Peer Review of Biodiversity Studies

WARRAH ROAD, NORTH NOWRA 49462E (D14/308516)

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ACRONYMS AND ABBREVIATIONS

DEC	Refer to OEH
DECCW	Refer to OEH
DP&I	(NSW) Department of Planning and Infrastructure
EEC	Endangered Ecological Community – as defined under relevant law applying to the proposal
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FM Act	*Fisheries Management Act 1994* (NSW)
HCV	High Conservation Value
IRGIP	Illawarra Regional Growth and Infrastructure plan 2014 (Draft)
KFH	Key Fish Habitat
LEP	Local Environment Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance under the EPBC Act (*c.f.*)
NBSP	Nowra Bomaderry Structure Plan
Noxious Weeds Act	*Noxious Weeds Act 1993* (NSW)
NSW	New South Wales
NV Act	*Native Vegetation Act 2003* (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water (DECCW) and prior to this, Department of Environment and Conservation (DEC)
REP	Regional Environmental Plan
RCP	Regional Conservation Plan
SCC	Shoalhaven City Council
SCRS	South Coast Regional Strategy
SCRCP	South Coast Regional Conservation Plan
SEPP	State Environmental Planning Policy (NSW)
SIS	Species Impact Statement
SLEP	Shoalhaven Local Environmental Plan
sp/spp	Species/multiple species
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
URA	Urban Release Area

1 INTRODUCTION

1.1 BACKGROUND

Shoalhaven City Council (SCC) require a review of existing biodiversity studies and reports for land known as the Crams Road Urban Release Area (Crams Road URA), North Nowra, New South Wales (NSW). The need for the review is based on conflicting biodiversity assessments that have been prepared for the site for SCC and the landowner. The five assessments reviewed include:

i. *Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan* (May 2008). Report prepared for Shoalhaven City Council by Allison Hunt and Associates.
ii. *Flora and Fauna Assessment and Constraints Analysis* (September 2010). Report prepared for the landowner by Biosis Research.
iii. *Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey* (April 2011). Report prepared for the landowner by Biosis Research.
iv. *Review of Hollow Bearing Tree Assessment of Lands at Warrah Road* (May 2011). Report prepared for the landowner by OMVI.
v. *Review of Conservation Significance of Lands at Warrah Road, North Nowra* (October 2011). Report prepared for the landowner by OMVI.

These assessments have reached different conclusions regarding the conservation significance of the habitats present within the Crams Road URA. This has implications regarding the potential for development of the land.

1.2 OBJECTIVES AND SCOPE OF THIS REVIEW

The primary objective of this report is to provide an independent and objective review of the existing studies. Based on the existing information, this report aims to determine whether or not the subject land contains areas of High Conservation Value (HCV) as defined in the South Coast Regional Conservation Plan or, if further assessment is required to define HCV areas.

This review:

1. Clearly identifies the land subject to review and provides a brief history of key planning decisions affecting the land.
2. Identifies relevant biodiversity legislation and regional planning documents, stating how they apply to the land.
3. Provides a summary of the five relevant studies including their objectives and key outcomes.
4. Audits the findings of each of the reports, identifying where they differ and assessing the accuracy and validity of each report based on their approaches, assumptions and depth of analysis.
5. Evaluates areas considered in the reports to meet the definition of HCV areas and provides independent justification according to relevant planning documents as to why these areas should be considered as such.
6. Provides recommendations regarding the potential for development on the subject land, in consideration of the above evaluation.

The scope of this review is limited to the evaluation of areas of HCV as they relate to biodiversity. This review does not consider other key factors such as Aboriginal heritage which may also have a bearing on the conservation value of the subject land.

2 APPROACH OF THIS REVIEW

The approach to this review was comprised of three main stages:

1. Initial desktop review of the five existing studies and updated searches of relevant databases.
2. A site inspection to assess the general accuracy of information within the existing studies.
3. Detailed review of the existing studies and identification of HCV areas.

Each stage is discussed in more detail below.

The review was completed by senior ecology staff, not previously involved in assessments undertaken in the URA (refer to Appendix A, Assessment Personnel).

2.1 INITIAL DESKTOP REVIEW

An initial desktop review of the five existing studies was undertaken. The general approaches of the studies, their objectives and key findings were documented (refer Section 5). The points of differences between the studies was also documented (detailed in Section 6) and formed the focus for the site inspection.

Updated searches of NSW and Commonwealth threatened species databases were undertaken as shown in Table 2-1 to identify any additional records of threatened species, populations or communities of relevance to the URA that may have been lodged since the studies were completed.

