Western Ringtail Possum (*Pseudocheirus occidentalis*) Survey and Data Collation in the Greater Albany Area.

Phase 1 Final Report
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Prepared for Department of Environment and Conservation, Albany Regional Office.

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This report does not necessarily reflect the views of the Department of Environment and Conservation, the Australian Government, the Minister for the Environment, or the Department of the Environment, Water, Heritage and the Arts

LIST OF TABLES

SUMMARY

The Western Ringtail Possum, *Pseudocheirus occidentalis* is a species endemic to the south-west of Western Australia, occurring in several separate populations. It is currently suffering decline in a number of these populations and is hence listed as threatened under Commonwealth legislation, and as "Fauna that is rare or likely to become extinct" under State legislation. To date, recovery actions for the species have focused on west coast populations which are under pressure from development and lack of habitat security in Conservation Estate. The Western Ringtail Possum population occurring in the Albany area on the south coast of WA is also currently experiencing rapid human population growth, and the associated development pressures are known to be impacting on the species habitat. The current Project (Phase 1) brings the Albany population into focus by increasing knowledge of distribution, abundance and habitat, outlining threatening processes, presenting some preliminary survey guidelines and making recommendations for further investigations.

Despite the project being a first step in the process of developing effective management actions for the population of the Western Ringtail Possum occurring in the Greater Albany Area there is still many key aspects of the species population-specific requirements that need to be elucidated.

1. Introduction

The Western Ringtail Possum, *Pseudocheirus occidentalis*, is a small, arboreal, folivorous marsupial endemic to the south-west of Western Australia. Its abundance and range has declined dramatically since that beginning of the 20th Century and abundance is continuing to decline. The factors contributing to this decline are complex and interactive, their significance varying between localities and scales (Wayne *et al.* 2005d, Richardson 2005). This highlights the importance of identifying population specific issues relating to the species throughout its range.

Legislative context of the Western Ringtail Possum

The current conservation status of the Western Ringtail Possum, *Pseudocheirus occidentalis,* under Commonwealth and State Government legislation is as follows:

Commonwealth: Listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

State: Listed in Western Australia under the *Wildlife Conservation Act 1950* under Schedule 1 species ('Fauna that is rare or likely to become extinct'), and currently ranked as Vulnerable under IUCN Red List criteria C2a(i): population size less than 10 000 mature individuals, declining, with no subpopulation containing more than 1000 mature individuals (IUCN 2001).

Distribution of the Western Ringtail Possum

The Western Ringtail Possum had an inferred pre-historic range from Geraldton, on the west coast of WA to the Hampton Tableland on the south coast approximately 200 kilometers west of the WA/SA border, and a pre-European range extending from just north of Perth, to as far east as the Pallinup River along the South Coast (Richardson 2005).

Western Ringtail Possum populations are currently known from seven highly disjunctive locations, both coastal and inland, in the south west of WA, within an area much contracted from the pre-European range (Table 1), extending from Harvey in the north, to Mt Manypeaks, near Cheynes Beach in the south. The status of these populations varies from stable to declining or unknown. The highest density populations appear to be in the Bunbury/Busselton regions, Perup areas and around Albany, the latter occurring from West Cape Howe in the west to Mt Manypeaks in the east, with an outlying population in the Porongurup National Park to the north (Richardson 2005; Jones *et al*. 1994a).

In addition there are four DEC approved translocation release sites at Leschenault Peninsula Conservation Park, Yalgorup National Park, Lane Pool Reserve and Karakamia Sanctuary (Richardson 2005).

Table 1: Current known populations of the Western Ringtail Possum (from DEC 2007)

Population	Location	Status
1	Inland, south of Harvey to Preston.	Declining
2	Sparse coastal population extending from south of Bunbury to Yalingup	Declining
3	Leeuwin-Naturaliste National Park (isolated records)	Stable
4	Southern forest between Bridgetown and Northcliff	Stable – Declining
5	South Coast -Walpole to east of Denmark	Declining
6	South Coast – West Cape Howe to Mount Manypeaks	Stable-Declining
7	Porongurup National Park (isolated records)	Status unknown since 2007 wildfires

The current Project

To date, recovery actions for the Western Ringtail Possum have focussed largely on the Busselton/Bunbury area of the species range due to the pressures of development and lack of habitat security in Conservation Estate. The Albany area is also currently experiencing rapid human population growth, and the associated development pressures are known to be impacting on Western Ringtail Possum habitat. While some populations are secure within Reserves surrounding Albany (eg. Two Peoples Bay NR), the urban areas and surrounds also contain significant numbers of Western Ringtail Possums. Compared to a number of other populations in the species range (eg. inland jarrah forest (Wayne *et al.* 2005a, b and c, Jones *et al.* 1994a and b) this south coast population has not been the subject of any detailed studies (apart from some work on a sub-population at Emu Point in Albany by Jones *et al.* 1994 a and b), and habitat usage and distribution in this population is poorly documented.

The area covered by the project is referred to as the "Greater Albany Area" and corresponded approximately to the Populations 6 and 7 in the Department of Environment and Heritage "Species Information Sheet". This encompasses the area along the coast from West Cape Howe to Mt

Manypeaks, near Cheynes Beach and inland approximately 15km, plus an outlying population centered around the Porongurup Ranges. This population is subsequently referred to as the Albany population.

Project aim

The aim of the current Project (Phase 1) is to improve our understanding of the distribution and habitat use of Western Ringtail Possums in the Greater Albany Area as a preliminary step in more comprehensive survey of the area. This will be achieved through the following:

1. Collating known records of presence and canvassing for, and acquiring and documenting new records.
2. Surveying a number of areas of remnant vegetation within the Albany area.
3. Documenting habitat preferences from records and surveys.
4. Prioritisation of survey areas for future work, and
5. Identifying methodology and protocols for survey within the Greater Albany Area.

The project addresses in part specific actions in the "Draft Recovery Plan for Western Ringtail Possum, *Pseudocheirus occidentalis*, Version 4, 2005"(Richardson 2005) namely:

5.1 Continue mapping existing populations and re-examine mapping framework.
5.2 Identify, describe and Map critical habitat and important populations.
5.3 Implement population monitoring of the Western Ringtail Possum across its range, including
5.3.1, *Develop protocols for monitoring populations.*

Biology and ecology of the Western Ringtail Possum

The Western Ringtail Possum is a largely solitary, territorial animal. Home ranges are small, usually less than 5 ha, and vary primarily with nutrient content of food resources. Mother and daughter home ranges overlap, however there is only slight overlap of male ranges with those of females and other males. Home ranges can overlap extensively in dense populations but there is usually temporal separation in the use of shared areas (Jones *et al.*1994b, Jones 1995, Wayne *et al.* 2005c). Refuge sites include dreys (self-built nests), platforms, tree hollows, vegetation, fallen hollow logs, grasstree (*Xanthorrhoea* spp.) skirts, on the ground under sedges and at the base of grasstrees and disused rabbit warrens. In suburban situations the species uses roof spaces and other artificial constructions (Jones *et al*., 1994b , Richardson 2005). Dreys are common refuge sites in coastal Peppermint woodlands and thickets whereas tree hollows are the preferred rest site in the inland populations that occur within Eucalypt woodlands. A number of refuge sites are occupied within a home range.

Pairs consist primarily of a mother and young. Females can breed at less than 12 months of age and can breed continuously, breeding is continuous in some populations, but generally there is a peak between May to June and occasionally in October to November in inland populations (Wayne 2005c). Females usually breed only once per year and litter size is usually one (Jones *et al.*, 1994b). Gestation is approximately 2-4 weeks and a pouch life approximately 100 days. Young are weaned at 6-8 months and disperse at 8 to 12 months (Richardson 2005). Reproductive output has been correlated with

habitat quality; in the peppermint woodlands low foliage nitrogen coincided with the minimum number of births (Jones *et al*., 1994b).

The diet of the western ringtail possum is not well understood. In the wild it has been found to consist almost exclusively of myrtaceous plants: peppermint, marri and jarrah (Jones *et al*., 1994b). In urban areas possums feed on introduced garden species (Richardson 2005), and captive animals fed on peppermint leaves show a preference for fresh, young green leaves rather than red leaves (Ellis and Jones 1992).

More detailed information on the biology and ecology of the Western Ringtail Possum can be found in Jones *et al.* (1994 a & b), Wayne *et al.* (2005c) and is summarised in Richardson (2005).

2. Mapping the distribution of Western Ringtail Possums in the Greater Albany Area.

The Draft Western Ringtail Possum RP (Richardson 2005) outlines key actions which relate to identifying and mapping extant populations, plus used as well as potential habitat (Action 5.1) as a first step in identifying important populations and critical habitat (Action 5.2). One objective of the current Project is to develop a database of Western Ringtail Possum records for the Greater Albany Area, which can assist in the development of management actions specifically for the Albany population, and in addition can be incorporated into existing State data storage systems, making a contribution of knowledge to assist in the management of the population as a whole.

The Greater Albany Area Western Ringtail Possum Database

Prior to this project Western Ringtail Possum records for the Greater Albany Region consisted of those occurring in State and Regional level databases. These comprise the DEC's Threatened and Priority Fauna Database (State level), held and administered by the Species and Communities Branch, and a Regional Threatened Species Database, created in 2004 as part of the Regional Threatened Species Recovery Plan Pilot Project (DEC 2008.). This latter database collected all known records for threatened species within the South Coast NRM Region and included records from both the above DEC State level database, an earlier (2000) regional threatened species database (South Coast Threatened Fauna Database) and various other sources (WA Museum records, local knowledge, EPA assessments).

A new database for the collation of the existing Ringtail Possum records residing in the above databases, and for the addition of new records was developed for this Project. The database was created in Microsoft Access 2007. The format was complicit with the Commonwealth Department of Environment, Water, Heritage and the Arts "Guidelines for Biological Survey and Mapped Data". This format differs to some extent from DEC's Threatened and Priority database but can be incorporated with some minor field name changes.

Field definitions and categories are outlined in the Metadata Statement (Appendix B).

