

Ginninderry Project – Rosenberg's Goanna Discussion Paper

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Contents

1	Introduction	5
1.1	Background.....	5
1.2	Scope and objectives	7
1.3	Key concepts and definitions.....	7
2	Approach	8
2.1	Literature review	8
2.2	Consultation.....	8
3	Rosenberg’s Goanna – locality context	9
3.1	Conservation status and key threats	9
3.2	Regional distribution	9
3.3	Habitat and home range	10
3.3.1	Potential habitat and protected area network.....	12
4	Site context	14
4.1	Conservation area	14
4.2	Conservation/urban interface	17
5	Ecological management within the conservation/urban interface.....	18
5.1	Objectives and guiding principles	18
5.2	Interface design recommendations	20
	References	25
	Appendix A: Excerpt from Knight Frank (2017)	27
	Appendix B: Indicative sketch of interface area and components	29

List of figures

Figure 1: Ginninderry development site and proposed variation to conservation area boundary	6
Figure 2: Rosenberg’s Goanna distribution – ACT and surrounds	11
Figure 3: Potential habitat and protected area network	13
Figure 4: Ginninderry development site	16

List of tables

Table 1: Habitat condition classes and associated areas	12
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1 Introduction

1.1 Background

The Ginninderry development site (hereafter “development site”) is situated adjacent to the suburbs of Holt and West McGregor, Canberra, and traverses both NSW and the ACT. The proposed development would support new housing, education, infrastructure, and open spaces to the West Belconnen/Parkwood region.

As part of the proposed development, a conservation area of 577 ha comprising the existing Murrumbidgee River Corridor and lands along the lower part of Ginninderra Creek, Ginninderra Falls and the associated gorge areas is also proposed. This proposed conservation area consists of undulating cleared land, open woodland and native grasslands, with steep gorge landscapes along the river corridor (TRC 2014).

In 2016, Eco Logical Australia (ELA) was commissioned to undertake a study to assess the extent and quality of potential habitat for *Varanus rosenbergi* (Rosenberg’s Goanna), listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act), across the majority of the proposed development and conservation area within NSW as well as immediate surrounds. The objective of the 2016 study was to determine if the currently proposed development area contains high condition habitat for *V. rosenbergi* (determined by the extent and distribution of habitat elements essential to the ongoing viability of the local population of *V. rosenbergi*), and to determine evidenced-based boundaries between conservation and residential development areas.

A recommendation arising from the 2016 study was to “maintain a minimum width of 300 m from the edge of a permanent water courses (Murrumbidgee River and Ginninderra Creek – below the falls) which are bordered by potential habitat” (ELA 2016a: 26). While the majority of the currently proposed conservation area satisfies this requirement, variations to the boundary were proposed at four locations (“proposed variation areas”) (**Figure 1**, A-D).

In response to this recommendation, Mr John Hyles of Tharwa Sand commissioned the Institute of Applied Ecology (IAE) at the University of Canberra to undertake additional studies to evaluate the findings of ELA (2016) and the appropriateness of a subset of the proposed variation areas for improving conservation outcomes for *V. rosenbergi*. This study (Green et al. 2017) focussed on assessing the potential habitat value for *V. rosenbergi* at two of the proposed variation areas (A and B as shown on **Figure 1**). It concluded that these proposed variation areas “do not contain habitat elements suitable for supporting a viable population of *V. rosenbergi* nor do they represent a comprehensive buffer to the reserve” and as such “are unlikely to improve the conservation outcomes of *V. rosenbergi* in their current state” (Green et al. 2016: 11).

The NSW Office of Environment and Heritage (OEH) reviewed the ELA (2016a) study, and provided comments in support of the “maintenance of a 300 m buffer or greater along watercourses to provide connectivity and also to protect identified key habitat for Rosenberg’s Goanna” (D. Oliver 2017, email comms). However, OEH questioned the value of some of the proposed variation area specific to this species, and whether potential future land use would be conducive to restoring this habitat.

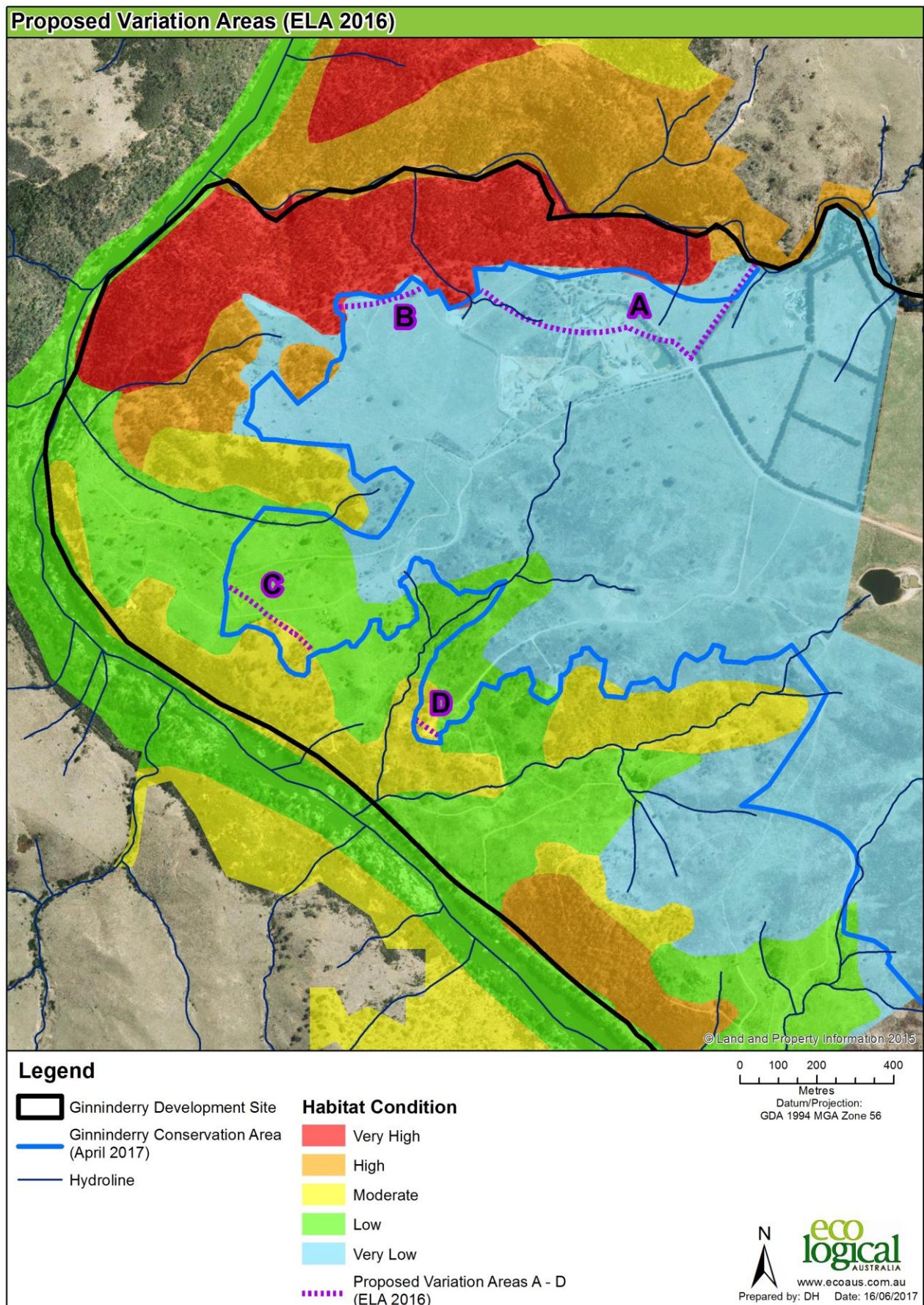


Figure 1: Ginninderry development site and proposed variation to conservation area boundary

1.2 Scope and objectives

The scope and objectives of this discussion paper are as follows:

1. To evaluate the recommendation (ELA 2016) of maintaining a minimum 300 m width from the edge of permanent watercourses for *V. rosenbergi* (Section 4.2);
2. To address the question of home range and habitat area requirements for *V. rosenbergi* (Section 3.3), raised by the Ginninderra Catchment Group and further discussed in Green et al. (2017); and
3. To provide recommendations - for incorporation into development planning - relating to detailed design and management of areas for enhancing conservation outcomes for *V. rosenbergi* within the development site (Section 5).