Table 2-1 Background searches undertaken for threatened entities

Resource	Target	Search Date	Search Area
OEH Wildlife Atlas Database	Threatened flora and fauna and populations.	17/04/15	10 kilometres radius of study area
EPBC Act Protected Matters Search Tool	Threatened flora and fauna, endangered populations and ecological communities and migratory species.	17/04/15	10 kilometres radius of study area

Literature relevant to the outcomes of the existing studies was also reviewed and included:

- NSW OEH Threatened Species Profiles
- Department of the Environment EPBC Act Species Profiles and Threats Database (SPRAT)
- Published vegetation mapping (e.g. Tozer *et. al.* 2010)
- Aerial maps

2.2 SITE INSPECTION

A site inspection was conducted across the subject land on the 21 April 2015. An initial walk around the boundary of the area proposed for development was completed by Senior Ecologist Dave Maynard, accompanied by Michael Park from SCC and the landowners. Following this, an independent inspection was carried out by the Senior Ecologist. The purpose of the inspection was to ground validate the results reported in the existing studies and to make an independent assessment of the general habitat and conservation values of the subject land. A random meander (after Cropper 1983) was completed across the entire subject lands; 74 hectares (refer to Section 3 for site description). A total of five person hours was spent on the independent inspection.

The locations of threatened species records (from recent searches and those recorded in the existing studies) were visited to assess the habitat values in these areas. Dominant flora species in the vegetation communities across the site were recorded to enable verification of vegetation types. A general assessment of the habitats present and the potential for them to support threatened species was made throughout the inspection. Targeted flora and fauna surveys were not undertaken during the inspection.

Observations were cross referenced with maps included with the existing studies. The locations of features of interest, such as important habitat resources and vegetation community boundaries, were recorded with a handheld Global Positioning System (GPS) for later analysis in a desktop Geographical Information System (GIS).

2.3 DETAILED REVIEW AND IDENTIFICATION OF HCV AREAS

The results of the initial desktop review and site inspection were compiled. GIS mapping was completed in ArcGIS 10 in which GIS data from the existing studies were imported and overlaid to identify discrepancies. The existing studies were then broken down into comparable components and analysed in detail. This was undertaken separately for the:

i. general threatened biodiversity and flora and fauna assessments and review
ii. hollow-bearing tree assessments and reviews.

The analysis was presented in tabular form (refer to Section 6).

Based on the results of the analysis, areas that meet the definition of HCV areas as defined by the South Coast Regional Conservation Plan were identified. The verification and rules for identification of HCV areas (set out in Section 8.1.1 of the SCRCP and included in this review as Appendix B were used to delineate HCV areas. High Conservation Value areas were then mapped in ArcGIS 10.

Conclusions and recommendations for the future zoning of the subject lands are provided in Section 7 of this review.

2.4 THE PRECAUTIONARY PRINCIPLE

In reviewing the survey and assessment methodologies applied in the existing studies and identifying areas of HCV based on these studies, the 'precautionary principle' as outlined in Section 3.1.14 of the draft *Threatened Biodiversity Survey and Assessment: Guidelines for developments and Activities* (DEC 2004) has been considered. The precautionary principle is defined in s6(2) of the NSW *Protection of the Environment Act 1991* as:

> "*if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation*"

The DEC 2004 draft guidelines advise that:

> "*where adequate surveys have not been conducted within a study area due to limitations, the precautionary principle should always be adopted. This involves assuming that threatened biodiversity which are likely to occur in the study area (based on the presence of suitable habitat and recent records) inhabit the whole of the study area*".

Biodiversity surveys, even when appropriately timed and extensive, provide a snap shot result, not a definitive list of all species for whom the site may have value. To account for this limitation, the 'precautionary approach' must be applied to some extent. How the precautionary principle is applied is fundamental in the conclusions of this review.

3 LAND SUBJECT TO REVIEW

3.1 DESCRIPTION

The land subject to review (the subject land) is Lot 24 DP 714096, Warrah Road, Bangalee, NSW (Figure 3-1). The subject land is located in close proximity to the Shoalhaven River, approximately 17 kilometres inland (west) of Shoalhaven Heads, where the river meets the sea.

The subject land is approximately 74 hectares in size and is primarily covered by woodland and open forest vegetation with the exception of some cleared and partially cleared areas in the east. There are a number of fire and access trails that have been established across the subject land and recreational activities such as motorbike and BMX riding have resulted in extensive disturbance in some localised areas. The majority of the site has been subject to grazing by domestic stock in the past and generally the eastern half of the subject land continues to be actively grazed by cattle. A 45 metre wide 132kV electricity easement runs along the eastern boundary of the subject land.