Western Ringtail Possum record sources

New records were acquired or extracted from a number of sources, via a number of methods as follows:

- Recent Environmental Impact Assessments and other Fauna Reports carried out within the Albany area.
- An update of WA Museum records
- An update of records from the DEC Threatened and Priority Fauna Database.
- Canvassing for information from the local community:

  This was achieved by the following methods:

  - An article calling for information on the distribution of Western Ringtail Possums in the Greater Albany Area was placed in the South Coast NRM Newsletter.
  - A flyer calling for information on the distribution of Western Possums was sent out to approximately 170 Land for Wildlife landholders in the Greater Albany Area.
  - Media coverage:
    - Two articles were placed in local newspapers (The Albany Advertiser and Weekender)
    - Two radio interviews (South Coast ABC Radio and Albany Community Radio) were conducted
  - A number of Wildlife Carers and Fauna Consultants within the Albany were contacted about their knowledge of Western Ringtail Possums in the area.

Current known distribution of Western Ringtail Possums within the Greater Albany Area

Prior to the commencement of the Project the distribution of the Albany population of the Western Ringtail Possum was derived from 83 known records. The above process of record acquisition has resulted in the addition of 215 new records to the database, an approximately 150 % increase in the number of records.

The response to the media coverage, articles and flyers was very high, with by far the greatest number of records, approximately 160, coming from individual community members and community groups (eg. Friends of Mt. Melville) providing information on possum locations, and observations on nesting and feeding habitats. This indicates a high level of community interest and concern about the conservation of Western Ringtail Possums in the Greater Albany Area.

An update of the WA Museum records only yielded two new records and that of DEC's Threatened and Priority Fauna database only yielded an additional five. The number of records obtained from recent Environmental Impact Assessments and other Fauna Reports was low, with the exception of that carried out by Green Iguana within part of Lots 3000 and 1523, Emu Point Drive, Emu Point (Green Iguana 2007) with 20 records (sightings).

Map 1 shows a comparison between records known prior to the Project and those residing in the current updated database. From existing records and those obtained through this project the current known distribution of Western Ringtail Possums within the Greater Albany Area is displayed in Map 2. Pre and post 2000 records are indicated.

Although the number of records increased substantially through this Project, the increase has not resulted in any large known range extension of the Western Ringtail Possum. There has been a small extension of c. 6 km south along the Torndirrup Peninsula (Big Grove). In addition, there is a possible

range extension by c. 6 km to the east with a sighting reported at Waychinicup NP campsite. However the observer left no contact details for confirmation of this record. There is also a small north-easterly extension (c. 5.5km) to Bornholm. There were no significant range contractions evident.

The most significant change has been in the number of records within the known boundary of the Albany population, with large increase in numbers from areas with existing records and the addition of records in areas where previously no records occurred. In particular:

- A significant increase in the number of records from an area within a radius of approximately 10km from the centre of Albany. Within this area, substantial increases in records from central Albany (within 3 km of town centre), including Mounts Melville, Clarence and Adelaide, Emu Point and from the northern suburbs of Albany, around Milpara, McKail and Gledhow.

- New records from areas where previously no records occurred, including Big Grove and Lower King.

- No records for the Porongurup area since the 2007 wildfire. The status of this population remains unknown.

Despite the large increase in the number of records notable record gaps still exist. These include:

- Inland between Upper Kalgan and Mt Manypeaks.

- Coastal area between Two Peoples Bay NR and Mt Manypeaks.

- Torndirrup National Park –east of Big Grove (one record from 1998 is possibly within the park, however the locality given for this record is vague). This park contains potentially suitable habitat in the form of *Agonis flexuosa* low woodland and thickets.

- West Cape Howe National Park- no records since 1975.

- The coastal area between Torndirrup NP and West Cape Howe NP- this is largely Shire Reserve and contains areas of suitable habitat in the form of *Agonis flexuosa* thickets and woodland and also forms an important coastal corridor.

It is unclear as to whether these data gaps represent real gaps in the Western Ringtail Possum's distribution. The existence of areas of suitable habitat, some of it within reserves, suggests that these gaps may be the result of a lack of data, however more work is needed to determine the extent of suitable habitat within these areas and the presence or absence of Western Ringtail Possums.

3. Western Ringtail Possum Surveys

Five areas of remnant vegetation were chosen to survey for Western Ringtail Possums. Four are areas proposed for residential or tourist development and one was a parcel of UCL, in close proximity to a proposed development area.

Site 1. Bayonet Head Outline Development Plan Area (Map 3)

The Bayonet Head Outline Development Plan area is a 282 ha site bounded by Lower King Road and remnant vegetation (largely Crown Reserve) to the west, Elizabeth Road to the north, existing urban residential development to the south and Oyster Harbour to the east. It is situated approximately 7km north-east of the Albany CBD. A number of landowners are involved in development of this site. During 2005 and 2006, ATA Environmental, was commissioned by two landowners, Heath Development Company and Landstart, to undertake a detailed environmental assessment of the study area. Part of this environmental assessment was a targeted survey to estimate the presence and number of Western Ringtail Possums (ATA Environmental 2006). This survey observed four animals during spotlighting but only two dreys were located. In addition 13 potentially suitable nesting tree hollows were observed, but they did not state how suitability was determined.

The remnant vegetation at the site contains 11 DRAFT vegetation units as described by Sandiford and Rathbone (*in prep*.) (see section 4 for more information). Six of these units (1-6) are restricted to soils that are either seasonally or permanently wet. Four of these were assessed as potentially suitable Western Ringtail Possum habitat based on the continuity and density of the canopy layer, and the potential for suitable refuge sites (8-11).

The area potentially suitable for Western Ringtail Possums covered approximately 200 ha.

Site 2: UCL Big Grove (Crown Reserve No.931, Plantagenet Location 104A) (Map4)

This site was 19.75 ha of remnant vegetation within Unallocated Crown Land (UCL), bounded by Princess Royal Harbour to the east, Frenchmans Bay Rd. to the west, residential development to the north and an area of privately owned remnant vegetation to the south. The site comprised largely *Agonis flexuosa* low woodland.

The first 200m of this site form Frenchmans Bay Rd. was considered to have too sparse an overstorey to the suitable for Western Ringtail Possums. The remainder of the site was considered potentially suitable for the species.

Site 3: Big Grove Outline Development Plan Area (Map 4)

The Big Grove Outline Development Plan (ODP) area is located on the southern shore of Princess Royal Harbour and to the north of Frenchman Bay Road, approximately 9km southeast of the Albany Central Business District. Most of the area is zoned rural under the City of Albany Town Planning Scheme No. 3 (Albany TPS No 3), and is identified in the Albany Local Planning Strategy as future residential. Peet Limited and Humfrey Land Developments own numerous lots within the area and are planning to develop their landholdings for residential subdivision.

The Big Grove Structure Plan area comprises 123.19ha and comprises native vegetation and areas cleared for rural and residential purposes. The site is currently separated from Princess Royal Harbour coastline by a number of discontinuous foreshore reserves. The ODP area includes a number of lots, only two were surveyed.

A previous desktop fauna survey of the ODP area (Landform Research 2004, Coffey Environments 2008b) suggested that the Western Ringtail Possum was no longer present in the adjacent Torndirrup NP, and spotlighting on Lots 1, 7 and 109, and a day search of dreys on lots 1 and 7 revealed no Western Ringtail Possums or signs (scats or dreys).

Areas surveyed

a) Lot 1

A 10.5 ha lot between Princess Royal Harbour and Frenchmans Bay Rd.

Vegetation type (Coffey Environments 2008a); ***LCFAf*** = Low closed Forest of *Agonis flexuosa* over Tall Open Shrubland of *Spyridium globulosum* over Shrubland of *Hibbertia cuneiformis*, *Adenanthos sericeus, Leucopogan racemulosus* over Open Sedgeland of *Lepidosperma gladiatum*

In addition, Bullich (*Eucalyptus megacarpa*) was observed in the current survey to be a component of the upper storey.

The condition of the vegetation was classed as *Excellent* by Coffey Environments (2008a), however this remnant has recently been "slashed" in bands of 20-30 wide throughout the block, leaving only approximately 60-70% of the original vegetation.

All of the site was considered potentially suitable for Western Ringtail Possums.

b) Lot 109

An 18ha lot between Princess Royal Harbour and Frenchmans Bay Rd.

Vegetation type (Coffey Environments 2008a): Largely comprising ***LWAf***- Low Woodland of *Agonis flexuosa* over Low Closed Heath of *Acacia pulchella* spp. *goadbyi*, *Sphenotoma ciliatum*, *Melaleuca thymoides, Gompholobium capitatum, Billardiera laxiflora* and *Leucopogon revolutus* to 1m over Sedgeland of *Cyathochaeta equitans, Lyginia imberbis, Schoenus caespititius and Lepidosperma squamatum.*

Condition: Degraded to Good

A large area of this block has been "slashed" leaving small clumps of this vegetation type, interspersed with bare areas, mostly greater than 20m wide, with only a low weed understorey. There was little or no connectivity remaining between the clumps.

Site 4. National Lifestyle Villages Oyster Harbour, Lot 500 Allison Parade, Albany. (Map 5)

This site is located to the north east of the city centre of Albany and in the precinct of Lower King. Allison Pde forms the eastern boundary of the property and Elizaberth Street the northern. The total area of the site is 18.2ha., however only approximately 10 ha is remnant vegetation and there is a permanent lake and wetland located at the southern end of lot 500, comprising about 5 ha. Not all of remnant vegetation was accessible due to inundation therefore the area surveyed comprised only approximately 6 ha.

Most of the remnant vegetation is comprised of *Taxandria juniperina* woodlands and a small portion of *Melaleuca*/ *Baumea* sedgelands. In the main, the cleared areas have extensive invasions of exotic week species throughout the sites and at the interface of the wetlands. The woody weed Sydney Golden Wattle (*Acacia longifolia*) is a prevalent in the mid and upper-storey throughout the remnant vegetation.

Survey Methods

Documented survey techniques for Western Ringtail Possums involve spotlighting, faecal pellet (scat) searches and searching for dreys (DEC 2007). All of these non-invasive methods are preferable to trapping, which causes disturbance to the animals, has a low capture rate, and is labour intensive. Spotlighting has been found to provide similar or better detection rates than trapping (Wayne *et al*. 2005a). Although the most effective, non-invasive techniques do have their limitations: the species may go undetected at low densities using spotlighting and scat searching (de Tores and Rosier 1997), and spotlighting is influenced by such factors as season and weather (Wayne *et al*. 2005b). These techniques have largely been trialed and used within jarrah forest in inland populations and peppermint woodland habitats in west coast populations.

