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ACS Environmental Pty Ltd

***BASELINE MONITORING SURVEY FOR WEEDS
& FERAL ANIMALS
AT THE SOUTHERN HIGHLANDS REGIONAL
SHOOTING COMPLEX (SHRSC)
WATTLE RIDGE ROAD,
HILLTOP NSW***

Prepared for:

ErSed Environmental Pty Ltd

PO Box 1124, Leichhardt NSW 2040

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ACS Environmental Pty Ltd

Flora and Fauna Surveys & Ecological and Biodiversity Impact Assessment Services
Australian Business Number (ABN) 24 154 491 120
7 Townsend Avenue, Frenchs Forest NSW. 2086
3/28 Tullimbar Rd, Cronulla NSW. 2230

Tel: 9527 5262, 9453 9397; Mob: 0403 081902, 0412 217896. Fax: 9527 7454

Email: acs@actinotus.com

Web: [www@actinotus.com](http://www.actinotus.com)

Directors and Senior Ecologists

Anthony Smith-White BSc. (Syd), CertHEd., MSc., PhD. (UNSW) ^α

Peter Stricker BSc. (Hons) (Syd) ^α

^α Member Ecological Consultants Association NSW Inc

The principals of 'ACS Environmental P/L' have collectively worked in the area of biodiversity impact and bushfire hazard assessment services for a period of greater than 20 years. They also have over 30 years of experience in scientific research (ecological, genetic) and teaching in biological science.

The principals of 'ACS Environmental P/L' have completed the NSW Consulting Planners Bushfire Training Course organised by the Planning Institute of Australia NSW Division for planning consultants and allied professionals relating to the implementation of 'Planning for Bushfire Protection', in June 2003.

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BASELINE MONITORING SURVEY FOR WEEDS & FERAL ANIMALS AT THE SOUTHERN HIGHLANDS REGIONAL SHOOTING COMPLEX (SHRSC,) WATTLE RIDGE ROAD, HILLTOP NSW

1 OVERVIEW

An existing rifle range site at Hilltop, operational since 1987 and modified in 2008, has been approved by the NSW Government (2004) to be developed as a regional shooting complex, becoming operational in 2010. Currently vegetation for the existing 800m range, the 500m range and the pistol range has been cleared and the ranges are established or being developed for operation (Figure 1). The shooting range facility is qualified as the Southern Highlands Regional Shooting Complex (SHRSC).

The complex occurs on land vested in and managed by the State Sporting Venues Authority (SSVA or S & R), which incorporates an Environmental Conservation Zone (E2) of about 900ha and a Special Activity Zone (SP1) of about 136ha, the latter containing the shooting facilities that comprise an area of about 25ha (Figure 1).



Figure 1 – Aerial view of the subject lands administered by S & R (SHRSC) including SP1

2 PEST SPECIES INCLUDING WEEDS AND FERAL ANIMALS

The agency Sport and Recreation (S & R) has committed to the implementation of:

- Weed management activities by periodic monitoring events and removal and control by qualified bush regenerator personnel using established, best-practice bush regeneration techniques, and
- Mitigation Measures of the Supplementary Ecological Assessment including:
- Monitoring of European Rabbit and European Red Fox activity within cleared firing ranges and implementation of control management plans.

3 ECOLOGICAL MANAGEMENT – OPERATIONAL AND ENVIRONMENTAL MANAGEMENT PLAN (OEMP)

The OEMP (GHD 2011 Draft Report) provides the framework for day-to-day operation of the SHRSC facility and the management of range and off-range ecological impacts. It reflects the commitments made by S&R in the Environmental Assessment Report (GHD 2007) and Preferred Project Report (July 2008) relating to operation of the project and relevant development conditions.

The OEMP reflects the values detailed in the Conservation Agreement under the National Parks and Wildlife Act 1974 between the Minister for the Environment and the Minister for S&R signed on 12 October 2010 in respect to Lot 100, DP 1088254. It is also consistent with the management regime incorporated in the various conditions of approval.

The OEMP details specific mitigation measures to minimise potential for off-site impacts on native vegetation (Appendix E of the Environmental Management Plan).