The subject land is bordered by residential development (zoned General Residential – R1) to the north and east and small rural holdings (zoned Environmental Protection – E2 and Environmental Management – E3) to the south and west. The Shoalhaven River is in close proximity to the southern boundary of the subject land.

3.2 HISTORY

The subject land was originally identified as part of the Crams Road Investigation Area in the Nowra Bomaderry Structure Plan (NBSP) and is under consideration as a new Urban Release Area (URA). The subject land is currently a "deferred matter" under Shoalhaven Local Environmental Plan (SLEP) 2014 (refer Figure 3-2). This means the zoning reverts back to Rural 1(d) (General) under the previous SLEP 1985.

There were three key stages in the SLEP 2014 process that resulted in the subject land being identified as a "deferred matter":

1. Prior to exhibition of the draft SLEP 2014 – Studies conducted by SCC and the landowner. Requests by the landowner to amend the proposed zonings to be exhibited.
2. Exhibition of the draft SLEP 2014 – Additional requests by the landowner, including submission of a planning proposal, to amend the exhibited zonings. Support from the NSW Office of Environment and Heritage (OEH) for the exhibited zoning and investigations into alleged illegal clearing.
3. Post exhibition of draft SLEP 2014 – Defer the subject land from the draft SLEP. In principle support by SCC for the planning proposal pending an independent peer review of the existing studies.

More detail is provided below regarding these three key stages, summarising information provided by SCC.