Wayne *et al.* (2005a) concluded that Western Ringtail Possums were best surveyed in the jarrah forest using 50W hand-held spotlight from a vehicle or by scat searches. Estimates of abundance by scat surveys were strongly correlated with spotlight counts. Jones *et al.* (1994a) used day search for dreys, scats and scratches on trees, and night searches using spotlight or head torch on foot or from a vehicle in peppermint woodland. Vehicle spotting was most suitable to open forest whereas foot spotting was obligatory in dense coastal vegetation.

A survey of an Emu Point development site by Green Iguana in Peppermint thicket (Green Iguana 2007) also used drey searches and spotlighting on foot, following parallel transects 10 m apart (two persons searching in each 10 m corridor). While efforts were made in this survey to search for scats, the density of the vegetation meant that scats were very difficult to locate across most of the site, particularly where a dense sedge understorey was present. The extremely dense overstorey and midstorey strata also necessitated a very slow searching rate to adequately investigate the presence of Western Ringtail Possum.

A possum survey expert (Maureen Francesconi) was present at the surveys. Prior to the surveys, surveyors were briefed in survey techniques. Survey techniques that could potentially be used at the sites included:

1. Spotlighting

a. On foot
   - A headtorch is best as this gives a direct beam of light from the observer's eyes to the animal's eyes, enabling eyeshine to be easily picked up. The best light source is an incandescent bulb, not LED, with a relatively tight beam. If using hand a held torch this should be kept at head height, close to eyes, in order to best detect possum eyeshine.
   - The vegetation is swept by the beam from top to bottom as the observer walks and every 20m or so the observer turns backwards and performs another sweep looking back.

- It should be fully dark before the start of spotlighting.

b. Vehicle
    - A hand-held spotlight is used from a moving vehicle.

2. Drey searches

- Involves walking a transect, and observing any dreys visible from the transect, or within a set distance from the transect. The distance required between transects will depend on the visibility from each transect.
- Transects can be walked through vegetation or along tracks.
- Can be carried out from a vehicle, as long as tree canopy is visible.

3. Scat searches

- Detecting the *presence* of possums by the *presence* of scats involves walking a transect and observing the presence or absence of scats at set positions along the transect.

- *Abundance* estimates from scats can be reliably obtained by counting numbers within a fixed area plot. This technique is not suitable, however under difficult substrate conditions e.g where there is a dense ground cover.

Prior to the survey each site was assessed for the suitability for the application of each of the above survey methods. This was largely dependent on vegetation structure and site characteristics such as the presence of tracks. The following techniques were used at each survey site:

Site 1. Bayonet Head Outline Development Plan Area

Day and night searches were carried out on the 2nd and 3rd of July 2008. Night conditions were clear and still.

This site had a number of vehicle tracks around the edges of the remnant and which traversed the remnant. Most of the vegetation deemed as potentially suitable habitat for possums was of relatively open nature, (eg. "*Allocasuarina fraseriana*/*Eucalyptus staeri* Low Open Woodland, over Open Heath, Mixed Sedgeland"), and contained some areas with little ground cover. The following survey methods were therefore employed at this site.

Day searching:

- **Drey search**- transects were walked every 50m throughout all suitable vegetation, by 3 or 4 people, one on each transect. Visibility from each transect was approximately 20-30m either side of transect.

- **Scat search**- the ground layer vegetation was too thick to use the technique of scat counts. In addition vehicle tracks were not suitable for scat searches as they had very little overhanging

vegetation. Observers therefore searched for the *presence* of scats only in any areas along the dry transects which offered the opportunity to see scats (bare ground, tree trunks/logs on the ground).

Night searching:

Spotlighting for possums involved headtorching on foot along all vehicle tracks through suitable vegetation and where foot tracks traversed the vegetation, or where the ground layer was open enough to allow safe night walking.

Site 2: UCL Big Grove (Crown Reserve No.931, Plantagenet Location 104A)

The day and night search was carried out on the 4th of July 2008. Night conditions were clear and still.

This site had a number of vehicle tracks around the edges of the remnant and which traversed the remnant. The vegetation type which was potentially suitable for possums (*Agonis flexuosa* low woodland) was very thick and quite impenetrable in most places. The following survey methods were therefore employed at this site.

Day searching:

- **Drey search**- these were carried out from a vehicle along the vehicle tracks.

- **Scat search**- as the vegetation was too thick for walking through and as vehicle tracks were not suitable for scat searches as they had very little overhanging vegetation, no scat searches were carried out at this site.

Night searching:

Spotlighting for possums involved headtorching on foot along all vehicle tracks through suitable vegetation .

Site 3: Big Grove Outline Development Plan Area

a) Lot 1

The day and night search was carried out on the 4th of July 2008. Night conditions were clear and still.

This site had a number of "vehicle tracks" (widely cleared areas) around the edges of the remnant and which traversed the remnant. The vegetation was very thick and quite impenetrable in most places. The following survey methods were therefore employed at this site.

Day searching:

- **Drey search**- these were carried out from a vehicle along the vehicle tracks (cleared areas).

- **Scat search**- as the vegetation was too thick for walking through and as vehicle tracks (cleared areas) were not suitable for scat searches as they had very little overhanging vegetation, and had a thick layer of felled vegetation, no scat searches were carried out at this site.

Night searching:

The felled vegetation within the cleared areas made walking difficult at night at this site. Therefore a technique of headtorching from the vehicle was trialed. This was possible as the vehicle tracks (cleared areas) were wide enough to allow the observer to easily observe the tree canopy. This technique requires two observers, one for each side of the vehicle and a driver; however a greater area can be covered in a shorter time compared to headtorching on foot.

b) Lot 109

The day and night search was carried out on the 4th of July 2008. Night conditions were clear and still.

All of this site could be accessed by vehicle due to the vegetation being in small clumps surrounded by large cleared areas. The following survey methods were therefore employed at this site.

Day searching:

- **Drey search**- carried out from a vehicle around all clumps of vegetation which were deemed large enough or had some connectivity with other clumps.

- **Scat search**- the vegetation clumps were too thick for scat searches. The intervening cleared areas were covered with a thick weed ground layer, making it difficult to see scats. At this site a scat search could potentially be carried out in summer when the weeds die off.

Night searching:

Spotlighting for possums involved headtorching from a vehicle around all clumps of vegetation which were deemed large enough or had some connectivity with other clumps.

Site 4. National Lifestyle Villages Oyster Harbour, Lot 500 Allison Parade, Albany.

The day and night search was carried out on the 13th of August 2008. Night conditions were clear and still.

Most of the site was accessible on foot, however some areas were inaccessible due to inundation. Some areas fringing the lake and creeks were quite impenetrable; however, the small size of the remnants enabled most of the canopy layer to be observed form the edges. There were a number of opportunities in the form of bare ground or very low ground layer vegetation to enable some scat searching to be carried out. The following survey methods were therefore employed at this site.

Day searching:

- **Drey search-** carried out on foot, along edges of remnants in within remnants where accessible.

- **Scat search**- carried out where vegetation was overhanging bare areas or areas with a very low round cover.

Night searching:

Spotlighting for possums involved headtorching on foot along all edges and along tracks.

Survey Results

Results of the survey were inputted into the Greater Albany Area Western Ringtail Possum Database. These records were designated by the entry "Commonwealth Western Ringtail Project Survey" under the field "Original Record Source". Details of survey results are presented in Appendix B.

Site 1. Bayonet Head Outline Development Plan Area (Map 3)

A total of four Western Ringtail Possums were sighted. Two of these were seen on the first night and consisted of a mother and sub-adult. The other two were adults seen on the second night, separately but within the same remnant vegetation block. This comprises an area to the NE of the ODP, that is to be maintained as Public Open Space.

Eleven dreys were observed throughout the ODP, and scats were observed in a number of locations where ground layer vegetation was sparse.

Site 2: UCL Big Grove (Crown Reserve No.931, Plantagenet Location 104A) (Map 4)

One Western Ringtail Possum was sighted in the NW corner of the remnant. Two dreys were located, one on the southern edge and one on the northern edge.

Site 3: Big Grove Outline Development Plan Area (Map 4)

a) Lot 109

No Western Ringtail Possums were sighted and no dreys were located.

b) Lot 1

A total of three Western Ringtail Possums were sighted. Two of these consisted of a mother and sub-adult.

No dreys were observed.

Site 4. National Lifestyle Villages Oyster Harbour, Lot 500 Allison Parade, Albany (Map 5)

A total of six dreys were observed. Only one of these could be reasonably assumed to be active as it had a large number of scats underneath. The other five were possibly inactive or only resting platforms.

Scats were observed at a number of locations and were very abundant under the active drey.

Western Ringtail Possum Densities

Density estimates based on number of animals seen per ha is not a very accurate estimate and is influenced by many factors (detectability of animal, intensity of survey). Ideally, radio-tracking is required to accurately determine densities.

Based simply on the number of animals observed per number of hectares of remaining suitable remnant vegetation the densities can be represented as follows; Bayonet Head ODP (0.02 per ha, including 1 sub-adult), Big Grove UCL (0.05/ha) and Big Grove ODP (Lot 1) (0.46/ha, including one sub-adult).

These densities are slightly lower than those found at Emu Point *Agonis flexuosa* thicket (minimum of 0.7/ha) (Green Iguana 2007) and comparable to those in *Agonis flexuosa* forest (0.08/ha including three subadults,) also at Emu Point (Jones *et al.*, 1994b), where low densities were the result of home ranges being widely dispersed and separated by areas of apparently suitable habitat that was not occupied (Jones *et al.*, 1994b).

Overall these densities are low in comparison with other estimates within the species range. Within peppermint forests at Locke Nature Reserve overall densities were estimated at 2.4 adults/ ha, but were up to 7.0/ha, and 3.7-4.3 /ha in Peppermint/tuart (*Eucalyptus gomphocephala*) association at Abba River (Jones *et al.*, 1994b).

