bank		2977
25/10	6	Creek line B	155	On rocks in creek line	*Carlia jarnoldae*	*Carlia* skink	1	SE	ID matched breeding male		2980-2982
25/10	6	Creek line B	155	On rocks in creek line	Carlia sp.	Carlia skink	1	SE	General ID, size, head shape & body markings matched *Carlia mundivenisis*		No photo taken
25/10	6	Creek line B	156	On rocks in creek line	*Amphibolurus nobbi*	Nobbi dragon	1	SE			2989-2990
25/10	6	Creek line B	156	On leaves of tree		Unidentified invertebrate	50+	SE	Leaves were covered in bright luminescent green beetles with orange legs, belly & band across back		2989-2990
25/10	6	Creek line B	157	On boulder creek bank	*Diporiphora australis*	Tommy roundhead dragon	1	SE	Darker grey body with general ID markings, Gular fold present		No photo taken
25/10	6	Creek line B	157	Flew in and out of trees along creek bank	*Taeniopygia bichenovii*	Double barred finch	20+	SE	Approx. 10m from wpt 157 opposite side of creek		

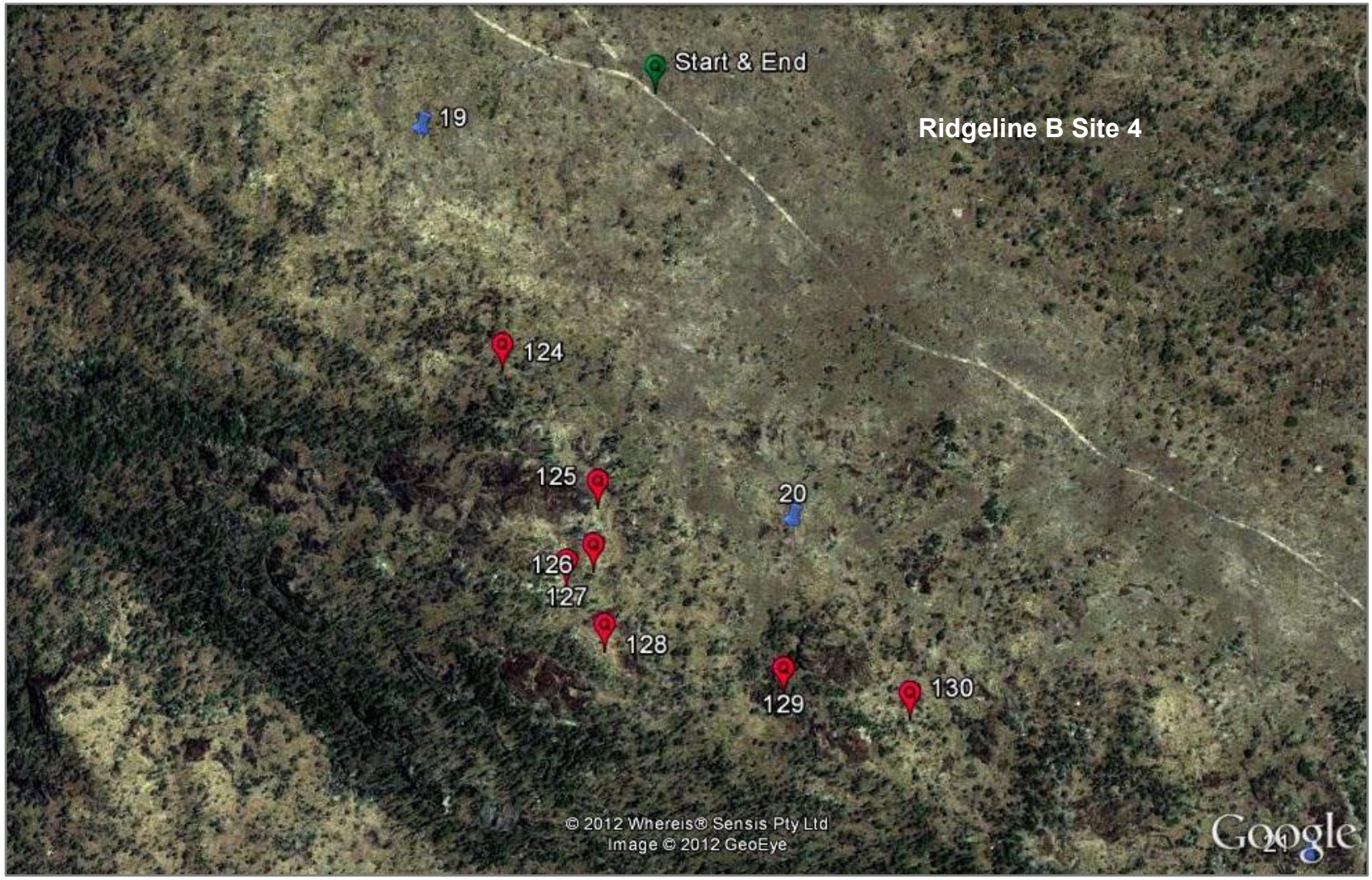
Date 2012	Site No	Site Name	Wpt No	Location Description	Species Name	Common Name	No	ID Method HE = heard SE = seen EV = evidence FO = flying over	Comments	Voucher no	SSEC photo no
25/10	6	Creek line B	157	Flew over creek line	*Calyptorhynchus banksii*	Red-tailed black cockatoo	1	SE FO			