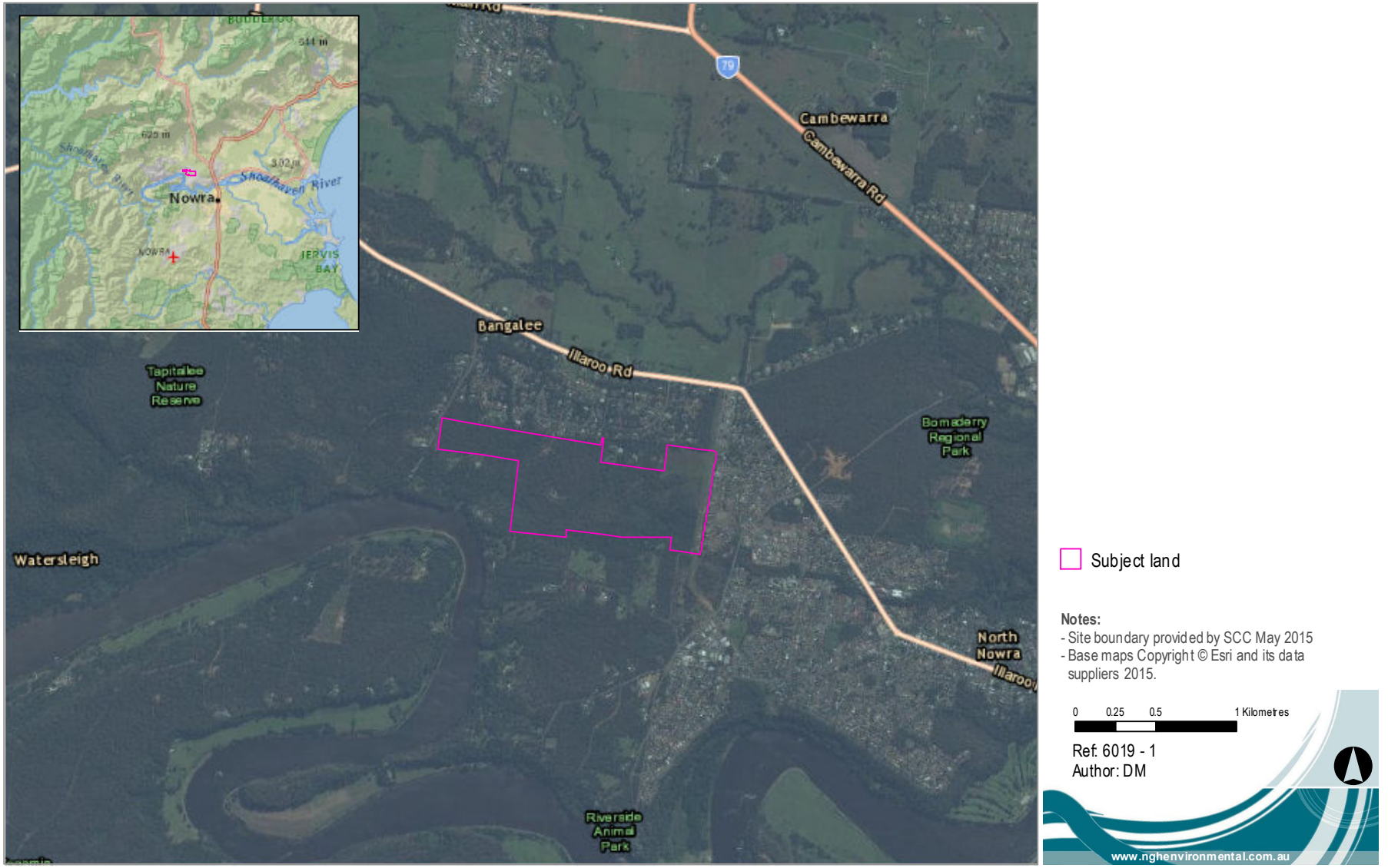

Figure 3-1 Location of the subject land

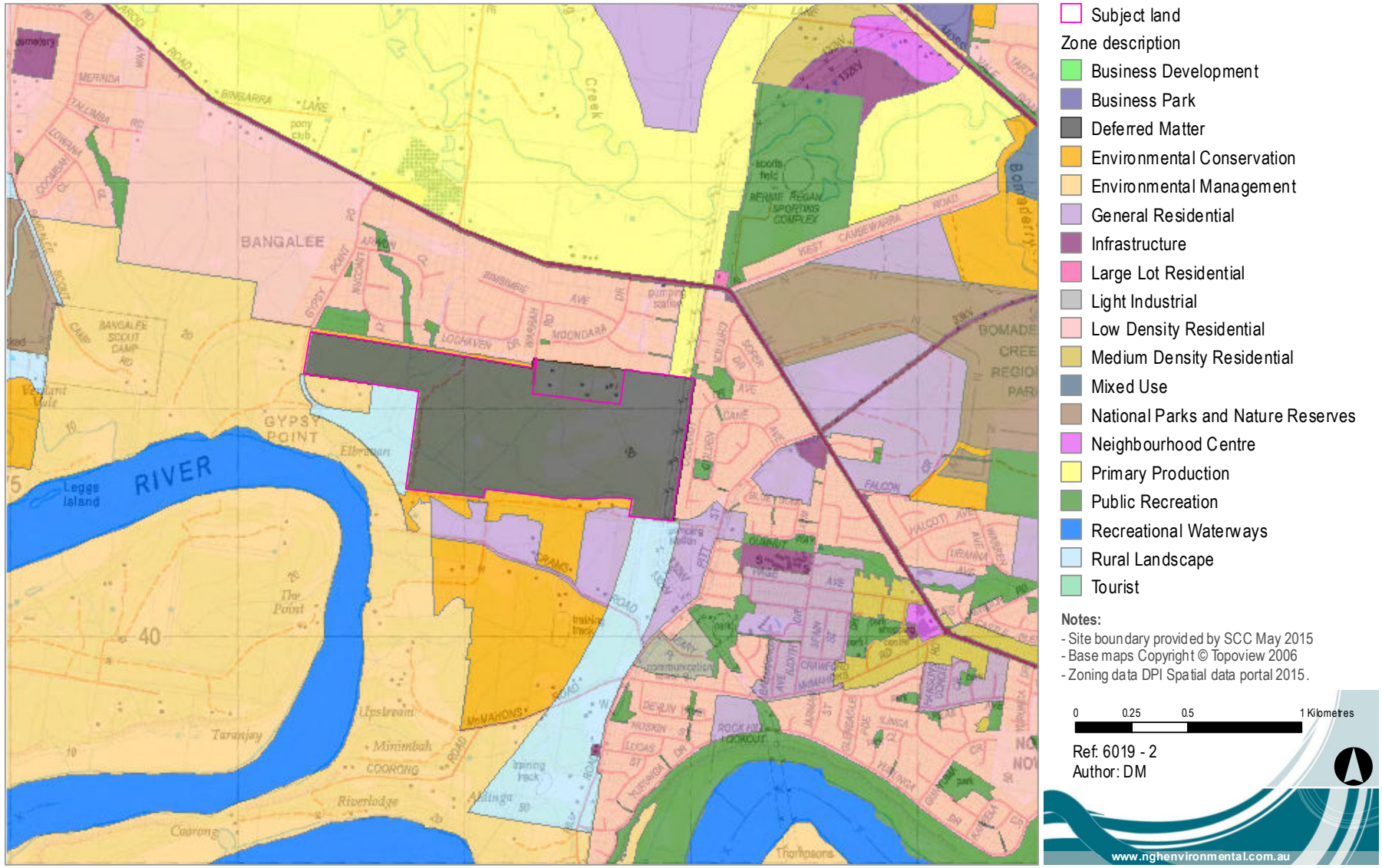

Figure 3-2 Current land zoning in the SLEP 2014

3.2.1 Prior to exhibition of the draft SLEP

The Crams Road Investigation Area was identified as one of seven URAs in the NBSP. In 2008, SCC engaged Alison Hunt and Associates (AHA) to undertake a strategic biodiversity assessment of all proposed URAs in the NBSP area to ascertain whether the land could be included in an area biodiversity certified under the NSW Biodiversity Certification Assessment Methodology. The assessment by AHA led to the identification of large areas assessed to be of high conservation value that would be suitable for biodiversity management and protection under the scheme.

Under the South Coast Regional Strategy (SCRC), SCC is not able to zone areas for urban expansion that have been verified as HCV areas. This led to a significant reduction in the area of the proposed Crams Road URA, supported by the detail provided in the AHA report and its recommendations. This reduced area was exhibited in the Draft SLEP 2014 (Figure 3-3).

Prior to the exhibition of the draft SLEP 2014, the landowner of the subject land (that makes up the majority of the Crams Road URA) notified SCC that they were undertaking their own comprehensive environmental study which would then inform a request by the landowner to amend the proposed zonings exhibited in the draft SLEP 2014. As a result of the landowner request, SCC resolved at its meeting on 17 May 2011 (MIN11.454) that it would be:

> "…e) *Giving in principle support to exhibiting alongside the DLEP* (DLEP refers to the draft SLEP 2014), *a request to amend the proposed zonings currently included in the DLEP for part of the Crams Road Urban Release Area, subject to the submission by the landowner of a supporting environmental study that is to the satisfaction of the General Manager and the Department of Environment and Heritage*".

Shoalhaven City Council staff subsequently met with the landowner, their consultants and the OEH in June 2011. The landowner requested that SCC display the subject land as either rural or 'still under investigation' in the draft SLEP 2014. This request was not supported by SCC or OEH staff given the detailed assessment contained in the AHA report.

3.2.2 During exhibition of the draft SLEP

During the exhibition of the draft SLEP 2014, the landowner requested that additional areas outside the exhibited zone boundaries be considered for rezoning to General Residential (R1). The request was based on detailed ecological work completed on behalf of the land owner by Biosis and OMVI in 2010 and 2011 which challenged the findings of the AHA 2008 report. A Strategic Planning Analysis (SPA) was also submitted which suggested that the exhibited General Residential (R1) area could be significantly increased on the subject land (identified as the 'New Living Area' on Figure 3-4).