High density populations have been reported to be associated with abundant Peppermint trees or Peppermint/eucalypt associations with a high continuity of either the canopy or mid-strata (Jones *et al.* 1994a). The canopy continuity may afford possums greater protection from terrestrial predators as they need to descend to the ground to travel between food trees less frequently (Jones *et al.* 1994b)

Dreys

It was not possible to determine if dreys were occupied or not. Some dreys were quite flattened and may have only been used as resting platforms, likely by males. Scats were found in some areas where no dreys were seen (Bayonet ODP) indicating that animals may be using dense undergrowth (eg. sedges) or hollows on the ground or in trees as refuges. In addition, animals were seen in areas where no dreys were observed (Big Grove ODP Lot 1).

The majority of dreys at all sites were greater than 3-3.5 m, this is in contrast to the situation found at Emu Point (Green Iguana 2007) in which the majority of dreys were located approximately 1.5 – 2 m.

Scats

There was limited scope for the use of this technique due to the density of ground layer vegetation at all sites. Only at the Bayonet Head ODP, for example in the *Allocasuarina fraseriana* woodland types or mixed *Allocasuarina fraseriana/ Eucalypt woodland* types were areas of bare or sparse ground cover encountered enabling scats to be seen easily detected. Also, vegetation did not usually overhang tracks, making searching for scats on tracks ineffective.

4. Guidelines for Western Ringtail Possum surveys within the Greater Albany Area

From the limited amount of survey work carried out within the scope of this Project, some preliminary guidelines for surveying for Western Ringtail Possums in habitats within the Greater Albany Area can be developed. The three methods employed in other parts of the species range (outlined above), i.e. spotlighting (vehicle and foot), drey searching and scat searching can essentially form the basis for survey within the Greater Albany Area. However, the differing nature of vegetation types from the jarrah forest and peppermint woodland, in which much of the survey work has been carried out, necessitates some caveats or variations on these techniques.

Vegetation structure and the degree of access via foot or vehicle tracks largely determine the most appropriate methods to employ at a site (Table 2). Examples of broad vegetation type in which all of these technique are suitable, in the absence of sufficient track access, include *Allocasuarina* woodland *Eucalypt* woodland or *Agonis flexuosa* woodland. Vegetation types such as *Agonis flexuosa* thickets can hinder the effectiveness of these techniques.

Table 2: Suitability of Western Ringtail Possum survey techniques in differing vegetation structures and access situations.

Survey Technique	Conditions / site characteristics conducive to technique	Conditions / site characteristics hindering technique
Spotlighting (nightime):		
Foot	easy access through vegetation, or presence of foot or vehicle tracks.	impenetrable vegetation thick head height vegetation which hinders visibility
Vehicle	presence of vehicle tracks, preferably through remnant as well as along edges.	absence of vehicle tracks
Drey searches (daytime)	easy access through vegetation, or presence of foot or vehicle tracks (can be carried out in thick vegetation but slow search rates prohibits effectiveness)	impenetrable vegetation thick head height vegetation which hinders visibility

Scat searches (daytime)	low, sparse ground cover trees overhanging tracks bare patches of ground fallen logs or flat areas of tree trunks where scats may be visible	any groundlayer vegetation which hinders detection of scats (if ground layer is largely weeds or annual species then may be suitable in summer when these species die off)

In summary,

- Spotlighting is the only technique that can be used to definitely conclude as to whether Western Ringtail Possums occupy a site. This technique can be carried out on foot with a headtorch, either along tracks or through easily traversed vegetation.

- Drey searches should where possible be carried out along transects set at 30-50m apart, such that the whole remnant is surveyed. Where the vegetation is too thick, drey searches can be carried out along tracks.

- Scat searches can only be carried out where the ground layer enables detection.

- Where possible a combination of the above three techniques should be employed.

- In low density populations, animals may go undetected using spotlighting and scat searches. In this case drey searches can be used. However the absence of dreys does not mean an absence of individuals, as dreys are not constructed in all habitat types. In this survey, no dreys were observed at Site 3(a), but animals were observed spotlighting. In addition, animals were detected by spotlighting at 3 sites (1, 2 and 3(a)) within only one night of spotlighting. However, despite the presence of dreys and scat at Sites 4, no animals were detected over one night. It is recommended therefore that spotlighting be carried out over at least two, preferably three nights in order to gain a reasonable probability of detection.

5. Habitat Associations within the Greater Albany Area

Previously known habitat associations and requirements

A high quality habitat for Western Ringtail Possum comprises a continuous canopy, suitable diurnal refuges, and high foliage nutrient value. Retaining high canopy continuity reduces the need for the animals to come to the ground and thus reduces predation pressure (Jones *et al.* 1994b, Richardson 2005).

Within the Greater Albany Area the Western Ringtail Possum, previous to this survey, has been reported to be found in peppermint (*Agonis flexuosa*) woodlands and thickets, myrtaceous heaths and

shrublands, Bullich (*Eucalyptus megacarpa*) dominated riparian zones, karri (*E. diversicolor*) forest and marri (Corymbia *calophylla*)/jarrah (*E. marginata*) woodlands.

Little is known of the relative abundance of the Western Ringtail Possum within and between these vegetation types (Richardson 2005), only two detailed surveys having been carried out within the Albany population. Jones *et al.* (1994a) surveyed 10 sites within the known range of this population (West Cape Howe, Elleker, King River, Lower Kalgan, Emu Point, Mt Melville, Mt Clarence, Lake Seppings,Two Peoples Bay and Porongurup Range). Disparate to information obtained in the current Project only three sites were found to be occupied. Animals were found to be present in a farmhouse garden at Elleker, in urban areas and in those with a 90% canopy cover of *Agonis flexuosa* with *Acacia* and *Hakea* spp. at Emu Point. At Two Peoples Bay NR Western Ringtail Possum occupied patches of low forest occurring in the valleys and gullies, comprising Marri, Jarrah, *Banksia* spp. and *Melaleuca* spp..

Throughout the Western Ringtail Possum's range Jones *et al*. (1994a) found that vegetation at all occupied sites belonged to one of three broad vegetation types defined as *A. flexuosa* forest (55% of occupied localities), eucalypt woodland or forest with a midstorey of *A. flexuosa* (38% of occupied localities), and eucalypt woodland or forest without *A. flexuosa* (11% of occupied localities). Urban or semi-urban habitat occurred at 7% of occupied localities, but *A. flexuosa* was common or abundant in all such habitats. Jones *et al*. (1994a) also found that the highest density populations were near-coastal, and associated with abundant Peppermint trees with a high continuity of either the canopy or mid-strata, as occured at the Emu Point site, and that many areas with abundant *A. flexuosa* did not support Western Ringtail Possums.

An extensive survey for Western Ringtail Possums was carried out in 2007 at a site proposed for urban development by Landcorp (the Western Australian Government Land Developer) at Emu Point (lots 3000 and 1523 Emu Point Drive) by Green Iguana Environmental Consultants (Green Iguana 2007). This is an area of Peppermint (*Agonis flexuosa*) thicket. The majority of Western Ringtail Possum sightings (19 out of 23, or 83%) occurred within the north-eastern parts of the site, where the tallest and densest Peppermint tree thickets occurred, and where the wettest swales also occurred. Dreys occurred across the site, most frequently in either the Peppermint tree or the Shark-tooth Wattle (*Acacia littorea*) (38% and 37% of records). Basket Bush (*Spyridium globulosum*), Native Wisteria (*Hardenbergia comptoniana*), *Hakea oleifolia* and Woolly Bush (*Adenanthos sericeus*) were also used (11%, 5%, 5% and 4% of records respectively).

At the Bayonet Head Outline Development Plan area possum dreys were located in a Jarrah (*Eucalyptus marginata*) and Sheoak (*Allocasuarina fraseriana*) tree by ATA Environmental (2006).

Habitat associations determined from project results.

Associations of records with vegetation types

The only vegetation mapping available within the Greater Albany Area has until recently been at a fairly broad scale, largely inferred from soils and topography (Beard 1980). A project currently being carried out by DEC Albany Region is mapping the vegetation at a smaller scale from ground surveys (Sandiford and Rathbone *in prep*.). The area covered by the mapping is an approximately 30km radius from Albany. Beard's vegetation mapping was deemed to be at too large a scale for use in determining habitat

associations for Western Ringtail Possums. The smaller scale mapping however is only in a draft stage and as a whole not sufficiently developed to use for correlating all of the Western Ringtail Possum records with vegetation type. However the area containing the Bayonet Head survey site has been sufficiently advanced. Therefore the results of the survey at this site are used as an illustration of vegetation associations of sightings, dreys and scats at a very preliminary level. These associations are shown in Table 3. Although possums were only sighted in only two vegetation types, dreys were located in all but one vegetation type searched.

Table 3: Number of Western Ringtail Possum sightings, dreys and scat sites in each vegetation unit at Survey Site 1. See Appendix A for vegetation unit names and descriptions.

Vegetation Unit	No. possum sightings	No. dreys	No. scat sites
8	1	3	2
9	1	2	5
10	0	2	0
11	0	0	0
8 & 10 mosaic	0	3	2

The project is due for completion at the end of 2009 and will provide a valuable tool in determining habitat associations of Western Ringtail Possums across a much larger area of the Albany population. It will also enable the determination of the extent of vegetation types utilised.

Specific trees observed to be utilised in surveys

Specific trees in which possums were sighted, dreys located in and scats observed under are shown in Appendix B.

At the Bayonet head ODP site three of the four sightings were in *Nuytsia floribunda,* the other in *Allocasuarina fraseriana*. Dreys were found in *Allocasuarina fraseriana* (7), *Nuytsia floribunda* (2), *Melalueca spp. (1)* and *Eucalyptus staeri* (1). Large concentrations of scats were found under *Nuytsia floribunda* and *Agonis flexuosa*, although the latter species only occurred in a small area on the southern boundary. These were very large (> 20m high) old trees occurring in a row that appeared to be planted

At the Big Grove UCL site one Western Ringtail Possum was sighted in a spindly Bullich (*Eucalyptus megacarpa*), one drey was observed in a *Banksia littoralis* and one in an *Agonis flexuosa* . The three possums sighted at the The Big Grove ODP site (Lot 1) were also in Bullich (*Eucalyptus megacarpa*)

Dreys or resting platforms were found in *Pinus* sp., Sydney Golden Wattle (*Acacia longifolia*) and *Melalueca preissiana* at the Oyster Harbour site.