This paper will address these questions at three levels:

- at a regional and local scale (Section 3);
- within the development area and conservation area (Section 4); and
- design of the conservation/urban interface (Section 5).

The design principles and recommendations (Section 5) will subsequently be used when implementing the development controls included in the Parkwood Planning Proposal (Knight Frank 2017) (Appendix A).

1.3 Key concepts and definitions

Definitions for key concepts presented in this discussion paper are as follows:

- “Proposed variation areas”: four areas in which the conservation area boundary was proposed to be changed (ELA 2016) in order to meet a recommended minimum 300 m width from a watercourse (**Figure 1, A-D**).
- “Conservation area”: an area of land located along the Ginninderra Creek and Murrumbidgee River that will be set aside for conservation, recreation and other community benefit, and will not be subject to development. Various referred to in other relevant reports as “conservation corridor” or “conservation reserve”.
- “Development area”: lands within the Ginninderry development site that are to be subject to development activities.
- “Conservation/urban interface”: all lands located between the conservation area boundary and urban development (**Appendix B**)
- “Ecological component of the interface”: lands located within the conservation/urban interface area that are managed with the objective of protecting and enhancing the ecological values of the conservation area, while also incorporating multiple use values and objectives that are consistent with these ecological values (**Appendix B**).

An indicative sketch (completed by Knight Frank, June 2017) showing the relative locations of the conservation/urban interface, and the ecological component of the interface, is included in **Appendix B**.

2 Approach

2.1 Literature review

A comprehensive literature review was conducted as part of the previous project (ELA 2016a). In addition to this previous data, the following documentation was reviewed for this paper:

- Green et al. (2017) ‘Habitat evaluation of two proposed extension areas to the Ginninderry reserve to provide improved ecological outcomes for *Varanus rosenbergi*’
- Ginninderra Catchment Group (GCG) (2016) ‘A Preliminary Biodiversity Survey of the Ginninderra Falls Area’
- Ginninderra Catchment Group (GCG) (undated) ‘Comments on the Rosenberg’s Goanna Habitat Assessment
- Draft development designs for Ginninderry development
- West Belconnen/Parkwood Planning Proposal – Guiding principles to be applied to detailed planning in the conservation/urban lands interface sector (Adams undated)
- Scientific and management literature relating to *V. rosenbergi* ecology, and protected area and conservation interface management.

2.2 Consultation

Consultation was undertaken with the Riverview Group, David Shorthouse, Tony Adams of ATA Consulting, and both Fiorenzo Guarino and Brian Green (IAE, Canberra University).

A site visit was undertaken on Thursday 30 March 2017 with Riverview, their consultants and various stakeholders including OEH and John and Anna Hyles (of Tharwa Sands) in order to discuss the preliminary outcomes of this discussion paper and potential design and management recommendations.

3 Rosenberg’s Goanna – locality context

This Section presents an overview of the regional conservation status, known distribution, and potential habitat of and protected area network for *V. rosenbergi* in the broader locality surrounding the Ginninderry development area, and within the ACT and neighbouring areas of NSW.

For more detailed discussions of the ecology and habitat requirements of *V. rosenbergi* see ELA (2016a) and Green et al. (2017).

3.1 Conservation status and key threats

V. rosenbergi is listed as Vulnerable under the NSW TSC Act. The species has declined across its historical range, with ongoing decline shown in the well-studied Kangaroo Island population (Rismiller et al. 2007).

Key threats identified for this species include habitat loss and fragmentation, removal of critical habitat elements, road kill, and predation by domestic animals (dogs and cats) (OEH 2017a). A number of studies have demonstrated the substantial impact that domestic dogs can have on native wildlife in urban and suburban areas (e.g. Holderness-Roddam 2011; Holderness-Roddam and McQuillan 2014). Data on domestic animal attacks on native fauna in Sydney LGAs between February 2003 and February 2016 show that, of 7,135 reported incidents, 2,222 were due to dog attack. Of the 19 reported attacks on *Varanus varius* (Lace Monitor), 16 were due to domestic dog attack. Rismiller et al. (2007) also cite predation by feral pigs as one contribution to population decline, while White and Burgin (2004), in their review of the effects of urbanisation on reptiles and amphibians in Sydney’s urban bushland reserves, discuss the impacts of direct disturbance by humans in disrupting basking times and foraging efficiency.

The targeted management strategy for this species, under the Landscape Management stream of the NSW Saving Our Species program, lists a number of actions to address these threats, such as negotiating conservation agreements to protect known habitat; community education programs with a focus on important habitat elements; and installing signs to warn motorists of the species’ presence and significance (OEH 2017a). OEH (2017b) identify additional activities to assist this species, including avoiding habitat fragmentation; retaining termite mounds and fallen timber in areas supporting *V. rosenbergi* populations; and ensuring connectivity between remnant populations.

3.2 Regional distribution

The GCG (2016) report identified 36 records of *V. rosenbergi* in the ACT and surrounding NSW. As discussed in ELA (2016a), the majority of these records are from upland ACT, for example in Namadgi National Park, and the Googong Area in NSW, with the nearest record to the development site located approximately 8 km away at Stony Creek Nature Reserve.

ELA obtained a GIS file containing six records of *V. rosenbergi* from the GCG, all located within the proposed conservation area or within 100 m to the north or west (i.e. outside the development area). Two of these were from camera trap observations obtained as part of the GCG biodiversity study (GCG 2016). This study also notes the observation of a juvenile *V. rosenbergi* emerging from a termite mound.

The distribution of *V. rosenbergi* based on Atlas of Living Australia records (ALA 2017), GCG records, and an additional observation by ELA (ELA 2016b) within the ACT and surrounding NSW is shown in

Figure 2. This figure shows a total of four records within the ACT and 32 records within 20 km from the ACT border in surrounding NSW (including the six GCG records). It should be noted that *V. rosenbergi* is also known from other locations within the ACT not shown in these records, such as Mount Ainslie Nature Reserve.

3.3 Habitat and home range

The GCG (2016) report suggested a much larger home range should be adopted for the conservation area. The home range requirements in this locality are discussed below.

V. rosenbergi occupies a range of habitat types, from broadly defined open forest and woodland to heath communities across its range in both mainland Australia and the southern islands it is known to occupy. Of the 1,385 Australia wide records of this species, the vast majority are from wooded areas (Atlas of Living Australia 2017). However, 170 records are from “Cultivated and Managed Lands”, indicating the species’ ability to utilise more disturbed or modified vegetation.

Smith et al. (2007) investigated the three apparently disjunct regions of *V. rosenbergi* distribution across Australia, and identified five distinct monophyletic groups corresponding to defined geographic regions (one of which being the combined ACT/NSW population).