11. **APPENDIX D - LOCATION MAPS OF SURVEY AREA AND POSITIVE QUOLL ODOUR INDICATIONS**




62
Start
Creekline A Site 2
65
112
113
61
114
66
60
© 2012 Whereis® Sensis Pty Ltd
Image © 2012 GeoEye
End
Google


Ridgeline B Site 3
18
End
Start
117
118
119
19
120
121
© 2012 Whereis® Sensis Pty Ltd
Image © 2012 GeoEye
Google


Start & End
19
Ridgeline B Site 4
124
125
20
126
127
128
129
130
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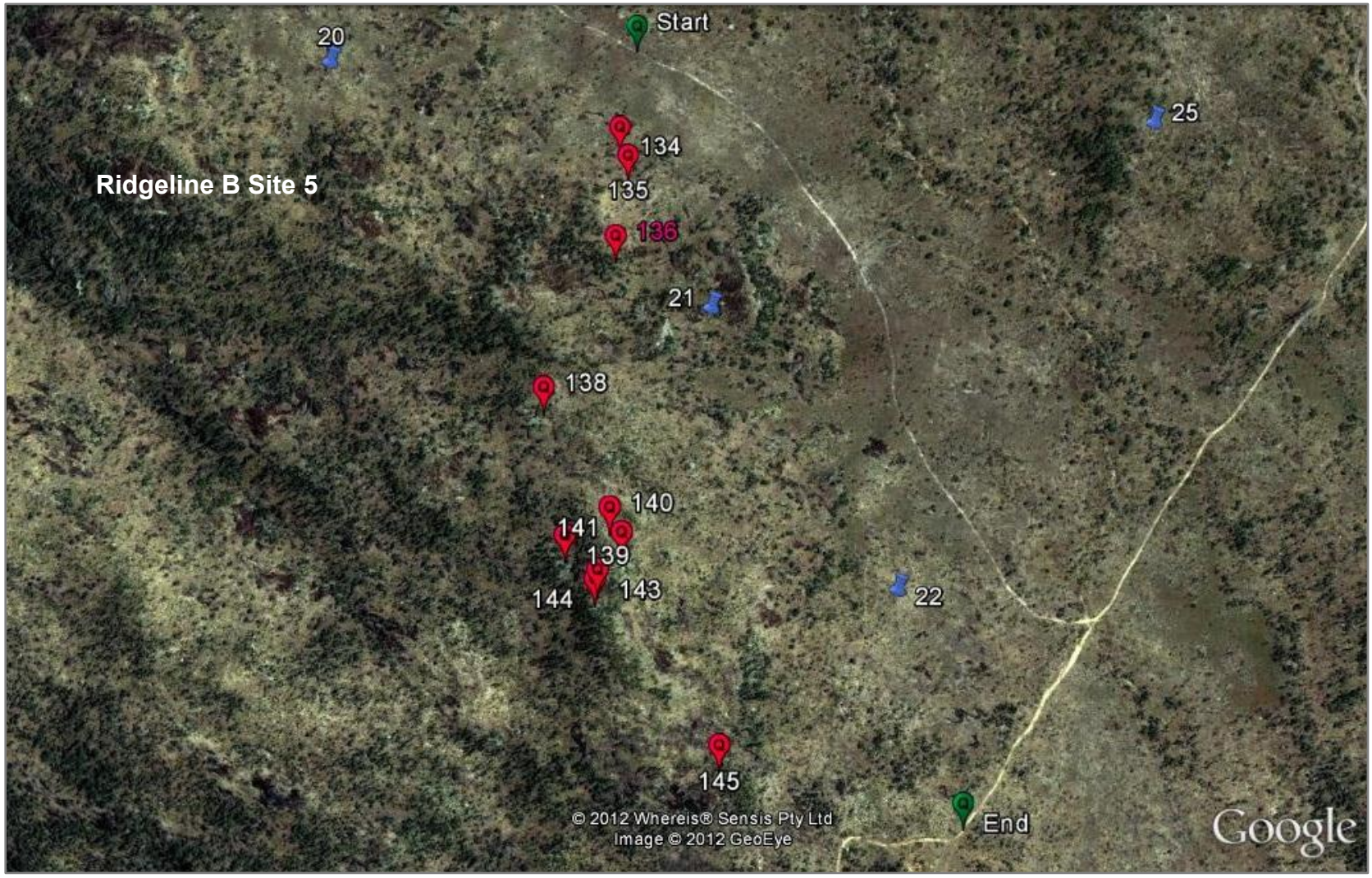