Observations on sightings, feeding, nest sites from community response

Many respondents to the call for information on Western Ringtail Possums provided observations on habits of the species, including feeding and refuge sites. A large number of these respondents observed possums eating or seen in exotic or native but non-indigenous garden plants (most notably, NZ Christmas Tree (*Metrosideros excelsa*), Lilly Pilly Tree (*Acmena smithii*) and fruit trees). Of native indigenous flora, most observations occurred in Peppermints (*Agonis felxuosa*), with observations also reported in Marri (*Corymbia* calophylla), Jarrah (*Eucalyptus marginata*), Sheoak (*Allocasuarina fraseriana*, Karri (*E. diversicolor*) and various native species (eg. Banksias, Melaleucas, Acacias), which were likely to be garden varieties.

One report from a DEC officer was of a Western Ringtail Possum seen in a dead *Banksia coccinea* at Gull Rock NP, the nearest Peppermint association being 1 km away. Vegetation type was emergent *Allocasuarina fraseriana* over 10-30% *Banksia coccinea* with *B. attenuata* and *B. ilicifolia*, over 10-30% *Jacksonia spinosa, Melaleuca thymoides, Agonis theiformis* and *Adenanthos cuneatus*, over 30-70% *Anarthria scabra, Anarthria prolifera, Schoenus caespiticius* and *Dasypogon bromeliifolius*. There was symptomatic evidence of *Phytophthora cinamomi* present (Damien Rathbone pers. com.)

6. Threats to Western Ringtail Possums in Greater Albany Area

Throughout its range the Western Ringtail Possum is impacted by a number of threatening processes. These threats are complex and interactive, and may vary across its range and with scale. A detailed discussion of these threatening processes appears in the Draft Recovery Plan, which emphasises the importance of understanding how and why these processes vary and how they interact across the range in the development of the species recovery strategy. Because of this, the Draft RP stratifies each threatening process by location and, in some instances, plant community (Richardson 2005). This indicates that threats operating specifically in the Greater Albany Area need to be identified in order to effectively manage this population.

The following is a brief summary of threats known to be impacting on Western Ringtail Possums (details can be found in the Draft RP (Richardson 2005), and an assessment of the importance of these threats within the Greater Albany Area. Threats to Western Ringtail Possum have previously been assessed within the South Coast NRM Region, which contains the Albany population, as part of a Regional Threatened Species Recovery Plan for this region (DEC 2008). This assessment was based on the expected impact of threat, considering the species biology, the distribution, size and number of sub-populations across the landscape and the degree of current impact of the threat the risk of occurrence of the threat.

i) Fox and cat predation

Fox predation is one of the main threats to Western Ringtail Possum populations throughout its range and continues to be main cause of mortality, although is slightly less in conservation estate that is regularly baited. Fox baiting can lead to an increase in numbers of, and consequently predation by, cats (Richardson 2005). The impact of fox and cat predation on Western Ringtail Possums within the Albany population has not been well documented. However, the persistence of a stable sub-population at Two Peoples Bay NR which is regularly baited for foxes, and the tenuous sub-populations at West Cape Howe

NP and Torndirrup NP, where apparently suitable habitat occurs, but no baiting is carried out, provides some evidence of the negative impact of fox predation. The species is known taken by cats, particularly in a domestic situation (Richardson 2005).

The impact of this threat to the Albany population as a whole is considered high as the species is presumed or known to be highly vulnerable to fox or cat predation but does occur in several disjunct sub-populations, reducing the threat of extinction of the whole population to one predation event (DEC 2008).

ii) Fire

Fire can have significant impacts on Western Ringtail Possum populations, including reduced availability of food resources, loss of shelter sites, reduced canopy continuity and/or direct or indirect death of individuals (Richardson 2005). Within the Greater Albany Area many of the vegetation types that the species occurs in are highly susceptible to very hot fires, killing animals and leaving few post-fire resources. Jones *et al.* (1994a) reported that the species was relatively abundant in the West Cape Howe National Park after a wildfire in the early 1970s, but much less abundant during the early 1980s, in addition, they found no sign of animals during their 1990-92 surveys. There were reports of Western Ringtail Possums during a hot fire in the Porongurup NP in 2007, but no reports since (Peter Collins, DEC. *pers. com*.)

Western Ringtail Possums are considered highly vulnerable to fire but as they occurs in several disjunct sub-populations, the Albany population as a whole would not be impacted by a single fire event (DEC 2008).

iii) Habitat loss and fragmentation

Another major cause of Western Ringtail Possum decline throughout its range is habitat loss and fragmentation. Indirect evidence indicates that high value habitat has been selectively cleared for agriculture, owing to its fertile and productive nature. (Wayne *et al.* 2005d). Within the Albany population many areas occupied by ringtail possums are not within reserves and therefore continue to be potentially under threat from habitat clearing.

The inability of Western Ringtail Possums to disperse across unsuitable/cleared habitat, even at very small scales, renders this species particularly vulnerable to habitat fragmentation. Its occurrence in some large, isolated remnants eg (Two Peoples Bay NR) affords some protection to the Albany population as a whole (DEC 2008), however many sub-populations occur in highly fragmented areas.

A recent severe storm along the south coast highlighted the negative impact that stochastic events may have on Western Ringtail Possums occurring in small isolated sub-populations, already being impacted by other threatening processes. A number of dead and injured possums were encountered after this storm. In addition the severe “wind burn” resulting in leaf death was very obvious in exposed Peppermint (*Agonis flexuosa*) trees, potentially reducing food resources to a critical level in some areas.

iv) Urban development

Clearing for urban development, particularly in the Bunbury/Busselton areas, has led to habitat fragmentation and a decrease in the availability of high-quality habitat (Richardson 2005). Increased urban development is also occurring within the Albany area. Two of the proposed residential development areas surveyed for this project contained Western Ringtail Possums and a significant sub-population occurs at Emu Point in an area proposed for development (Green Iguana 2007).

Clearing of habitat for development will inevitably result in the death of animals, as a direct result of the clearing process or as a consequence of it. If no suitable habitat exists adjacent to the cleared site, the vulnerability of animals forced to come to the ground and traverse unsuitable means that animals will simply have nowhere to re-establish. Even if suitable habitat occurs adjacent to the cleared site, the territorial nature of Western Ringtail Possums and the amount of food resources limiting the number of animals that can be supported by a patch of vegetation means that any new animals entering the adjacent patch will likely be excluded or will starve.

Other consequences of urban development include:

- Domestic cat and dog predation – this is exacerbated by having to come to ground where the continuity of vegetation is low.

- Disease- cats spread the disease toxoplasmosis, which kills possums and has been reported to be the possible cause of death in a number of cases within the Albany population (Sue Gleave (Wildlife Carer) *pers.com*.)

- Modified activity and diet – possums living in urban environments find refuge in artificial constructions, roofs, use fences and power lines for movement and eat exotic and non-indigenous plants. The impact of these behavioral modifications have, however, not been quantified. The kill rate on power lines is thought to be low Jan Henry (Fauna Consultant) *pers.com*).

- Roadkills- also exacerbated by having to come to ground to access neighboring patches of vegetation.

v) Climate change

The Western Ringtail Possum is likely to be impacted by a predicted warming drying climate in the South-west of WA. It fulfills a number of criteria which have been proposed to increase a species vulnerability to climate change: low mobility; occurring in highly fragmented habitat, and at the limit of distribution (bounded by coastline) (Brereton *et al.* 1995, DEC 2008).

Mitigating other threatening processes operating on this species, and developing accurate monitoring protocols and measures of abundance, will assist in and monitoring and mitigating the impacts of climate change.

Security of sub-populations within the Greater Albany Area

A number of sub-populations of Western Ringtail Possum within the Greater Albany Area are within reserves and are therefore secure, at least from habitat clearing. Likely strongholds for the species include Two Peoples Bay NR and Mt Manypeaks NR/Waychinicup NP where regular fox-baiting is carried out. In other DEC managed land where apparently suitable habitat exists, the status of Western Ringtail Possums is unclear (eg. West Cape Howe NP, Torndirrup NP and a number of smaller nature reserves). These areas are not baited regularly for foxes.

While some sub-populations occur within reserves the conservation of habitat and populations outside reserves is also necessary for the recovery and long-term viability of this population. Based on current known records, the majority of the Albany population occurs outside of DEC reserves, and at a rough estimate 50-60% outside any reserve (including Crown or Shire).

The significant sub-populations occurring in urban and semi-urban areas within the Albany population have little security, where a significant proportion of coastal Western Ringtail Possum habitat is also preferred habitat for urban and tourist development.

7. Recommendations

1. Monitoring and survey protocols

The Draft Western Ringtail Possum Recovery Plan recommends that "*To ensure that population monitoring data are comparable between populations (at least within the same vegetation types) and between times, a consistent and reliable monitoring method needs to be developed"*(Richardson 2005)

Monitoring and survey protocols need to be developed specifically for the Albany population, appropriate to the habitat types Western Ringtail Possums occur in within in this region.

This project has provided some preliminary guidelines as to the appropriateness of standard techniques used for surveying the species in some vegetation types, however more extensive work is needed to:

- Incorporate the full extent of vegetation types used by the species into survey guidelines.
- Develop appropriate, accurate and standardised measures of abundance for occupied habitat within the Albany population.
    - The commonly used technique of measuring abundance via scat counts is inappropriate in many habitats and therefore alternative measures will need to be developed. This could involve for example the placement of fixed area plastic sheet or collecting tray over dense ground cover to collect and count scats, or the use of an extendable pole with a mirror attached, as used to examine eggs in bid nests, to provide a more accurate estimation of the number of dreys that are active within an area.
    - Determine the relationship between estimates obtained by any alternative techniques employed.

The use of remote sensing cameras was considered as a possible method for detecting Western Ringtail Possums, however they were not considered appropriate due to the necessity of placing the camera within trees resulting in excessive false triggering due to leaf movement.