Within its broad habitat types, the species requires a number of key micro-habitat elements for breeding, refuge and foraging. The most critical habitat element for this species is termitaria (OEH 2017, Green and King 1993; Green et al. 2017). Hollow logs, burrows and rock crevices are important for refuge, while shrub cover can also assist in avoiding predation.

The home range of *V. rosenbergi*, defined by Green and King (1978: 418) in their study of the Kangaroo Island population as the “area traversed by an individual in its normal activities”, includes key areas containing these microhabitat elements. The various studies conducted for the Ginninderry development (ELA 2016a; GCG 2016; Green et al. 2017) cite a range of literature to quote a wide range of estimated home ranges for this species. The majority of these estimates of home ranges of *V. rosenbergi* are from studies of the Kangaroo Island population. Green et al. (2017) clarify that the 1500 ha home range cited and mapped by GCG (2016: Figure 7) relates to life-long home range, and that mean home ranges of adult *V. rosenbergi* over several years on Kangaroo Island were 96 +/- 4 ha for females, and 257 +/- 21 ha for males. Furthermore, the study by Green and King (1978: 420) found that there was “considerable overlap of home ranges” of different individuals.

However, the availability and quality of key habitat elements (discussed above) in the landscape influence movement (and therefore home range) of *V. rosenbergi*, and therefore discussions of home range should take into account the concept of ‘home range in suitable habitat’.

Smith et al. (2007) cast doubt on the applicability of these Kangaroo Island studies in guiding conservation management decisions in NSW. This former population (as studied) predominantly occupies habitats of generally flat, slightly undulating terrain (Rismiller et al. 2007). Green et al. (2017: 7) highlight that in areas of steeper and more dissected terrain such as around Googong (and, as could be inferred, within the Murrumbidgee River and Ginninderra Creek corridors) the two-dimensional “plan area for home range is much smaller than the surface area” utilised by terrestrial fauna in this terrain. As such, “plan” home ranges for *V. rosenbergi* that utilise the steep gorge country within the proposed conservation area could be smaller than the 96 ha and 257 ha cited above. Furthermore, as discussed in ELA (2016a), territorial range and home ranges are not necessarily the same, and home ranges of individuals may overlap and adapt to variation in habitat and resource availability.

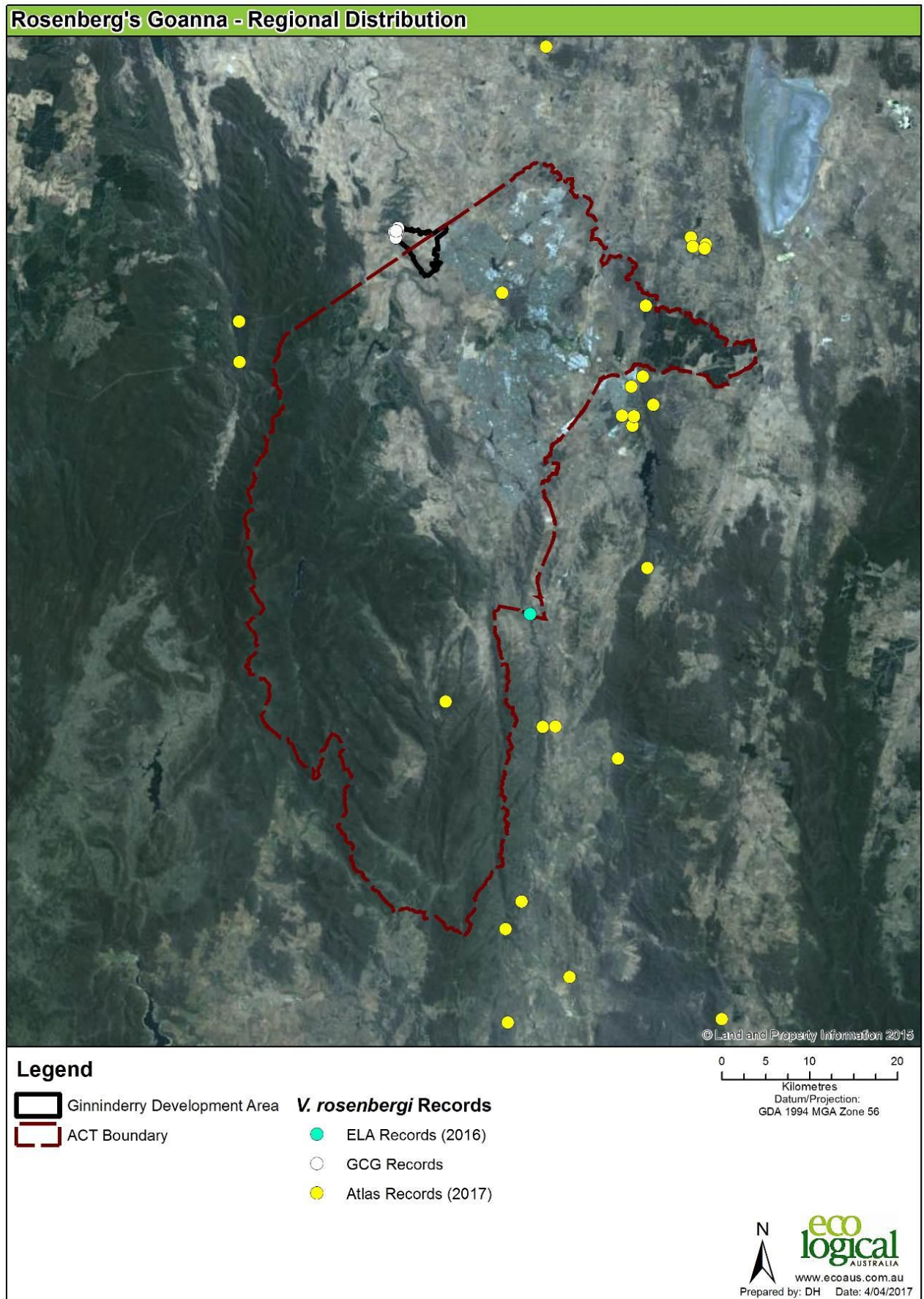


Figure 2: Rosenberg's Goanna distribution – ACT and surrounds

3.3.1 Potential habitat and protected area network

Figure 3 shows the extent of mapped (ELA 2016a) habitat for *V. rosenbergi* (including termitaria mapped by ELA (2016a)) in the immediate locality of the development site. It also shows the broader network of river corridors (NUZ4 in the ACT Territory Plan), mountains and bushlands (NUZ5) and nature reserves within the ACT, and adjacent E3 zoned lands and National Parks and Wildlife Service (NPWS) estate in NSW. As shown, there is an extensive network of non-urban areas and nature reserves, zoned primarily for environmental protection and conservation of ecological values and services, that is directly connected to the proposed Ginninderry conservation area.

A total of at least 2,409 ha of ACT nature reserves, primarily those located along the Murrumbidgee River corridor, form direct links to the proposed conservation area. While this area has not been specifically mapped in terms of habitat values for *V. rosenbergi*, it is considered likely that these nature reserves contain habitat of various condition for *V. rosenbergi* and may be utilised as part of the species’ home range. In NSW, lands located along the Murrumbidgee immediately north of the development site are zoned E3 Environmental Protection under the Yass Valley Local Environment Plan.