Ridgeline B Site 5
Start
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138
140
141
139
144
143
22
145
End
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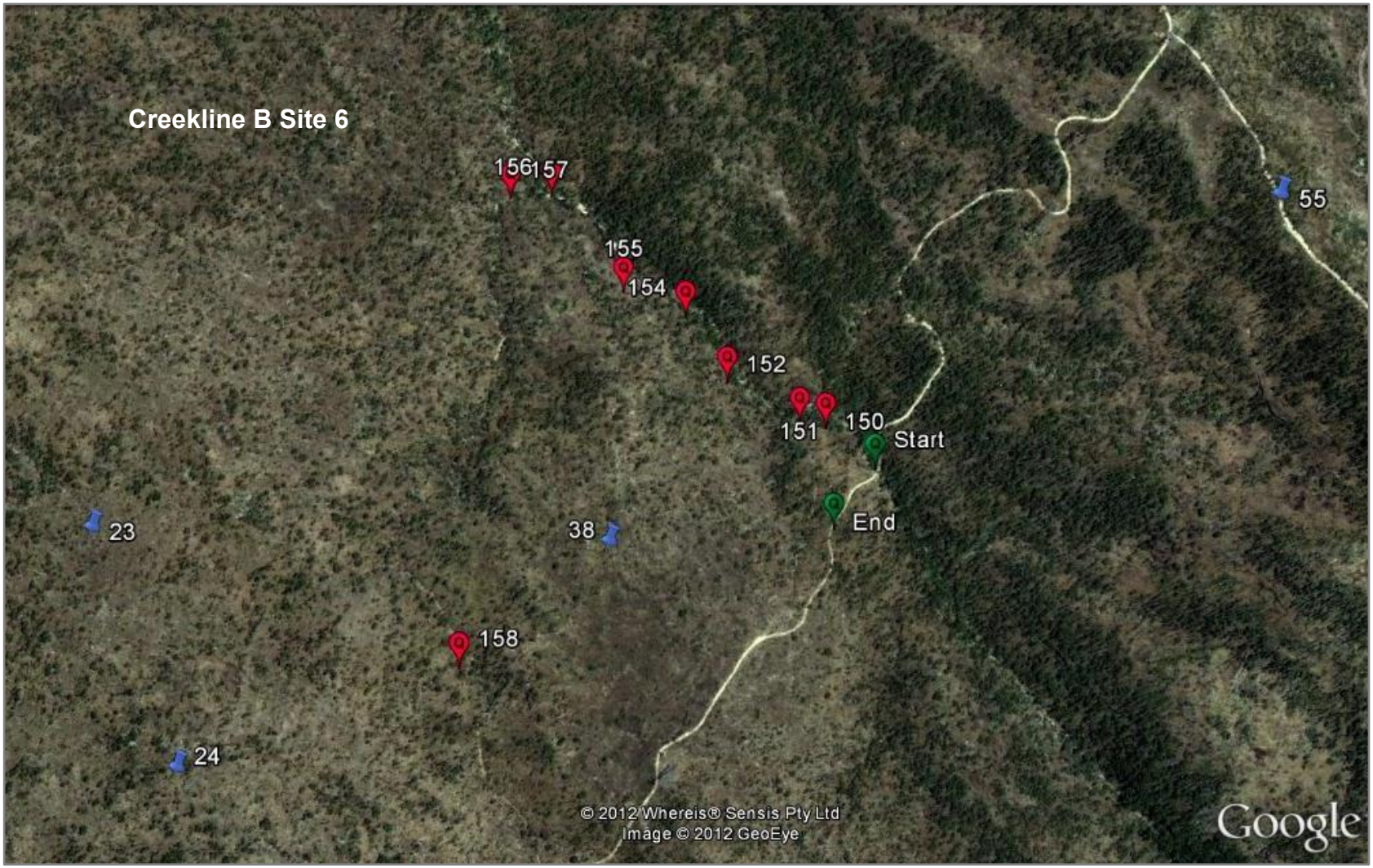
Creekline B Site 6
156
157
155
154
152
151
150
Start
End
55
23
38
158
24
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12. **APPENDIX E -** ***Carnarvon Canines - Quoll Detection Dog Proforma***