2. Distribution, abundance and habitat use

Although the project has increased our knowledge of Western Ringtail Possum abundance and distribution within the Greater Albany Area, more extensive investigations are required in order to obtain adequate baseline data on which to base management decisions. These investigations should be based on further survey, plus further analysis of the now quite extensive distributional dataset in order to:

- Identify the variety of habitat types used.
- Estimate the relative abundance of the species within these different habitat types.
- Determine which sub-populations are secure (involving analysis of distribution versus tenure)
- Determine the important sub- populations for the persistence of Albany population as a whole
- Identify habitat which forms either core habitat, supporting habitat or primary corridors for the species (as per DEC's Draft Policy Guidelines for the EPBC listed Western Ringtail Possum in the Southern Swan Coastal Plains)

Possible areas for further survey

Further surveys for Western Ringtail Possums should be centred on:

- large reserves in which the status of sub-populations is currently unknown. These include; Torndirrup NP, West Cape Howe NP , Down Road NR, Porongurup NP, Bakers Junction NR and Gull Rock NP.

- areas where record gaps exist (see Section 2 above)

- areas potentially forming corridors between key sub-populations (possibilities include King and Kalgan Rivers or the coastal remnant vegetation between Torndirrup and West Cape Howe NP or between Gull Rock NP and Two Peoples Bay NR at a large scale, or at a smaller scale the tenuous links between the urban sub-population and the likely more secure semi-urban or reserve sub-populations (eg. Yakamia Creek).

Habitat associations

Additional work is required to determine habitat associations and preferences of Western Ringtail Possums within the Albany population.

- The Albany Regional Vegetation Survey (ARVS) when complete at the end of 2009 can be used in conjunction with the The Greater Albany Area Western Ringtail Possum Database to analyse habitat associations within a 30km radius of Albany. Recent advances in generating pseudo-absence points in such datasets based on some *a priori* ecological or biological knowledge of the species, can enable

the application of statistical *habitat classification models* to determine habitat preferences (Zarnetske *et al.* 2007). This technique could be successfully applied in this case, providing only records with a certain degree of precision, relative to vegetation unit size, are included .

The ARVS will also enable the determination of the regional extent of vegetation types utilised by the species.

- Any field based determination of habitat preference should involve a systematic approach with sampling for presence or abundance of Western Ringtail Possums within the full array of potential habitat types.

3. Threatening processes

A number of threatening processes have been identified as acting on Western Ringtail Possums in other parts of range. Many of these are common to the species across its range and are known to be impacting on the Albany population (eg. fox predation), however some might be specific to the Albany population or their importance may differ from those acting in other parts of the species range.

It is therefore recommended to identify which threatening processes are having the greatest impact on the survival and persistence of the Albany population as a whole, and which might be scale or locality specific i.e. which threats are having the most impact on differing sub-populations (eg. urban vs semi-urban vs. those within reserves)

4. Raising awareness

The project revealed a significant level of community interest in Western Ringtail Possums in the Greater Albany Area and concern about the conservation of its habitat. Building on this interest by continuing to raise awareness about the vulnerable status of possums and the importance of conserving their habitat can play an important role in the protection of the Albany population.

A number of individuals and groups expressed interest and made suggestions and offers of assistance in the conservation of the Albany population of the Western Ringtail Possum. Examples of these included:

- Individuals offering to record sightings and roadkills

- Friends of Mt.Melville, who carry out regularly spotlighting on Mt Melville in the centre of Albany, and offered assistance in increasing local knowledge about possums and contributing to their conservation.

- The Kalgan River Conservation Community Group, who are currently weed mapping with a view to planning a weed eradication and rehabilitation program along the Kalgan River, focusing on the Western Ringtail Possum in order to engage other sectors of the community in conservation of native fauna (and their habitat).

- A community member whose children attended Calista Primary School in Kwinana on the west coast of WA and made possum boxes for new housing estates where the environment had been disturbed, and suggested that a primary or high school within Albany could run a similar project.

- There are many stakeholder groups that can play a role in the protection of the Western Ringtail Possum. These included Friends groups (Friends of Mt. Melville, Lake Seppings), Kalgan River Conservation Community Group, Albany Bushcare Group, Land For Wildlife (DEC), City of Albany, Shire of Plantagenet, South Coast NRM, Wildlife Carers and Government Departments (DEC, Department of Water).

5. Development Guidelines

- A number of Development Guidelines have been developed or are being developed for the population of Western Ringtail Possums occurring on the west coast, particularly in the Busselton-Dunsborough region. A decision should be made as to whether separate Development Guidelines should be developed for the Albany population.

- Any such guidelines should consider the significance of a particular remnant proposed for development for the persistence of Western Ringtail Possums at both a local (sub-population) and a whole population level.

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Appendices

Appendix A: Draft Albany Vegetation Units at Site 1: Bayonet Head Outline Development Plan Area

VEGETATION UNIT NO.	VEGETATION UNIT NAME	DESCRIPTION
1	***Hfir/Crub/Lten/Egra***	*Cosmelia rubra* Tall Open Shrubland over *Homalospermum firmum Shrubland, Astartea corniculata/Sphenotoma gracile* Low Open Shrubland and *Leptocarpus tenax/Schoenus multiglumis* Sedgeland. Restricted to the wet areas. Nb no *Egra- Empodisma gracillimum* was recorded but is included due to regional variations.
2	***Eari/Bspa/Sgra.***	*Evandra aristata* Sedgeland over *Beaufortia Shrubland* and *Sphenotoma gracile* Low Shrubland. Located in wet depression drainage lines and often in mosaic with 4.
3	***Keri***	*Kunzea ericifolia* Open Heath over mixed Low Shrubland and Mixed Sedgeland. Restricted to drainage lines.
4	***Pspo/Ttre/Esta***	*Pericalymma spongiocaule* Open Low Heath over *Tremulina tremula Sedgeland* with emergent *Eucalyptus staeri.* Located on edges of drainage lines and low flats with impeded drainage. The identity of the *Pericalymma* species is unclear. Whist the dominant sedge is *Tremulina tremula* this layer is characterised by high species diversity.
5	***Mpre.***	*Melaleuca preissiana Low Woodland.* This unit is on private land and has not been fully surveyed. The floristics of understorey may warrant its separation as a distinct unit or the *Melaleuca preissiana* Low woodland may be a variation on another unit.
6	***Clan***	*Callistachys lanceolata* Low Closed Forest.
7	***Esta/Afra/Bcoc.***	*Eucalyptus staeri/Allocasuarina fraseriana* Low Open Woodland over *Banksia coccinea* Tall Open Scrub, *Melaleuca thymoides/Jacksonia spinosa* Open Heath and Mixed Sedgeland. As mentioned above this unit is variable in structure species composition.
8	***Afra/Emar/Athe.***	*Allocasuarina fraseriana/Eucalyptus marginata* Low Open Forest over Tall Shrubland, Shrubland, Low Shrubland and Sedgeland. This unit is restricted to shallow soils with laterite at or close to surface. It has a distinctive suite of shrubs, sedges and herbs and frequently occurs as mosaic with unit 10.
9	***Afra/Esta***	*Allocasuarina fraseriana/Eucalyptus .staeri* Low Woodland over Open Heath, Mixed Sedgeland. This unit is restricted to deeper sands of lower slopes and shares species with unit 7 and 10.
10	***Afra/Emar/Esta/int***	*Pericalymma spongiocaule* Open Low Heath over *Tremulina tremula* Sedgeland with emergent *Eucalyptus staeri.* Located on edges of drainage lines and low flats with impeded drainage. The identity of the *Pericalymma* species is unclear. Whist the dominant sedge is

		Tremulina tremula this layer is characterised by high species diversity.
11	***Afra/Emar/Hspp***	*Allocasuarina fraseriana/Eucalyptus marginata* Low Woodland over *Hakea ferruginea +/-Hakea trifurcata* Open Heath and Mixed Sedgeland. This unit appears to be restricted to areas of laterite with some impeded drainage

NB: the vegetation map is a draft only. On a regional scale the extent of variation expected within some of the mapped associations is not yet known (Sandiford and Rathbone *in prep*.).

Appendix B: Metadata Statement and Database Field Definitions:

Metadata statement

Title	Greater Albany Area Western Ringtail Possum Database
Custodian	WA Department of Conservation and Environment, Albany Regional Office
Project Area	South Coast of WA, West Cape Howe NP to Cheynes Beach and inland to The Porongurup Range
Survey targets and methods	The species included in the database is the Western Ringtail Possum (*Pseudocheirus occidentalis*), specific survey methods include spotlighting, drey searches and scat searches. The database also contains information on locations of this species from community observations.
Survey dates	The database covers records from 1933 up until August 2008
Spatial data	The data is held in a Microsoft Access 2007 file, coordinate system is geographical decimal degrees (GDA94)
Limitations on use of data	Data and/ or information from the database can be accessed by written request to the Regional Ecologist, Department of Environment and Conservation Albany. Detailed locational information for threatened species is generally kept confidential unless direct conservation benefits to the species can be demonstrated.
Comments	

Database structure and field definitions

Field name	Description/explanation
ID	Record ID
Scientific Name	Scientific name of species
Common Name	Common name of species
Observer/collector	Name of person reporting observation
Start Date	Date of observation, if regular occurrence then date reported.
End Date	End of observation (survey only)
Locality	General location
Site	Specific location
Latitude	Latitude (decimal degrees)
Longitude	Longitude (decimal degrees)
Datum	Datum of coordinate
Certainty	Validity assigned to record: 1= Sighting (dead or alive) or sign (drey or scat) and full details given (description of animal etc.) or observer certain and deemed reliable.