ELA (2016a) mapped a total of 971.66 ha of *V. rosenbergi* habitat in varying condition across the majority of the development site in NSW, as well as in surrounding areas to the north and south (“study area”). **Table 1** presents a summary of the condition classes mapped as part of this study, and a breakdown of the area of each contained within the study area; the proposed conservation area (note that habitat was not mapped in the ACT portion of the conservation area by ELA (2016)); the proposed development area; and adjoining ACT nature reserves.

As shown in **Table 1**, 99% of very high condition habitat and 96% of high condition habitat are protected by existing ACT nature reserves, NSW E3 zoning, and/or the proposed conservation area.

Table 1: Habitat condition classes and associated areas

Habitat condition	Area (ha)					
	Study area (ELA 2016a)	Development area	Conservation area	Nature reserves (ACT)	E3 lands (NSW)	Total in conservation area /nature reserves/E3
Very high	89.45	0.41	41.23	14.38	33.06	88.67 (99%)
High	179.02	0.42	21.1	55.49	95.82	172.41 (96%)
Moderate	243.33	2.21	41.85	98.48	82.3	222.63 (91%)
Low	247.77	20.22	66.69	85.93	27.33	179.95 (73%)
Very Low	212.09	188.15	36.36	0.00	0.31	36.67 (17%)
Total	971.66	211.41	207.23	254.29	238.82	700.33 (72%)

In conclusion, the Ginninderry development has a very high proportion of the ‘very high’, ‘high’ and ‘moderate’ *V. rosenbergi* habitat set aside for conservation, which adjoins a significant additional area of potential habitat. Much of this additional potential habitat has varying degrees of existing environmental protection (from nature reserve to environmental zoning).

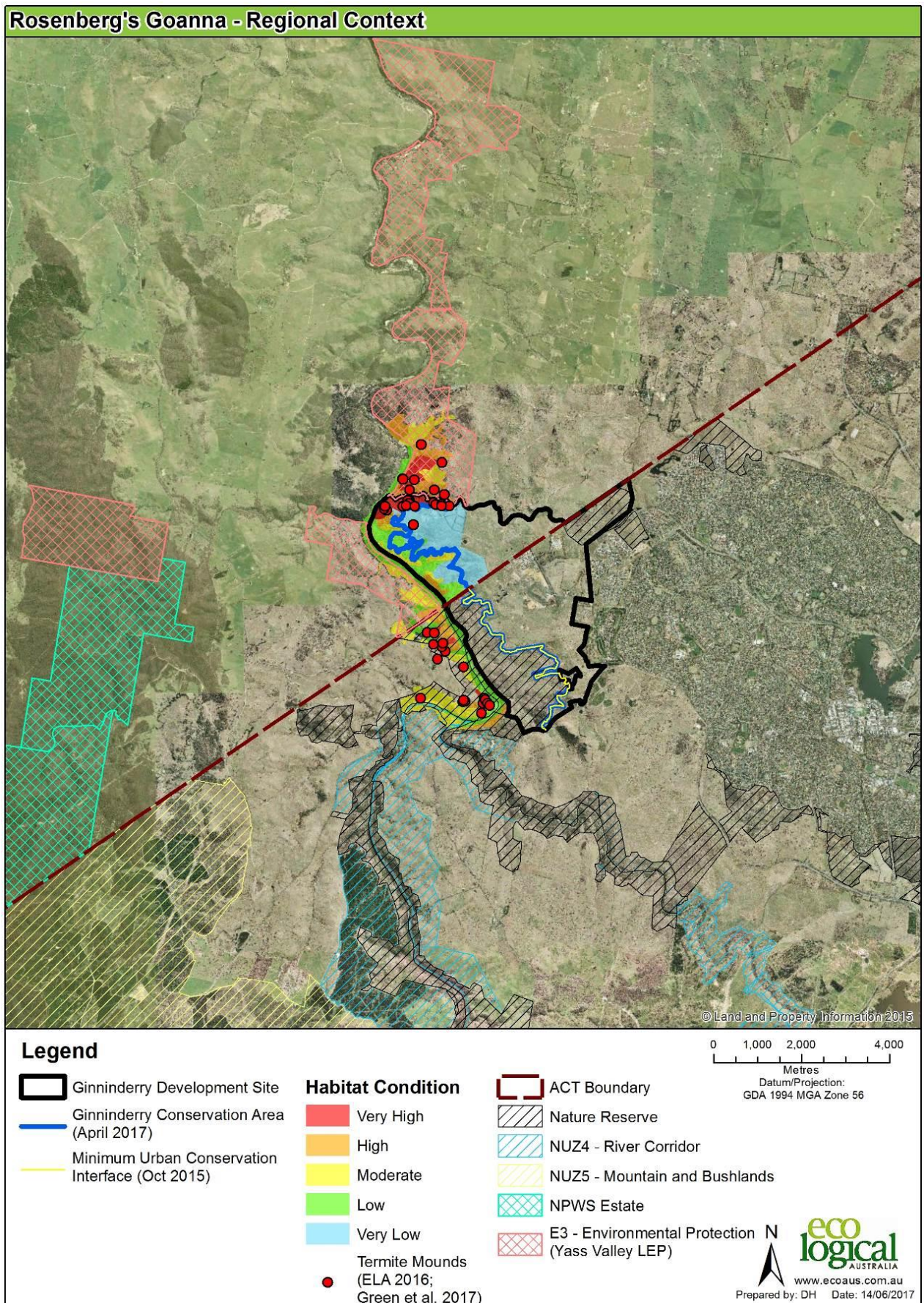


Figure 3: Potential habitat and protected area network

4 Site context

4.1 Conservation area

The proposed 577 ha conservation area incorporates 371 ha of land within the ACT and 206 ha in NSW, and approximately 6 km of Murrumbidgee River frontage (AT Adams Consulting 2015). The area contains a range of native vegetation communities (open forest, woodland and native grasslands), cleared lands, and riverine gorge landscapes along the Murrumbidgee River and Ginninderra Creek (TRC 2014). As shown in **Figure 3** and **Figure 4**, this conservation area will maintain landscape and habitat connectivity between the Ginninderra Creek corridor and the Murrumbidgee River corridor which includes several ACT nature reserves within its boundaries.

The conservation area will be managed as an IUCN Category IV reserve (as with most areas of the Canberra Nature Park), and is proposed to be managed by a newly established environmental management trust (EMT). Statutory zoning provisions in both the ACT (variation to Territory Plan) and NSW (Yass Valley LEP) will also be implemented to limit activities in line with the overarching environmental and conservation objectives; namely:

- Protecting and restoring biodiversity and ecosystem functions and ecological connectivity across the landscape
- Managing the urban edge to protect the values of the conservation area
- Provide quality recreation experiences
- Encourage active learning and engagement (AT Adams Consulting 2016).

The conservation area will be managed by the EMT in accordance with an environmental management plan. Key areas in the development area will also be subject to the development and implementation of an environmental management plan.

The eastern boundary of the conservation area was primarily designed to protect the following Matters of National Environmental Significance (listed under the *Environmental Protection and Biodiversity Act 1999* (EPBC Act)):

- *Aprasia parapulchella* (Pink-tailed Worm Lizard): listed as Vulnerable under the EPBC Act, ACT *Nature Conservation Act 2014* (NC Act), and NSW *Threatened Species Conservation Act 1995* (TSC Act); and
- White Box – Yellow Box - Blakely’s Red Gum Grassy Woodland and Derived Native Grasslands (DNG) (hereon “box gum woodland”): a Critically Endangered Ecological Community (CEEC) under the EPBC Act, and as an Endangered Ecological Community (EEC) under both the NC Act and TSC Act (referred to as “Yellow Box/Red Gum Grassy Woodland” and “White Box Yellow Box Blakely’s Red Gum Woodland” respectively).