Operation of the venue as a regional shooting complex has the potential to introduce and facilitate the spread and establishment of weeds within the site and into adjacent vegetation.

Weed Management Strategy

The following measures will be implemented to mitigate potential impacts of weeds on native vegetation and habitats and are consistent with item 1(a) of the Conservation Agreement:

- Implementation of a weed management strategy:
- removal and control of noxious weeds using appropriate methods and timing;
- reduction of edge effects and invasion of exotic species into adjacent vegetation;
- weed species to be monitored on an annual basis by professional bush regenerator;

- all weed management activities to be undertaken by qualified bush regenerators using established bush regeneration techniques;
- every reasonable precaution will be taken to avoid introducing or encouraging the proliferation of noxious weeds or other undesirable and non-indigenous plants; and
- any new infestations of weeds will be eradicated or controlled as soon as practical consistent with NSW Government weed eradication procedures and *Noxious Weeds Act* as applicable and as outlined in the weed management strategy.

Threats and management measures associated with weed invasion during the operational phase

Threats include weed establishment on disturbed soils within the construction area and adjoining vegetation. Associated management measures include:

- Completion of annual weed surveys by bush regenerator personnel, to compare the pre (zero or negligible weeds) and post construction environments, and
- Weed control as required according to the weed management strategy to be undertaken by professional bush regenerator personnel.

The spread of weeds throughout OEMP area can be monitored by:

- Completion of annual weed surveys by bush regenerator, to compare the pre (zero or negligible weeds) and post construction environment.
- Photos will be taken at the established photo points to compare with pre-construction conditions as per the Conservation Agreement.

Weed monitoring and control

Specifically the following measures will be undertaken to survey and monitor the occurrence of weed incursions:

- _ existing weeds to be surveyed and mapped by the contractor's ecologists within the vicinity of construction sites and adjoining areas of native vegetation during pre-clearing surveys to identify current baseline weed levels, inform future management and to enable comparison of pre- and post-construction environment;
- _ vegetation photo-points to be established in vegetation adjoining the development areas as per the Conservation Agreement. Photos will be taken at the established photo-points to compare with pre-construction conditions;
- _ annual weed surveys to be completed by a professional bush regenerator to compare the pre (zero or negligible weeds) and post construction environments; and
- _ any weed outbreaks identified in yearly surveys of the SP1 Zone to be treated by a professional bush regenerator using appropriate control techniques.

Weed Presence

The SP1 zone of the site has been declared as essentially 'weed free' (though refer to current weed status report of areas within SP1, as at March 2013). Any further future development of the site will require regular monitoring to ensure that any small, newly-established weed populations can be easily removed by hand, or similar small-scale methods. Weekly site inspections of the construction area will be included as a contract requirement for construction personnel to report any weed occurrence on the construction area or in adjoining vegetation for early removal and management.

The presence of weeds in the SP1 area is to be monitored annually by a qualified bush regenerator personnel in accordance with the Conservation Agreement. Baseline weed mapping undertaken in the development area and immediate surrounds during the pre-construction phase and photos at established photo points following construction activities will be used to determine changes in weed levels and to identify required management activities.

Photos are to be taken annually at established photo-points in the plan area to monitor changes in weed levels and to form the basis for decisions on ongoing management activities.

Weed management in the plan area are consistent with programs to be applied to the surrounding Parks and Wildlife Group (PWG) estate and may form a component of the agreed annual works program undertaken by an environmental management contractor engaged by S&R. A report on the annual works and the targets met by the program will be submitted to S&R at the end of each financial year.

4 CURRENT BASELINE SURVEY

Methodology

An initial baseline survey of weeds and evidence of feral animals at the 800m, 500m and 50m Pistol Range sites, as well as access roads, tracks and constructed drainage ditches, was undertaken on 6th March 2013.

Each area was surveyed on foot (DEC 2004), discrete weed occurrence locations were identified and recorded in quadrats or along linear transects and weed species ranked frequency of occurrence and evidence of feral animal distributions recorded.

Photo points were established at significant occurrences of weed incursions.

Results

Results are tabulated and presented in Tables 1 - 4.