During the exhibition of the draft SLEP 2014, the OEH expressed support for the findings of the AHA report. The zoning derived from the AHA report was supported by the OEH as an adequate protection of the environmental values of the site however, the OEH recognised that there may be some scope for additional small areas of residential zoning on the eastern side of the site adjacent to the Western Bypass easement (refer to Figure 3-3) as this area had greater levels of disturbance, including a weedy understorey. OEH recommended that any alteration to the exhibition boundary should be demonstrated by the findings of an appropriate level of environmental assessment.

During exhibition of the SLEP 2014, OEH also began an investigation into alleged illegal clearing of vegetation on the subject land and on 1 July 2014 issued a direction to carry out remedial works to repair and rehabilitate the unlawfully cleared lands for a period of 15 years.

Note: This review relies on the information contained in the existing studies and does not consider any reduction in conservation value that may have occurred as a result of the illegal clearing activities.

3.2.3 Post exhibition of draft SLEP 2014

Following the exhibition of the draft SLEP 2014, it was resolved by SCC's special Development Committee between the 17 July 2013 and 14 August 2014, that SCC:

a) Defer the area identified as Lots 21, 22, 23, 24 DP714096 from the Draft LEP 2013 to enable further specific consideration;
b) Remove the deferred area from all relevant overlays; and
c) Consider a planning proposal for the site after the completion of the investigations into alleged illegal clearing.

Subsequently, SCC at its Development Committee meeting of 2 September 2014, considered a Planning Proposal related to the deferred matter and resolved that:

a) Council support the draft Warrah Road, Bangalee Planning Proposal in principle, pending an independent peer review of the conflicting threatened species and biodiversity assessments that exist over the site – prior to submitting the proposal for Gateway determination;
b) Council engage an independent consultant (to be funded by the proponent) to peer review the existing threatened species and biodiversity assessments related to the site of the Warrah Road, Bangalee Planning Proposal and make recommendations on the biodiversity significance of the site;
c) A report of the findings of the peer review be reported back to Council with recommendations on the preferred approach to continue the proposal; and
d) Council advise the proponent of the above resolution.