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SADDLER SPRINGS
EDUCATION CENTRE

Site No.		**Recorder:**		**Date/Time:**	
Purpose		QPWS – CNP Salvator Rosa Section – Mitchell Springs – Northern Quoll Survey			
Locality					
GPS Start	**Zone**		**E**	**N**	**Datum** GDA94
GPS End	**Zone**		**E**	**N**	**Datum** GDA94

Transect Description (e.g. creek line, rocky outcrop, spring, easement & approx. m):

GPS Track Y / N Track No:

Quoll Dog Indication: Positive= + (strong sit & bark response)
Recheck= ? (weak response – revisit with 2nd dog & visual obs)

Site Description within Transect search: (e.g. Start of creek line search) (i.e. At location of Quoll Evidence &/or Dog indication)	**Quoll Odour Dog Indication (Tick)**			**Flagged GPS Wpt**	**Quoll Evidence (Tick)** S=Scat D=Den T=Track Q=Quoll O=Other V=Voucher						**Quoll Den Habitat:** (Crevice, Boulders, Outcrop, Logs, Termite mounds)	**Comments** (Dog behaviour & Quoll Evidence notes) (For other species, habitat, impact notes record back page with wpt ref)	**Camera Trap Set**		
	+	**?**	**Dog Name**		**S**	**D**	**T**	**Q**	**O**	**V**			**Y/ N**	**Camera Number**	**Results Form No**

Photos Nos:

Voucher Specimens: (Desc. Wpt & ref code on sample)

Vegetation Description (Upper, Mid, Ground, Soil)**:**

Microhabitat Notes (Circle):

Rock Cover: None | Few | Moderate | Many

Type: Rocks | Boulders | Outcrop

Notes (Dens):

Logs (hollows): None | Few | Moderate | Many

Dead standing trees (hollows): None | Few | Moderate | Many

Leaf litter: None | Few | Moderate | Many

Termite mounds: None | Few | Moderate | Many

Bare soil patches: None | Few | Moderate | Many

Burrows: None | Few | Moderate | Many

Water body type: None | Soak | Spring | Creek |

Distance to permanent water:

Disturbances (Circle): (Ferals – record as Incidental records, weeds record esp. WONS)

Ferals: Pigs | Dogs | Cats | Rabbits | Toads | Cattle | Horses

Impacts:

Fire: None | Light | Moderate | Severe

Impacts:

Weeds: None | Light | Moderate | Severe

Species known:

Other:

Fauna Incidental Observations: ID - HE=heard SE=seen EV=evidence FO=flying over

Species (for EV only record e.g. Echidna scat)**:**	**No.**	**ID Method**	**Confirmed by**