Conclusions:

1 800m Shooting Range

Weed species:

- The 800M Shooting Range became operational in 1988.
- Weeds occur in small patches particularly along the eastern, mulched border of the shooting range and often in association with downslope wash out zones onto the adjacent access road (Table 1).
- The mulch material bounding the eastern and western boundaries of the 800m Shooting Range originates from mulching of natural bushland on the recently cleared areas for the 500m Shooting Range and the 50m shooting range (Pistol Range) (Figure 1). These areas were cleared about 2 years previously and contained no weed source material.
- All weed species currently occurring on the mulched borders derive from the exotic grassland assemblage that constitutes the vegetation of the shooting range (Table 1). The most common weed species include Flaxleaf Fleabane, Cats Ear, Kikuyu, Common Couch and Slender Pigeon Grass.
- All scattered occurrences of weed incursion along the eastern mulched border of the range and along the access road along its eastern boundary can be removed by hand-pulling or spraying as the occurrences are not extensive and readily controlled. Regular monitoring and weed control is recommended to ensure weed occurrence is contained.

Feral Fauna Pest Species:

- Rabbit scat was recorded in several locations within the mulch along the south-eastern side of the 800m shooting range and in one location on the north-western corner. Scat was also recorded on top of the 700m and 500m berms and within the grassy areas between the 800m and 700m berms and between the 200m and 300m berms. A map marking distribution of scats is shown in Figure 2 (page 27).
- No rabbit warrens were recorded within the study area.
- Fox scat was recorded close to the 400m berm on the north-western side of the range (Figure 2, Table 3).
- No fox lairs were recorded within the study area.

2 500m Shooting Range & Pistol Range (50m Range)

Weed species:

- Weeds occur on 'spray-grass' treated berms (target and side walls and intermediary hill rises along the range), in moist depression sinks along the frontal base of berms and in drainage ditches draining to sediment ponds and in drainage gutters along access roads (Table 2).
- Natural bushland was recently cleared in areas for the 500m Shooting Range and the 50m shooting range (Pistol Range) (Figure 1). These areas were cleared about 2 years previously and contained no weed source material.
- All weed species occurring on the 500m shooting range and Pistol Range derive from spray-grass treatment of cleared areas and from weed sources inadvertently brought in externally. The most common weed species include Tall Fleabane, Red Clover, White Clover, Purple Cudweed, Purple Top and Barnyard Grass (Table 2).
- All occurrences of weed incursion at the 500m Shooting Range and Pistol Range could eventually be removed by hand-pulling or spraying and can be readily controlled. Regular monitoring and weed control is recommended to ensure weed occurrence is contained.

Feral Fauna Pest Species:

- No feral pest species were recorded in this section of the study area (Table 4).

5 REFERENCES

DEC (2004) threatened Biodiversity and Assessment: Guidelines for Developments and Activities

GHD (2007) Southern Highlands Regional Shooting Complex – Ecological Assessment

GHD (2011) Southern Highlands Regional Shooting Complex - Operational and Environmental Management Plan

Table 1 – Locations of discrete patches or areas of weed species in relation to the 800m Shooting Range

SITE DESCRIPTION		1 EASTERN EDGE	2 EASTERN EDGE	3 EASTERN EDGE	4 EASTERN EDGE	5 EASTERN EDGE	6 EASTERN EDGE	7 EASTERN END BERM TARGETS	WEST EDGES	SHOOTING RANGE	ACCESS ROAD TO EAST
COMMENTS		Small patch	Small patches	Small patch	Lineal patch	Wash-out zone		On grassy berm	Along mulched edge	On grassy range	In drainage channels
DISTANCE FROM TARGET (M)		500	410 - 420	390	250	210	100	0	180, 210, 260	300	
COORDINATES (DECIMAL DEGREES)		34.31773 150.45615	34.31836 150.45565			34.31989 150.45443					
AREA (M)		1 X 1M	1 X 1M	1 x 1M	7 X 1M	2 X 2M				800 X 40M	
PHOTO TAKEN		001	002		003	004		005, 006, 007	008	009, 010, 011	012, 013, 014, 015
SPECIES SCIENTIFIC NAME	COMMON NAME										
MAGNOLIOPSIDA: MAGNOLIDAE											
Asteraceae											
<i>Cirsium vulgare</i>	Common Thistle	u									u
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	o				o		o		o	
<i>Hypochaeris radicata</i>	Cats Ears	o		c	u	o	o	o	u	c	o
<i>Senecio madagascariensis</i>	Fireweed									u	u