The conservation area will incorporate all of the box gum woodland located within the development site, as well as 145.8 ha of *A. parapulchella* habitat (AT Adams Consulting 2016). It will also provide connectivity to the existing Murrumbidgee River Corridor to the south; will incorporate the majority of the remnant native vegetation within the development site; and has the potential to provide habitat and habitat connectivity for a range of threatened fauna species, listed under the EPBC Act, NC Act and/or TSC Act (TRC 2014; GCG 2016).

As shown in **Table 1** above, the conservation area will also include 104.18 ha of very high, high or moderate condition habitat for *V. rosenbergi*, plus an additional 103.05 ha of low or very low condition

habitat. It will also support the connectivity between areas of moderate to very high condition habitat, as well as other potential habitat not mapped by ELA (2016), outside the development site along the Murrumbidgee River and Ginninderra Creek.

The known and likely habitat area available to *V. rosenbergi* is substantial and the proposed conservation area is a key link in this habitat network. The Ginninderra Creek and Murrumbidgee River do not provide a barrier to the movement of individuals between suitable habitats on either side of the waterways (F. Guarino, pers. comm). The conservation area within the development site is not considered to require expansion to include additional low and very low quality habitat areas. Of greater importance is the complementary management of adjoining areas and appropriate conservation/urban interface design.

It is noted that there are two small ‘inholdings’ of private land in the conservation area. The management of these areas has not been addressed in this paper.

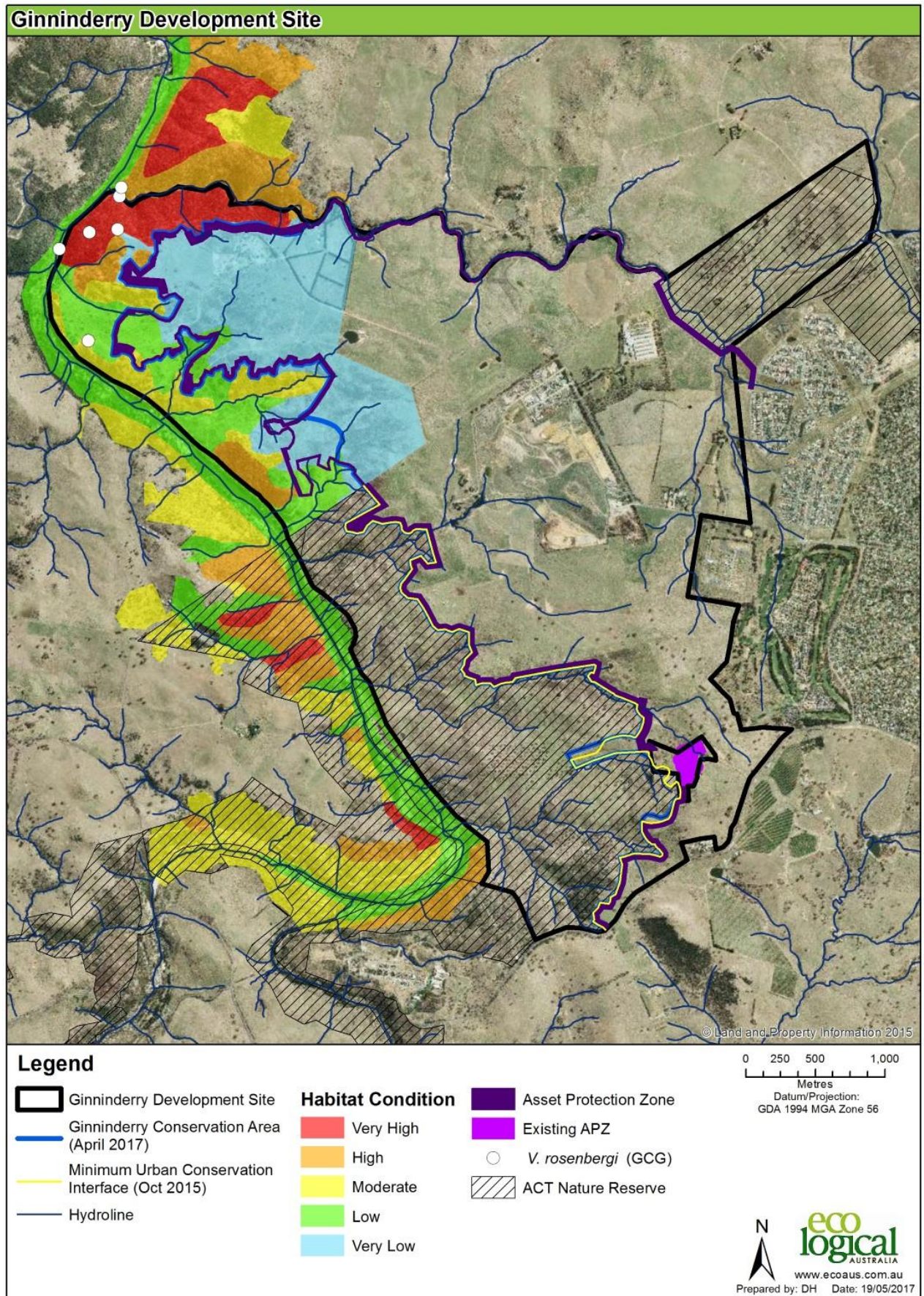


Figure 4: Ginninderry development site

4.2 Conservation/urban interface

The majority of the conservation area boundary in NSW passes through habitat mapped by ELA (2016a) as being of very low to moderate condition for *V. rosenbergi* (**Figure 4**). These areas of low and very low habitat condition predominantly lack key habitat elements such as termitaria and hollow logs, however they may provide marginal foraging habitat and/or facilitate movement between patches of higher condition habitat.

The areas of higher condition habitat, and the native fauna that occupy them, have the potential to be negatively impacted by development activities, particularly if urban development is located immediately adjacent to the conservation area boundary. Managing the potential risks posed by urban development to *V. rosenbergi* (see Section 3.1), as well as to other threatened fauna species that may utilise this edge habitat, will be a priority for the planning and management of these conservation/urban interface areas. Ecological protection, restoration and management objectives and criteria are to be considered as part of the conservation/urban interface area (see Section 5).

Enhancing and protecting the areas of high and very high condition habitat is considered a priority for improving conservation outcomes for the local population of *V. rosenbergi*. This view is supported by the conclusions of Green et al. (2017). While the vast majority of high and very high condition habitat located within the development site is contained within the conservation area, approximately 0.73 km of the conservation area boundary, located in the north-west corner of the NSW portion of the development site, passes through areas mapped as high or very high condition *V. rosenbergi* habitat (the majority of which are contained within, or are immediately adjacent to, proposed variation areas A and B, **Figure 1**).

The original recommendation by ELA (2016) to include a “minimum width of 300 m” between the edge of permanent water courses (bordered by potential habitat) to the development area was guided by a high-level assessment of topography and areas of high quality habitat. Two of the four proposed variation areas are adjacent to high or very high quality *V. rosenbergi* habitat, and were intended to protect these habitat values (**Figure 1**, A, B).

A more appropriate approach to designing the edge of the conservation corridor is to include ecological objectives and principles in the detailed design along the entire conservation corridor boundary, rather than defining a nominal boundary from a water course.