SCC appointed NGH Environmental to undertake the peer review the existing threatened species and biodiversity assessments related to the site land. This review addresses the requirements of item b) above.

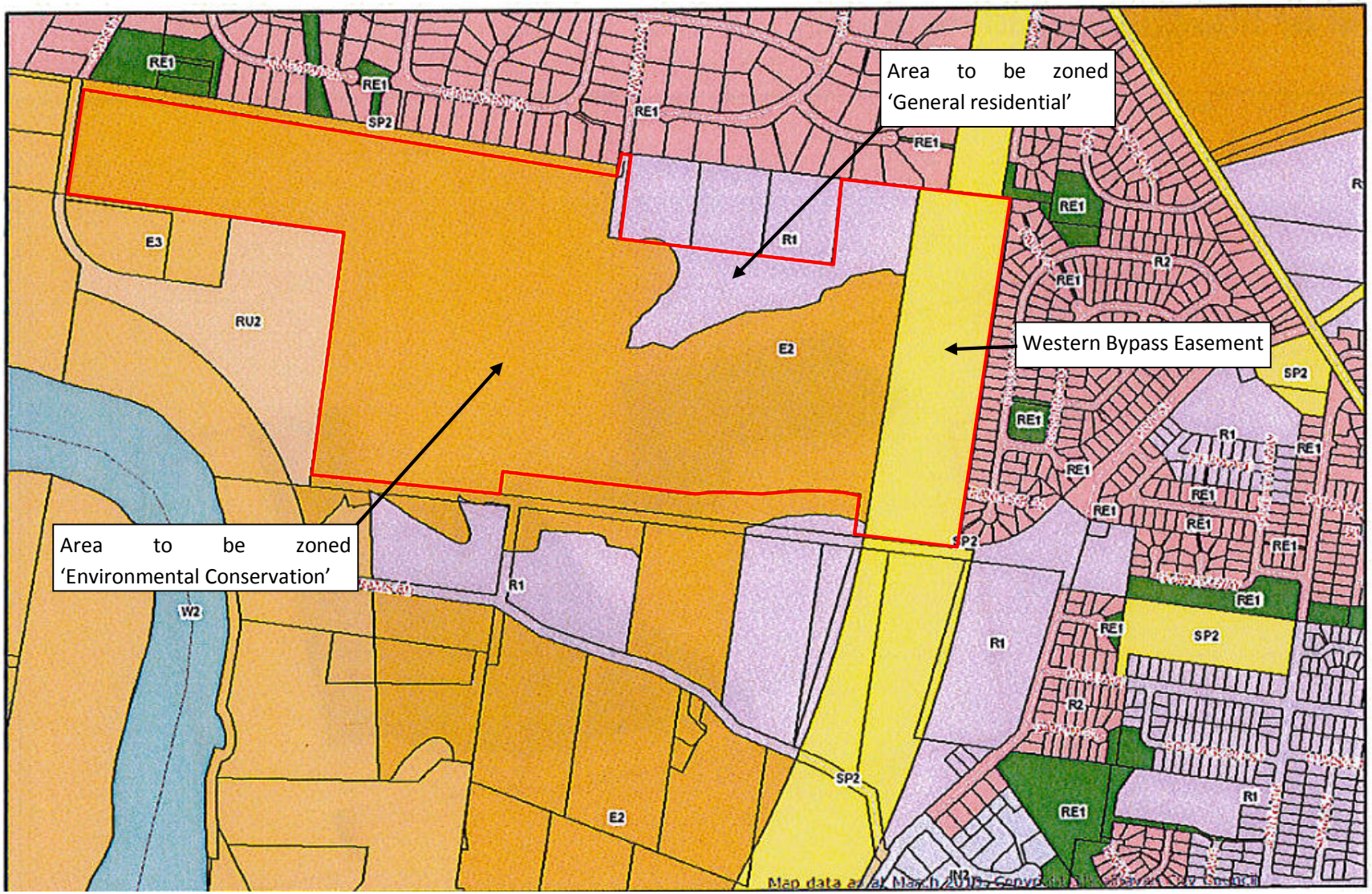

Figure 3-3 Extract from the draft SLEP 2014 as exhibited (subject land identified by red outline)