SPECIES SCIENTIFIC NAME	COMMON NAME	1 EASTERN EDGE	2 EASTERN EDGE	3 EASTERN EDGE	4 EASTERN EDGE	5 EASTERN EDGE	6 EASTERN EDGE	7 EASTERN END BERM TARGETS	WEST EDGES	SHOOTING RANGE	ACCESS ROAD TO EAST
Fabaceae: Faboideae <i>Trifolium repens</i>	White Clover					o					
Gentianaceae <i>Centaurium tenuiflorum</i>								o		o	u
Oxalidaceae <i>Oxalis corniculata</i>	Oxalis							o		o	
Verbenaceae <i>Verbena litoralis</i>	Purple Top									o	
MAGNOLOPSIDA: LILIDAE											
Cyperaceae <i>Cyperus eragrostis</i>	Umbrella Sedge										u

SPECIES SCIENTIFIC NAME	COMMON NAME	1 EASTERN EDGE	2 EASTERN EDGE	3 EASTERN EDGE	4 EASTERN EDGE	5 EASTERN EDGE	6 EASTERN EDGE	7 EASTERN END BERM TARGETS	WEST EDGES	SHOOTING RANGE	ACCESS ROAD TO EAST
Poaceae											
<i>Axonopus affinis</i>	Narrow-leaved Carpet Grass			o		o					
<i>Cynodon dactylon</i>	Common Couch	o			o	o	c			c	
<i>Eragrostis mexicana</i>	Mexican Lovegrass							o			
<i>Paspalum dilatatum</i>	Paspalum							o			
<i>Pennisetum clandestinum</i>	Kikuyu		o		c	o	c	c		c	
<i>Setaria gracilis</i>	Slender Pigeon Grass			o		o		o		c	

PHOTOGRAPHS - 800M RANGE



Photo 001 – Small patch at 500m from target. Variable species.



Photo 002 – Small patch at 410 - 420m from target. Kikuyu.



Photo 003 – Lineal patch of Kikuyu at 250m from target.



Photo 004 – Wash-out zone at 210m from target. Variable species.



Photo 008 – Mulched corridor along western boundary of range.



Photo 009 – Typical exotic grassed area occurring at 300m from target on 800m Shooting Range.



Photo 010 – Typical grassed vegetation along Range.



Photo 015 – Weeds occurring together with native seedlings within drainage gutters along access road.

Table 2 – Locations of discrete patches or areas of weed species in relation to the 500m Shooting Range

SITE DESCRIPTION		PISTOL RANGE						ROADWAY	500M RANGE		CARPARK
WITHIN SITE DESCRIPTION		1 STH END BERM BASE	2 STH END BERM WALL	3 EAST SIDE BERM BASE	4 EAST SIDE BERM WALL	5 SPRAY GRASSED FLAT AREA	6 DRAINAGE DITCH (RANGE)	7 DRAINAGE DITCHES (ROAD)	8 END BERM BASE & OTHER BERMS	9 BELOW MAIN FIRING BERM	10 CARPARK AREA
COMMENTS		Tall weeds	Less weeds	Less weeds	Low freq weeds	50% bare ground	Drains to west	Mostly weed free	Moist area	Moist areas	
APPROX. AREA (M)		625 M ²	840 M ²	200 M ²	500 M ²	1250 M ²			600 M ²	1800 M ²	8000 M ²
PHOTO TAKEN		16, 19	17, 19	18	20	21, 22	23, 24	25 (around range: 26, 27, 28, 29, 31, 32, 36 (E)	33, 34, 35, 37	38, 39, 40, 41, 42, 43	44, 45, 46
SPECIES SCIENTIFIC NAME	COMMON NAME										
MAGNOLIOPSIDA: MAGNOLIDAE											
Asteraceae											
<i>Cirsium vulgare</i>	Common Thistle		u								
<i>Conyza sumatrensis</i>	Tall Fleabane	c	c	c	c				o	c	c
<i>Gamochaeta purpurea</i>	Purple Cudweed					o	o			c	c
<i>Hypochaeris radicata</i>	Cats Ears										o