	2= Observer themselves uncertain of sighting or sign 3=No details at all given (animal not described, observer not known) This score was in some instances re-evaluated from the score given in a previous database
Precision	Precision of the coordinates, within radius of value given in metres. Low precision can be the result of poor description of location or from the method of obtaining the coordinates (eg. pre GPS/GIS coordinates will have lower precision than post GPS/GIS coordinates, coordinates obtained with a GPS has better precision than those obtained from GIS map)
Survey method	How the species was recorded
Number of animals recorded	Number of animals recorded
Comments	Comments
Original Record Source	If the record was extracted from another database, the name of that database. If record first appears in this database then entry is "*Commonwealth Western Ringtail Possum Project*"
Regional_recovery_plan_ID	The ID number of the record within the Regional Threatened Species Recovery Plan Database
SCTFDbase_ALBDBNO	The ID number of the record within the South Coast Threatened Fauna Database
DEC_Fauna_File_DBNo	The ID number of the record within DEC's State Threatened and Priority Fauna Database

Appendix C: Survey results

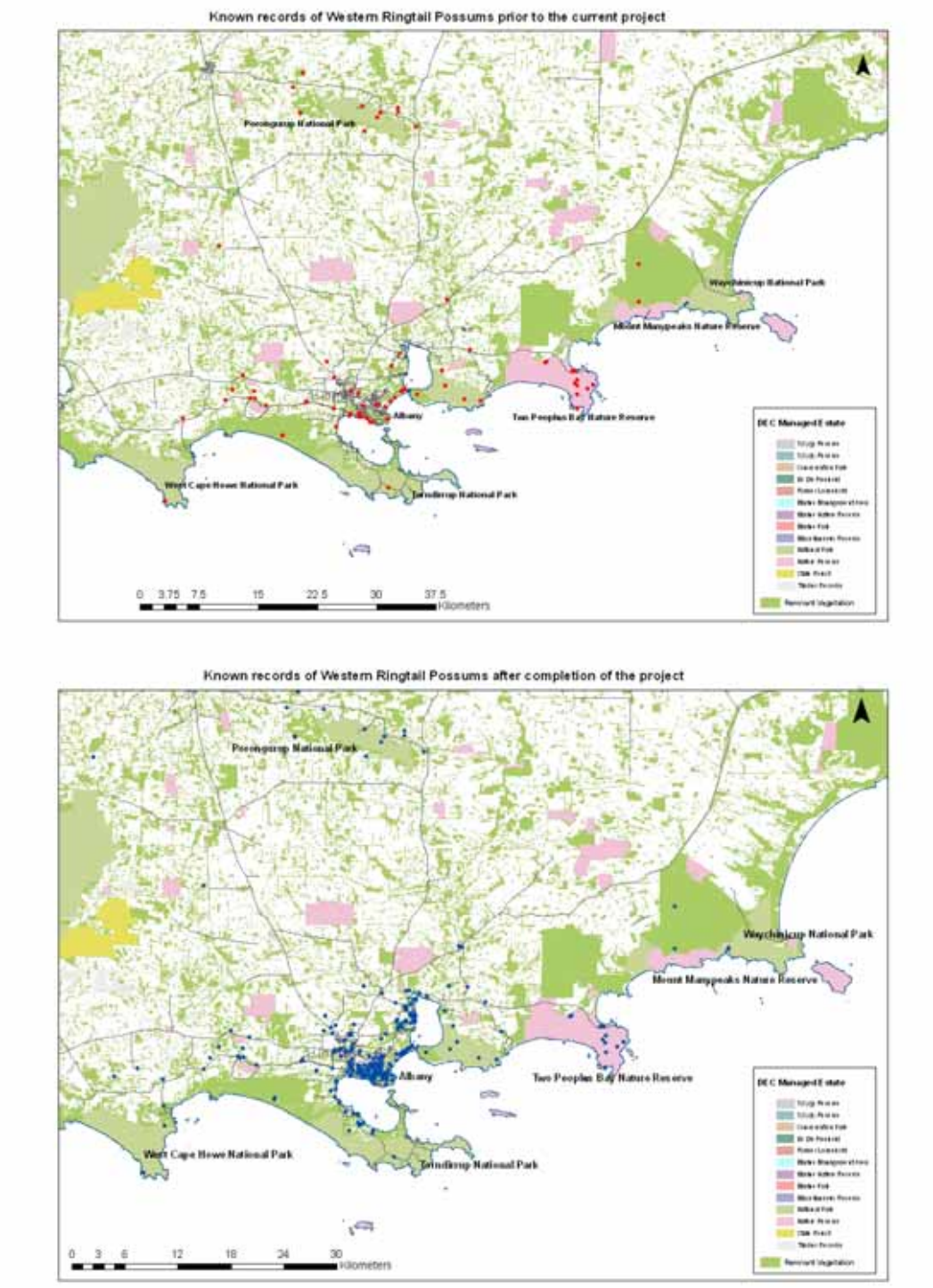
Due to sensitivities of this data spatial records from this section have been removed. For further information please contact DEC Albany

Site	Method	Date	Latitude	Longitude	Description
1. Bayonet Head ODP	**Possums sighted**	02-Jul-08			2 Ringtails seen together headtorching on foot, mother and young in Nuytsia floribunda
		03-Jul-08			1 Ringtail seen headtorching on foot, in *Nuytsia floribunda*.
		03-Jul-08			1 Ringtail seen headtorching on foot, in *Allocasuarina fraseriana*.
	Dreys observed	02-Jul-08			Two dreys seen c. 10m apart in *Nuytsia floribunda*, c. 2m up, possibly resting platform only, scats underneath
		02-Jul-08			4m up a 6m high *Eucalyptus staeri*
		02-Jul-08			4m up a 5.5m high *Allocasuarina fraseriana*
		02-Jul-08			3.5m up a 4.5m high shrub (*Melaleuca spp*.).
		02-Jul-08			4.5m up a 6m high *Allocasuarina fraseriana*
		02-Jul-08			7.5m up a 8.5m high *Allocasuarina fraseriana*. Tree showing signs of herbivory and drey very dense, probably active
		02-Jul-08			3m up a 10 high *Allocasuarina fraseriana*. Tree showing signs of herbivory, but no scats observed
		02-Jul-08			3m up a 4m high *Allocasuarina fraseriana*.
		03-Jul-08			2 possible dreys in large pine trees on NW corner of development site
		03-Jul-08			2m up a 4m high *Allocasuarina fraseriana*, next to *Nuytsia floribunda.*
		02-Jul-08			4.5m up a 6m high *Allocasuarina fraseriana* .Same location as previous fauna survey (ATA Environmental)
	Scats observed	02-Jul-08			Under hollow in Eucalyptus staeri
		02-Jul-08			Large concentration of scats under *Nuytsia floribunda* and Peppermint (*Agonis flexuosa*)
		02-Jul-08			
		03-Jul-08			Under *Nuytsia floribunda*
		03-Jul-08			In clearing underneath large *Nuytsia floribunda*, no dreys observed.
		03-Jul-08			Under *Nuytsia floribunda*
		03-Jul-08			Under very large (20-30m high, 4-5m diameter) Peppermints (*Agonis flexuosa*), trees in a row, probably planted.
		03-Jul-08			Under *Nuytsia floribunda*

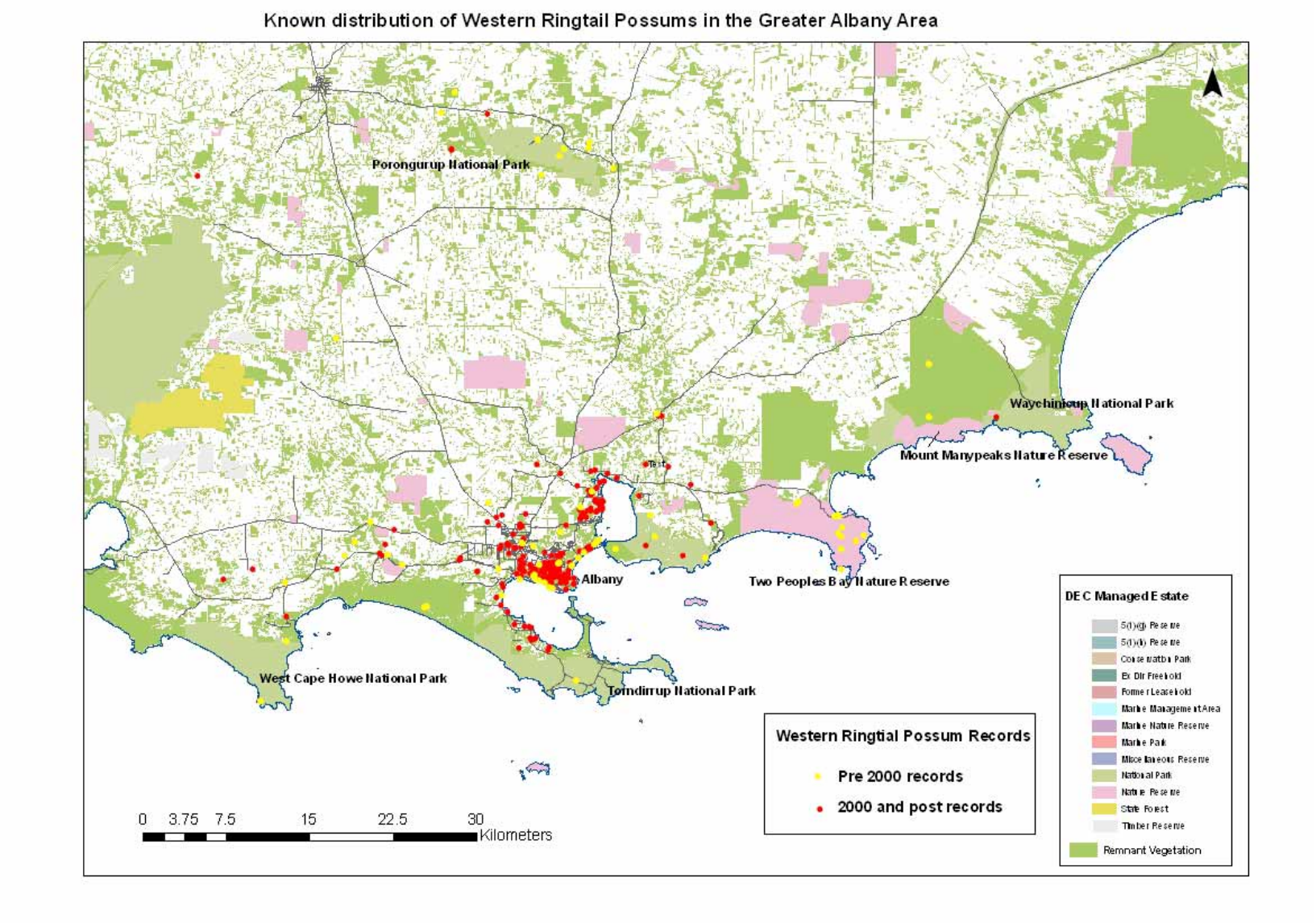
		03-Jul-08			Under *Nuytsia floribunda*
2. Big Grove UCL	**Possums sighted**	04-Jul-08			1 Ringtail seen headtorching from vehicle in spindly Bullich (*Eucalyptus megacarpa*), c. 4m up tree.
	Dreys observed	04-Jul-08			3m up a 4m high *Banksia littoralis*
		04-Jul-08			4m up a 5m high Peppermint (*Agonis flexuosa*)
	Scats observed	Not suitable for searching			
3. Big Grove ODP					
Lot 1	**Possums sighted**	04-Jul-08			1 Ringtail seen headtorching from vehicle in spindly Bullich (*Eucalyptus megacarpa*), c. 5m up tree.
		04-Jul-08			2 Ringtails seen together headtorching from vehicle in spindly Bullich (*Eucalyptus megacarpa*), c. 5m up tree.
	Dreys observed	NONE			
	Scats observed	Not suitable for searching			
Lot 109	**Possums sighted**	NONE			
	Dreys observed	NONE			
	Scats observed	Not suitable for searching			
4. Oyster Harbour	**Possums sighted**	NONE			
	Dreys observed	13-Aug-08			c. 4m up a 6m high Sydney Wattle (*Acacia longifolia*) (weed)
		13-Aug-08			c. 30m up a 35m Pine tree, large number of scats (100+) under tree
		13-Aug-08			old, disused drey in Sydney Wattle (Acacia longifolia)
		13-Aug-08			c. 6m up a 7m tall Sydney Wattle (*Acacia longifolia)* (weed)
		13-Aug-08			3 dreys seen within a 5m radius, c. 3m up *Melaleuca preissiana*, possibly just resting platforms, no scats seen underneath trees
	Scats observed	13-Aug-08			Small number found under *Taxandria juniperina* and Sydney Wattle (*Acacia longifolia*)
		13-Aug-08			Large number (100+) under Pine tree