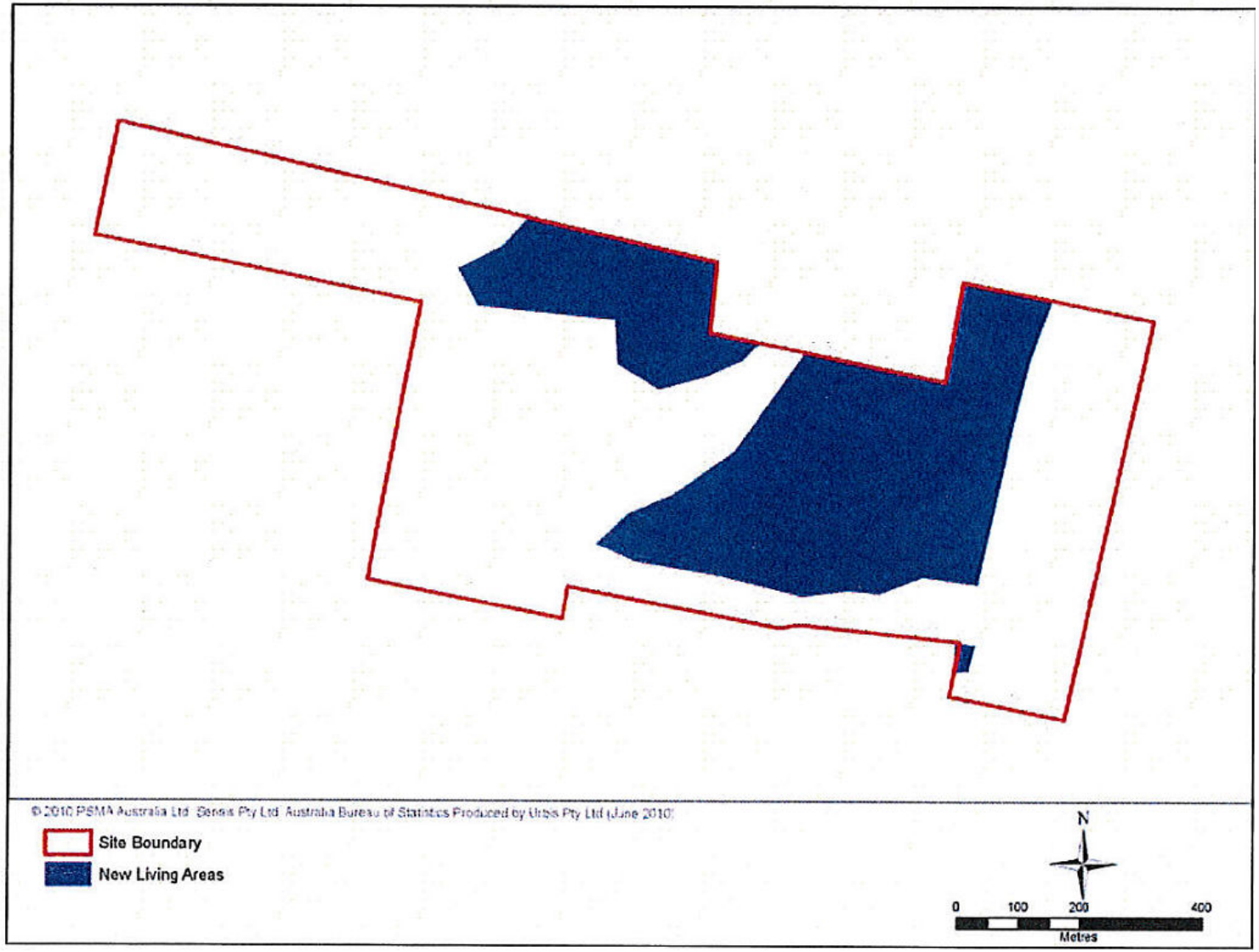

Figure 3-4 Extract from the Strategic Planning proposal submitted by the landowner

4 RELEVANT BIODIVERSITY LEGISLATION AND PLANNING DOCUMENTS

Commonwealth and State legislation, State planning policies and regional and local strategies and plans that relate to biodiversity have been considered when determining the conservation values of the subject lands. The legislation and planning instruments relevant to this review are discussed below.

4.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as matters of national environmental significance (MNES). Matters of national environmental significance relevant to biodiversity are:

- Wetlands of international importance.
- Nationally threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.

Where the subject land contains known or potential habitat for threatened flora, fauna or ecological communities listed under the EPBC Act, this would contribute to the conservation value of the land.

Any further development proposals that may have a significant impact on MNES (as determined in accordance with the *Significance impact guidelines 1.1 – matters of national environmental significance*, Department of Environment, Water, Heritage and the Arts, 2006) must be referred to the Commonwealth Environment Minister via the Department of the Environment (DoE).