SITE DESCRIPTION		PISTOL RANGE						ROADWAY	500M RANGE		CARPARK
WITHIN SITE DESCRIPTION		1 STH END BERM BASE	2 STH END BERM WALL	3 EAST SIDE BERM BASE	4 EAST SIDE BERM WALL	5 SPRAY GRASSED FLAT AREA	6 DRAINAGE DITCH (RANGE)	7 DRAINAGE DITCHES (ROAD)	8 END BERM BASE & OTHER BERMS	9 BELOW MAIN FIRING BERM	10 CARPARK AREA
SPECIES SCIENTIFIC NAME	COMMON NAME										
Asteraceae (cont)											
<i>Senecio madagascariensis</i>	Fireweed	o	o			o		u		o	o
<i>Tagetes minuta</i>	Stinking Roger		u								
Fabaceae: Faboideae											
<i>Trifolium pratense</i>	Red Clover		o						u		o
<i>Trifolium repens</i>	White Clover	o	o			o	o	u	c		c
Malvaceae											
<i>Modiola caroliniana</i>	Red-flowering Mallow					u					o
Oxalidaceae											
<i>Oxalis corniculata</i>	Oxalis										o
Polygonaceae											
<i>Polygonum arenastrum</i>	Wireweed	o				o	o				

SITE DESCRIPTION		PISTOL RANGE						ROADWAY	500M RANGE		CARPARK
WITHIN SITE DESCRIPTION		1 STH END BERM BASE	2 STH END BERM WALL	3 EAST SIDE BERM BASE	4 EAST SIDE BERM WALL	5 SPRAY GRASSED FLAT AREA	6 DRAINAGE DITCH (RANGE)	7 DRAINAGE DITCHES (ROAD)	8 END BERM BASE & OTHER BERMS	9 BELOW MAIN FIRING BERM	10 CARPARK AREA
SPECIES SCIENTIFIC NAME	COMMON NAME										
Verbenaceae <i>Verbena bonariensis</i> <i>Verbena litoralis</i>	Purple Top Purple Top		o			o u			o	o	o
MAGNOLOPSIDA: LILIDAE											
Cyperaceae <i>Cyperus eragrostis</i>	Umbrella Sedge						u	u			
Poaceae <i>Axonopus fissifolius</i> <i>Cynodon dactylon</i> <i>Echinochloa crus-galli</i> <i>Eleusine indica</i> <i>Setaria gracilis</i>	Narrow-leaved Carpet Grass Couch Barnyard Grass Crowsfoot Grass Slender Pigeon Grass		o o u o	o	o			c c	c c	c c	o