The following section (Section 5) identifies overarching conservation objectives and principles for the design and management of the ecological component of the interface, with a particular focus on areas adjoining high and very high condition habitat for *V. rosenbergi*. Section 5 also presents a series of recommendations for design in the areas adjoining the conservation area boundary.

The objectives and considerations will be given effect through a Development Control Plan (DCP) in NSW and an equivalent mechanism/s in the ACT that deliver on these outcomes.

5 Ecological management within the conservation/urban interface

5.1 Objectives and guiding principles

A number of discussion papers, reference groups, and consultative processes within the ACT and/or associated with the Ginninderry development have resulted in the identification of key considerations and recommendations to inform the management of conservation/urban interface areas for enhancing ecological outcomes (e.g. Conservation Council ACT Region 2013; Bush on the Boundary reference group; Adams (undated)).

The Conservation Council ACT Region (2013) identifies a number of key priorities for managing conservation/urban interface areas, including enhancing landscape and ecological connectivity (including habitat enhancement and restoration), promoting community participation, and managing edge effects such as predation by domestic animals and invasion of exotic species.

The objectives for the Ginninderry project conservation/urban interface area (Appendix B), including the ecological component of the interface area, are to:

- To preserve and enhance the landscape, cultural, heritage, visual and ecological values of the Murrumbidgee River and Ginninderra Creek corridors.
- To restrict development, including buildings, alterations and vegetation clearing on the subject land, so as to minimise any adverse impact on the landscape, cultural, heritage, visual and ecological values of the Murrumbidgee River and Ginninderra Creek corridors.
- To ensure that the risk of bushfire is satisfactorily addressed in the design and siting of development.
- To ensure that development takes into account and is appropriate for the land terrain and slopes (Knight Frank 2017).

This paper does not seek to define the specific extent of the ecological component of the interface area along the conservation area boundary. The ecological component of the interface will provide a minimum 20m width for *V. rosenbergi*, noting it will need to vary along the length with detailed design. It has been previously recommended that a minimum ‘no development zone’ width of 20m also be provided adjoining *A. parapulchella* habitat, in order to enable weed control, appropriate vegetation management, and to allow for more natural surface drainage (see also rules contained within Knight Frank 2017 and Appendix A). In practice the ecological component of the interface area will vary in width and design, often being wider based on other factors such as Asset Protection Zone (APZ), incorporation of high quality fauna habitat elements, water quality controls and urban design considerations (see Section 5.2).

The design will also need to align with the principles and objectives outlined in the ‘West Belconnen Conservation Reserve Draft Management Plan 2016 – 2021’ (TRC Tourism 2017), in particular Sections 4.1.6 ‘Managing urban interface effects’ and 4.1.7 ‘Sensitive location and design of infrastructure’, and the ‘West Belconnen Landscape and Open Space Strategy’ (McGregor + Coxall 2017). Design will also need to consider the Cultural Heritage Report (Waters 2017), APZ requirements and site specific Cultural heritage Management Plans.

The design of the ecological component of the interface should be based on a range of considerations, including:

Ecological:

- The vegetation type (e.g. forest, open woodland, grassland) and habitat condition (e.g. for *V. rosenbergi* and *A. parapulchella*) in the adjacent conservation area;
- Incorporating remnant native vegetation, particularly large remnant trees;
- Incorporating habitat requirements and other ecological features to support the range of threatened species that have the potential to occur within the development site;
- Local topography and associated habitat, e.g. rocky outcrops;
- Incorporating areas of better soil structure and restoration potential, including box gum woodland;
- Incorporating the APZ design requirements (e.g. vegetation structure, understorey and ground cover requirements and need for maintenance); and
- Light spill to habitat areas where fauna may be affected.

Development:

- Areas with existing development restrictions due to slope and serviceability;
- The placement of proposed locations of infrastructure that do not conflict with conservation objectives (e.g. water basins, horse or walking tracks);
- To provide for the collection and treatment of run off from hard or soft infrastructure (roads, trails, etc); and
- Provision for access and maintenance of infrastructure, conservation/urban interface areas and APZs.

Cultural/Educational:

- Visual amenity, safety and sustainable design principles;
- Managed access to the conservation area to be directed to the less sensitive areas;
- Opportunities for positive experience with environmental values and interpretation, education about the values and needs of the area. Supporting a sense of ownership and community involvement in the interface as well as the area; and
- Development in the interface zone in the vicinity of any site of known Aboriginal cultural significance shall not occur prior to the completion of a cultural heritage management plan for the site.

5.2 Interface design recommendations

Specific design proposals for the future management of the ecological component of the interface area shall be in accordance with the planning controls for the conservation/urban interface (referred to as “Conservation/Urban Edge Interface” in the Parkwood Planning Proposal (Knight Frank 2017 and Appendix A)) and include consideration of the recommendations below. These recommendations will support improved conservation outcomes and ecologically sensitive design across the conservation/urban interface and adjoining conservation area.

Design feature/objective	Recommendation for ecological component of the interface area
Width and alignment of interface area	An ecological component of the interface is to extend along the entire length of the conservation area boundary. Detailed design at the precinct design stage to address adjoining natural and cultural conservation values (e.g. reptile habitat, etc).
	Minimum width is to be 20 m. Width to be larger where other infrastructure is incorporated that may pose a risk to ecological or cultural values present. For example, where it includes active termite mounds or hollow bearing trees (note there is one known termite mound that is located in the development area and is not recommended for inclusion in the conservation/urban interface area).
	The width, design and management of the APZs should be considered and incorporated into the design and management to the greatest extent possible, to align these objectives.
	Width and alignment along the length will vary based on ground-truthing of location specific features (e.g. vegetation, topography and habitat), development restrictions (e.g. unserviceable areas), proposed infrastructure and other design considerations as described in Section 5.1.
Residential development and infrastructure	No residential or commercial development is to back onto the conservation areas.
	The edge road is to be located outside the ecological component of the interface area.
	All hard surface areas are to collect run off for treatment prior to release downstream.
	Along the edge of the high quality <i>V. rosenbergi</i> habitat use concrete (or another light/coloured material (OEH, pers. comm)) rather than bitumen for road construction to increase the visibility of individual animals that may potentially cross this road. Limit speed on the ring road adjacent to very high and high quality habitat.
	Construct a fence along the boundary of the conservation area. If required by OEH, a predator-proof fence should be provided along areas of high and very high condition <i>V. rosenbergi</i> habitat. This should not impede movement along the river corridor (i.e. it does not continue down to the river/creek).