Appendix D: MAPS

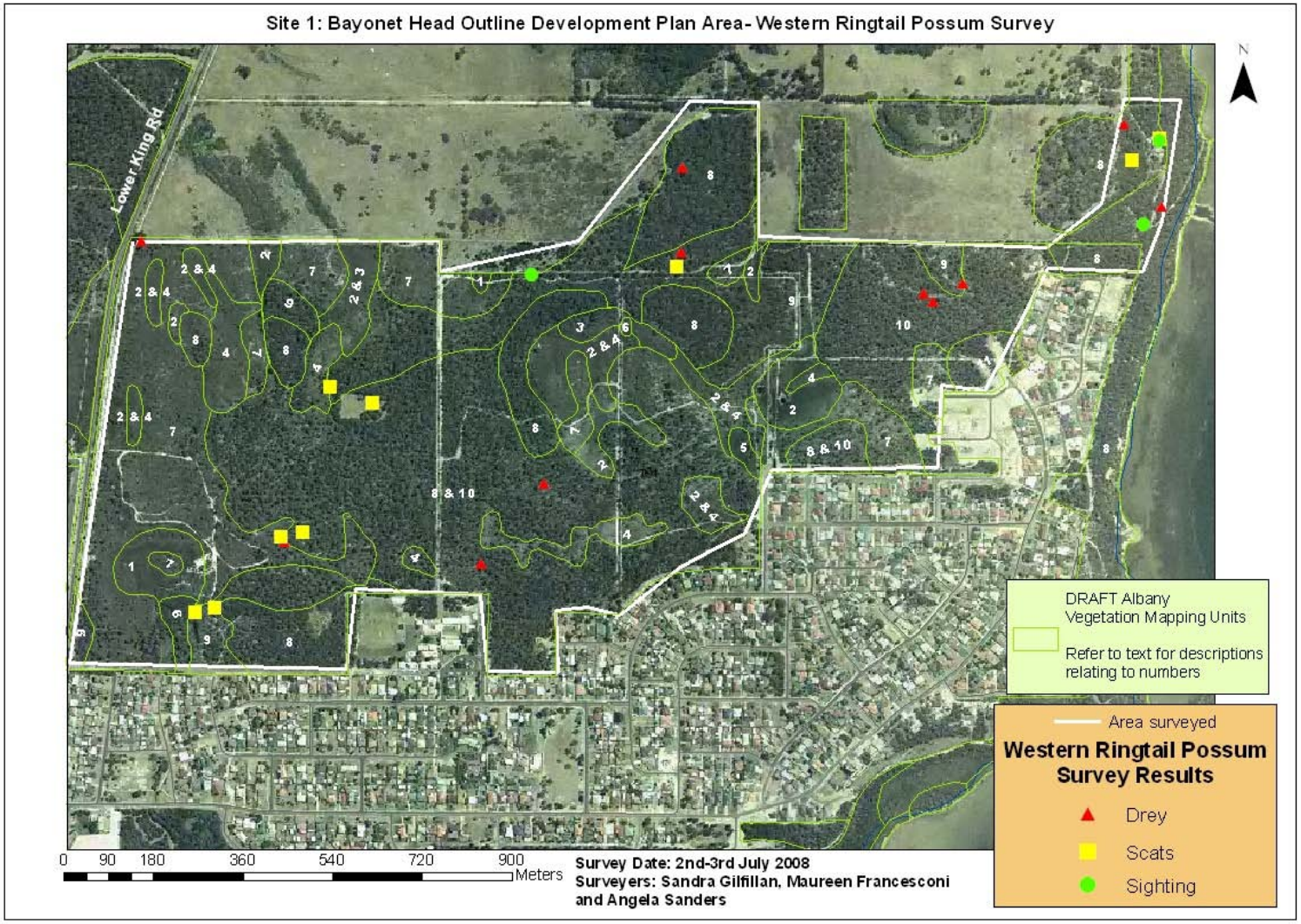
Map 1: Comparison of known records prior to the project and the full dataset after completion of the project.



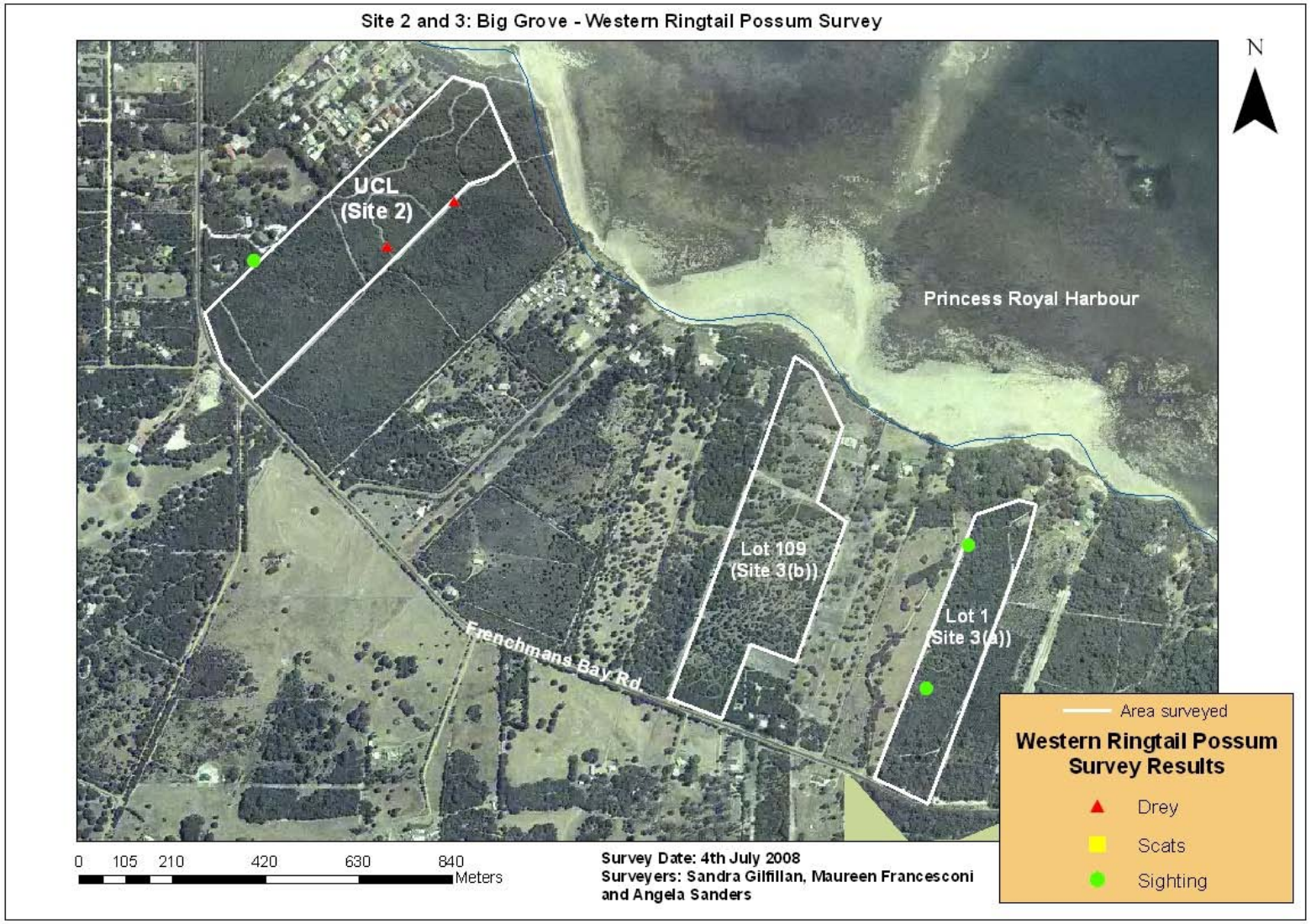
Map 2: The distribution of the Western Ringtail Possum in the Greater Albany Area based on current known records.



Map 3: Western Ringtail Possum survey results for Site 1.



Map 4: Western Ringtail Possum survey results for Sites 2 and 3



Map 5: Western Ringtail Possum survey results for Site 4.