PHOTOGRAPHS – 50m PISTOL RANGE

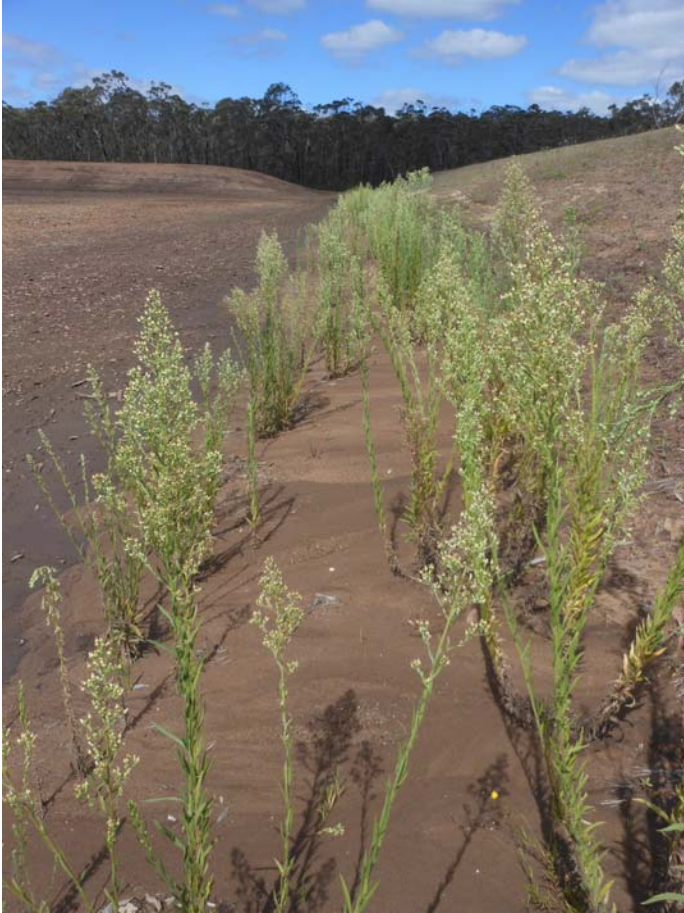


Photo 16 – Lineal row of Tall Fleabane at base of berm



Photo 19 – End berm wall showing Fleabane at base and weed occurrence on berm wall



Photo 18 – Southern berm wall and base, less weeds



Photo 20 – Spray-grassed flat area along northern boundary of range



Photo 23 – Drainage ditch to sediment pond below Pistol Range



Photo 25 – Weeds in drainage ditch alongside sediment mound from 500m Range

PHOTOGRAPHS – 500m RANGE



Photo 28 – Drainage ditch along western edge of Range, weed-free.



Photo 31 – Sediment drain at north-west corner of 500m Range, weed free



Photo 33 – Weeds at base of target berm on 500m Range.



Photo 35 – Drainage ditch eastern side of 500m Range, weed free.



Photo 37 – Weeds at base of intermediary berm on 500m Range.



Photo 38 – Weeds at base of firing berm on 500m Range.



Photo 42 – View of weeds from firing berm to target berm.



Photo 46 – View of weeds occurring over car park site.

Table 3 – Locations of feral fauna pest species in relation to the 800m Shooting Range

WITHIN SITE DESCRIPTION	COMMENTS	1 EASTERN EDGE	2 EASTERN EDGE	3 EASTERN EDGE	4 EASTERN EDGE	5 EASTERN EDGE	6 EASTERN EDGE	7 EASTERN END BERM TARGETS	SHOOTING RANGE	ACCESS ROAD TO EAST
Rabbit scat	Recorded close to the clubhouse and surrounds	✓	✓	✓	✓	✓	✓	✓	Recorded at 700m and 500m berms	✓
European Fox scat	No recordings									
WITHIN SITE DESCRIPTION		1 WESTERN EDGE	2 WESTERN EDGE	3 WESTERN EDGE	4 WESTERN EDGE	5 WESTERN EDGE	6 WESTERN EDGE			
Rabbit scat	Recorded in grassy areas between 200m and 100m	✓								
European Fox scat	One scat found on mulched area				✓					

Table 4 – Locations of feral fauna pest species in relation to the 500m and 50m Pistol Range

SITE DESCRIPTION	COMMENTS	PISTOL RANGE						ROADWAY	500m RANGE		CARPARK
WITHIN SITE DESCRIPTION		1 STH END BERM BASE	2 STH END BERM WALL	3 EAST SIDE BERM BASE	4 EAST SIDE BERM WALL	5 SPRAY GRASSED FLAT AREA	6 DRAINAGE DITCH (RANGE)	7 DRAINAGE DITCHES (ROAD)	8 END BERM BASE & OTHER BERMS	9 BELOW MAIN FIRING BERM	10 CARPARK AREA
Rabbit scat	No recordings										
European Fox scat	No recordings										