Design feature/objective	Recommendation for ecological component of the interface area
	Underground sewer works and water basins may be constructed within the ecological component of the interface area, provided these do not impact upon high condition <i>V. rosenbergi</i> habitat, remove remnant trees or fragment habitat. Basins and water courses to be stabilised to avoid erosion.
	Ensure cat containment provisions apply to the development site across ACT and NSW. Should specific legislation not be available at the time of development in NSW then consider the use of other appropriate mechanisms such as covenants to manage cat predation on the number of threatened and other fauna.
	The quarry is not recommended for inclusion in the ecological component of the interface area. Where disturbed areas are located in the conservation/urban interface they are to be prioritised for infrastructure or tourism/commercial/education centres.
Habitat protection and enhancement	Where the ecological component of the interface is the minimum of 20 m in width, then only ecological restoration and native landscaping is to be delivered with minor infrastructure (such as low impact managed trails and water bodies).
	The ecological component of the interface should be designed and managed to enhance habitat connectivity for the diversity of native fauna species, including threatened species, that have the potential to utilise these areas (e.g. small woodland birds).
	Planting in adjoining urban and public areas should be consistent with habitat enhancement and connectivity objectives for small woodland birds and other native fauna.
	Where remnant mature trees are located in close proximity to the boundary of the ecological component of the interface area then it should be designed to incorporate and retain these.
	Relocate fallen timber and bush rock from the development area/other disturbance areas to the ecological component of the interface area to provide habitat (particularly shelter) for <i>V. rosenbergi</i> and other ground-dwelling fauna. Priority should be given to restoration areas of the conservation area prior to using them in the ecological component of the interface area.
	Undertake native revegetation utilising local provenance seed/tubestock. The selection of species should be determined by the composition and structure of adjoining remnant vegetation.
	Establish a nursery (or appropriate partnership) for the purpose of supplying a local provenance tubestock to the development.
	Provide habitat features for reptiles and birds to avoid and evade predator and human disturbance.
	Placement of trees and shrubs to be consistent with the bushfire

Design feature/objective	Recommendation for ecological component of the interface area
	<p>guidelines in areas where APZs overlap with the ecological component of the interface.</p> <p>Shrub and canopy restoration should not occur within 20 m of identified <i>A. parapulchella</i> habitat. Limited revegetation with shrub and tree species within 20 m to 50 m of <i>A. parapulchella</i> habitat, with species and structure to be consistent with <i>A. parapulchella</i> habitat requirements.</p>
Cultural, education and engagement	<p>Install signage at access points and key locations (e.g. near termite mounds) educating the public about the ecological values present within the area.</p> <p>Incorporate areas identified as having Aboriginal cultural significance in the conservation area and ensure protection of those values through sensitive design.</p> <p>Install signage and educate all residents on restrictions on firewood and bushrock collection as well as dog restrictions within the conservation and interface areas.</p> <p>Provide areas for the community to enjoy and appreciate the conservation/urban interface area as a recreation resource and high quality amenity.</p> <p>Develop a community engagement strategy to foster awareness amongst residents of the conservation values of the area and to provide advice on how they can support these (e.g. responsible sourcing of firewood, no bushrock collection, cat containments, no dogs in conservation area, low impact recreation opportunities, involvement in bush regeneration, etc).</p> <p>Signage should be interpretive and utilise positive messaging and visual aids (e.g. photographs/illustrations of species, maps indicating where different activities are permitted).</p> <p>Any tourism or recreation facilities adjacent to the area to be subject to a detailed design that incorporates these ecological protection and restoration principles at a scale appropriate to the scale of the proposed facility.</p>
	<p>Control access into the conservation area to strategic locations (e.g. away from high condition habitat or significant habitat features).</p> <p>Ecologically sensitive low-impact recreational activities are to be encouraged and facilitated.</p> <p>Low-impact recreation infrastructure such as walking trails, horse tracks and bicycle tracks can be incorporated into the ecological component of the interface area. The design of this infrastructure network should be informed by the existing environment, e.g. aligning with natural topographic pathways and avoiding key habitat features (remnant trees, rock habitat, termite mounds etc).</p> <p>Dogs must be kept on a leash at all times in the conservation/urban</p>
Recreation and recreational infrastructure	

Design feature/objective	Recommendation for ecological component of the interface area
	interface area.

Each of the urban release areas will require detailed design for the ecological component of the interface area. The detailed designs will need to be consistent with the design recommendations as provided in this paper. A number of potential design options for varying areas will be prepared for the development control plan.

Management

A key objective of the management of the ecological component of the interface area is to coordinate management with the conservation area, utility or infrastructure providers and user groups. Management is to incorporate the findings of the Cultural Heritage Report and subsequent Management Plan. Where required the minimum width of the ecological component of the interface area would need to be increased and demonstrate it has met these and other ecological and cultural requirements.

The requirements for the management of the ecological component of the interface area to be incorporated into environmental management plans for the conservation area and development area. It is intended that the local authority own the ecological component of the interface area and are transferred the lands following a satisfactory implementation phase delivered by the developer. The recreational and environmental assets are to be managed by the EMT that is to be established. It is noted that the final ownership of these interface lands is still being negotiated.

A Cultural Heritage Management Plan is to be produced.

Activities to be addressed in the management plan(s) should include, among others:

- Infrastructure maintenance – e.g. water quality ponds, surface of paths and trails.
- Fence, access and signage maintenance.
- Weed control.
- Feral animal controls (e.g. Fox control, including adjoining areas)
- APZ maintenance.
- Erosion and scour repair.
- Native vegetation loss – replacement.
- Community engagement.

Research

A number of research proposals have been suggested. Although they add to the bank of understanding of this species it is not needed for the design of the conservation area or approval of the development. If it they are considered by the authorities then the movement of *V. rosenbergi* throughout the Murrumbidgee Corridor and adjoining areas should be prioritised and would provide a greater understanding of the species' use of habitat in and movement throughout this locality.

Final word

The minimum width for the ecological component of the interface area is to be 20 m. This is to be designed in accordance with the aims and considerations provided in this report. Where the ecological component of the interface area is to be larger, for example where it is adjacent to and is required to

incorporate high quality habitat features such as termite mounds and remnant trees, the aims and considerations still apply and will be part of the neighbourhood planning and design process.

It is recognised that there are large areas of known and potential *V. rosenbergi* habitat outside the lands that are the subject of this development, particularly to the northwest of the development area. Many of those areas have various levels of protection but inconsistent and limited management actions for the known values and threats (e.g. predators, weeds, etc). This proposal provides an opportunity for leadership to be demonstrated by landholders and relevant agencies in both conservation management as well as design and management of an urban interface in this locality.

References

- Adams, T. (undated). *West Belconnen/Parkwood Planning Proposal: Guiding principles to be applied to detail planning in the urban/conservation lands interface sector*. Discussion paper prepared for the Riverview Group.
- A T Adams Consulting (2015). *West Belconnen Draft Variation No. 351*. Planning Study prepared for Riverview Projects (ACT) Pty Ltd.
- A T Adams Consulting (2016). *Urban Development at West Belconnen*. Program Report prepared for Riverview Projects (ACT) Pty Ltd.
- Atlas of Living Australia (2017). *Varanus rosenbergi* Mertens, 1957 – Heath Monitor. [available online at <http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:a01a6bb4-8757-4ebf-9da7-0089e657d8d1>]
- Conservation Council (ACT Region) (2013). *Managing the Urban Edge*. Discussion Paper. December 2013.
- Eco Logical Australia (2016a). *Ginninderry Project, Rosenberg’s Goanna habitat assessment*. Prepared for The Riverview Group.
- Eco Logical Australia (2016b). *M2G Biodiversity Offset Monitoring Report*. Prepared for Icon Water.
- Ginninderra Catchment Group (2016). A Preliminary Biodiversity Survey of the Ginninderra Falls Area. A report commissioned by the Riverview Group.
- Ginninderra Catchment Group (undated). Comments on Rosenberg’s Goanna habitat Assessment.
- Green, B. and King, D. (1993). *Goannas: The biology of Varanid Lizards*. University of New South Wales Press, Pty Ltd., Sydney
- Green, B., Guarino, F. and Higgisson, W. (2017). *Habitat evaluation of two proposed extension areas to the Ginninderry reserve to provide improved ecological outcomes for Varanus rosenbergi*. The Institute for Applied Ecology, University of Canberra.
- Holderness-Roddam, B. 2011. The effects of domestic dogs (*Canus familiaris*) as a disturbance agent on the natural environment. Masters thesis. University of Tasmania, Hobart.
- Holderness-Roddam, B. and McQuillan, P. B. 2014. Domestic dogs (*Canis familiaris*) as a predator and disturbance agent of wildlife in Tasmania. *Australasian Journal of Environmental Management*. 21 (4): 441-452.
- Knight Frank Town Planning (2017). Parkwood Planning Proposal. May 2017.
- McGregor + Coxall (2014). *West Belconnen Landscape and Open Space Strategy*. Prepared for Riverview Projects [ACT] Pty Ltd & ACT Land Development Agency.
- Office of Environment and Heritage (2017). *Rosenberg’s Goanna (Varanus rosenbergi)*. Saving our Species Program – Species Profile. Available: <http://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10826>

Office of Environment and Heritage (2017b). *Threatened Species Profile – Rosenberg’s Goanna*. Available: <http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10826>. Accessed March 2017.