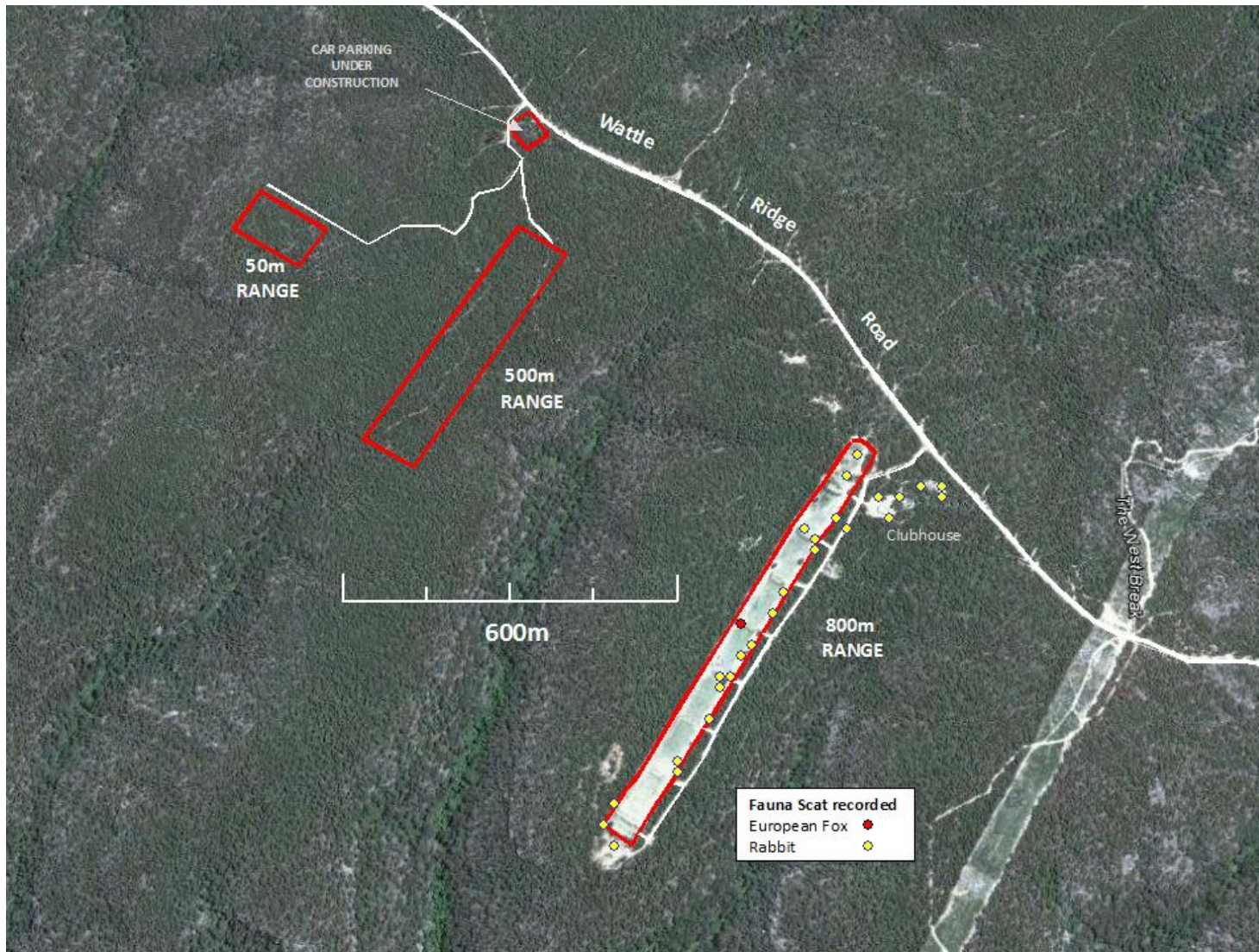


Figure 2 – Recordings of feral pest fauna species.

5 REFERENCED DOCUMENTS

Conservation Agreement dated 12 October 2010 pursuant to Section 69B Part 4 Division 12 of the National Parks and Wildlife Act 1974 between the Minister for the Environment and Minister for S&R in respect to Lot 100, DP 1088254.

Ecological Management Plan 7 October 2010

GHD (2008) *Southern Highlands Regional Shooting Complex: Supplementary Ecological Assessment*. Report prepared for NSW Sport and Recreation. Sydney, NSW.

GHD (2011 Draft) Southern Highlands Regional Shooting Complex Operational and Environmental Management Plan.

Preferred Project Report July 2008