Rismiller, P., McKelvey, M. and Steinlechner, S. (2007). Temperature and humidity in egg incubation mounds of *Varanus rosenbergi*. *Mertensiella*, 16(1): 353-363.

Smith, W., Scott, I.A.W. and Keogh, J.S. (2007). Molecular phylogeography of Rosenberg’s goanna (Reptilia: Varanidae: *Varanus rosenbergi*) and its conservation status in New South Wales. *Systematics and Biodiversity* 5(4): 361–369.

TRC Tourism (2014). *Proposed West Belconnen Conservation Area: Options for establishment and management*. Prepared for Riverview Projects (ACT) Pty Ltd.

TRC Tourism (2016) *Draft Management Plan: West Belconnen Conservation Reserve 2016-2021*. Draft November 2016.

White, A.W. and Burgin, S. (2004). Current status and future prospects of reptiles and frogs in Sydney’s urban-impacted bushland reserves. *Urban Wildlife: more than meets the eye*. Lunney and Burgin (eds) 2004. Royal Zoological Society of New South Wales.

Appendix A: Excerpt from Knight Frank (2017)

Conservation/Urban Edge Interface

(1) The objectives of this clause are to:

- a) To preserve and enhance the landscape, cultural, heritage, visual and ecological values of the Murrumbidgee River and Ginninderra Creek corridors.
- b) To restrict development, including buildings, alterations and vegetation clearing on the subject land, so as to minimise any adverse impact on the landscape, cultural, heritage, visual and ecological values of the Murrumbidgee River and Ginninderra Creek corridors.
- c) To ensure that the risk of bushfire is satisfactorily addressed in the design and siting of development.
- d) To ensure that development takes into account and is appropriate for the land terrain and slopes.

(2) This clause applies to land identified as ‘Conservation/Urban Edge Interface’ on the Conservation/Urban Edge Interface map.

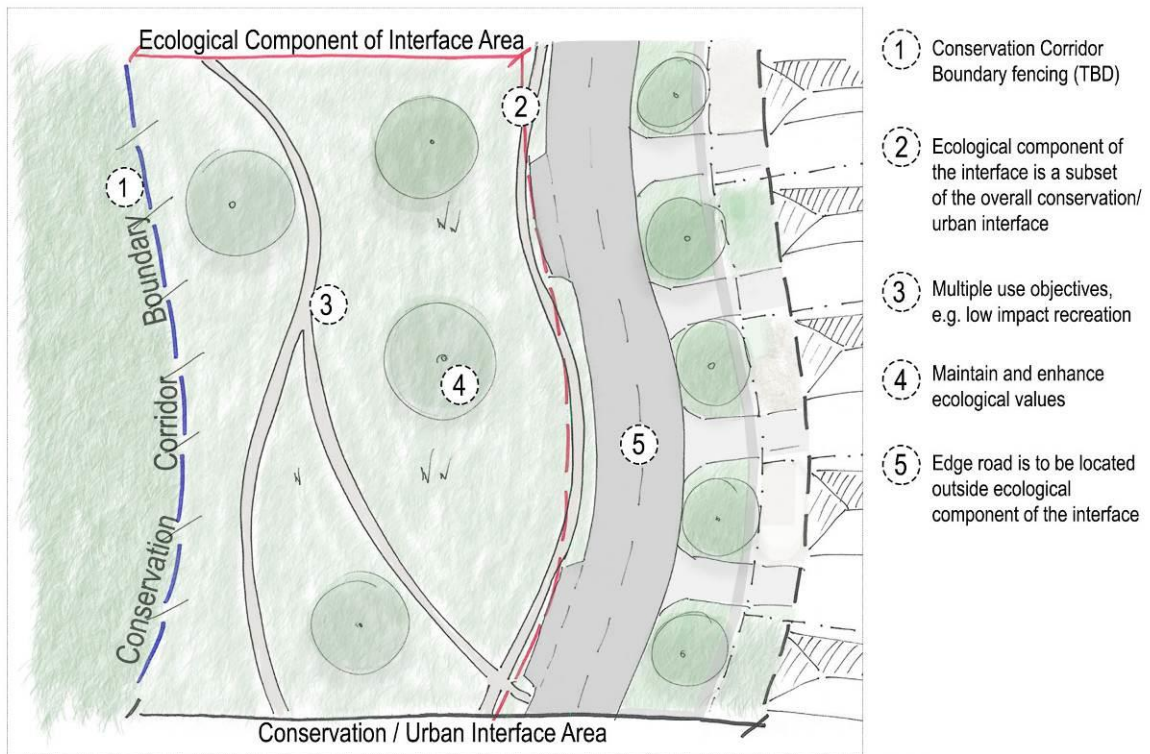
(3) Development consent must not be granted to development, unless the consent authority is satisfied that:

- a) The development will not have any significant adverse impact on the ecological, cultural or scenic values of the Murrumbidgee River and Ginninderra Creek corridors, and the development will not:
 - i. Result in any urban stormwater flows entering directly into the Conservation Corridor without first being treated in accordance with an approved Water Sensitive Urban Design Strategy for the site;
 - ii. Require any earthworks to extend into the Conservation Corridor except in respect of any approved Water Sensitive Urban Design facility, stream stabilisation or habitat protection or enhancement works;
 - iii. Require the removal of any significant existing native vegetation within the Conservation Corridor; and
 - iv. Directly impact on any defined habitat for threatened species within the Conservation Corridor.
- b) The proponent has considered and provided an assessment of any areas or items that are of high cultural significance to the Aboriginal community that may be impacted upon by development.
- c) The proponent has carried out and provided an assessment of any existing native vegetation on the development site which demonstrates that the proposed development will retain any identified significant existing native vegetation in a sustainable manner as part of the development.
- d) The development will be constructed of unobtrusive non-reflective materials that are complementary in colour and hue to the natural environment of the adjacent Murrumbidgee River and Ginninderra Creek corridors.
- e) The risk of bushfire has been addressed in accordance with the NSW Planning for Bushfire Protection, including the provision (if required) for an APZ.
- f) The development will be designed and sited to respond sympathetically to the land form of which it will form a part.
- g) A geotechnical report prepared by a suitably qualified person demonstrates that the land is suitable for the proposed development.

(4) This clause does not apply to land where a neighbourhood structure plan has been prepared and adopted by the relevant planning authority.

Appendix B: Indicative sketch of interface area and components

Ecological Component of The Conservation / Urban Interface | Indicative Sketch



Note: This diagram is indicative only and should be read in conjunction with the Rosenberg’s Goanna Discussion Paper prepared by Eco Logical Australia 2017.

NB: “Conservation Corridor” in this sketch refers to “conservation area” as discussed in this paper.



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