4.2 THREATENED SPECIES CONSERVATION ACT 1995 (TSC ACT)

The Threatened Species Conservation (TSC) Act 1995 aims to conserve biological diversity, promote ecologically sustainable development, prevent extinctions and promote recovery of threatened entities, protect critical habitat, assess the impacts of actions on, and encourage the conservation of threatened entities. The TSC Act contains lists of critically endangered, endangered, and vulnerable species, populations and ecological communities, as well as a list of key threatening processes in NSW.

The TSC Act also directs the preparation and implementation of recovery plans, threat abatement plans, priority action statements, and other conservation measures to assist with managing threatened entities. It also identifies the need to consider 'critical habitat'.

Where the subject land contains known or potential habitat for threatened flora, fauna, populations or ecological communities listed under the TSC Act, this would contribute to the conservation value of the land.

4.3 NSW STATE ENVIRONMENTAL PLANNING POLICY NO. 44 – KOALA HABITAT PROTECTION

SEPP 44 encourages the conservation and management of natural vegetation areas that provide habitat for Koalas to ensure that permanent free living populations will be maintained over their present range.

SEPP 44 aims to identify areas of *potential* and *core* Koala Habitat. These are described as follows:

- *Core Koala Habitat* is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females, and recent and historical records of a population.
- *Potential Koala Habitat* is defined as areas of native vegetation where the trees listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

As the Shoalhaven Local Government Area (LGA) is listed in Schedule 1 of SEPP 44, this review considers the potential for the subject land to contain core or potential Koala habitat. The presence of core or potential Koala habitat would contribute to the conservation values of the land.

4.4 SOUTH COAST REGIONAL STRATEGY (SCRS) 2006 - 31

The SCRS sets out a land use plan for the South Coast, which has an overarching objective to balance the demands for future growth with the need to protect and enhance environmental values. The key aim of the strategy relevant to biodiversity is to:

> "*Protect high value environments including pristine coastal lakes, estuaries aquifers, threatened species, vegetation communities and habitat corridors by ensuring that no new urban development occurs in these important areas and their catchments*".

The SCRS recognises that naturally vegetated riparian corridors (such as those occurring on the subject land) are important for a wide range of benefits including providing habitat and connectivity for native species.

The subject land is included in areas mapped as a 'Biodiversity Assets Outside Conservation Areas' on Map 2 of the SCRS. Councils are required to verify the conservation significance of these areas and consider this in their planning process. The 2008 AHA report aimed to address this requirement.

The SCRS states that new urban development is to be prohibited by LEPs on land assessed as being of high conservation value and also states that appropriate planning controls are required to be incorporated into LEPs to protect biodiversity values on land of lower conservation value.

4.5 NOWRA BOMADERRY STRUCTURE PLAN (NBSP) 2006

The purpose of the NBSP is to provide a framework for the integrated development of the Nowra Bomaderry area. It assesses the need to balance Nowra Bomaderry's long term role as a service provider and major urban area with the need to conserve the significant environmental attributes of the area.

The eastern section of the subject land is identified in the NBSP as part of the Crams Road 'New Living Area' (Figure 4-1) and it is noted in the NBSP that to determine the extent of the future residential area a number of studies would need to be completed including a biodiversity assessment.

The NBSP also recognises the values associated with riparian corridors in the area stating:

> "*There is only one stream of significance that traverses the northern part of the site. This stream is only 2km long but is still heavily vegetated with significant habitat value worth retaining"*.

This stream occurs within the subject land. The NBSP states that:

> *"Water ways within Area 4 (Crams Road New Living Area) will be protected and enhanced in accordance with the study 'Riparian Corridor Objective Setting for Selected Streams in Nowra and Bomaderry"*

The NBSP also identifies opportunities for east-west habitat corridors to link with riparian corridors to enhance the environmental values of the site. It also states that:

> "*an appropriate north-south wildlife link should also be provided to connect the river corridor to the south-east, the site and bush land to the north-west of the site"*.

A key requirement of the NBSP is that any proposed subdivision in the Crams Road New Living Area is to achieve a high standard of environmental performance in order to maintain and enhance the condition of environmental systems in the vicinity which includes biodiversity.

4.6 SOUTH COAST REGIONAL CONSERVATION PLAN (SCRCP) 2010

The primary objective of the South Coast RCP is to guide South Coast Councils in achieving biodiversity conservation outcomes, particularly through planning processes. It has greatest relevance for the production of new local environmental plans (LEPs) and biodiversity certification processes.

As part of the overall aim of maintaining and enhancing the region's biodiversity, the SCRCP aims to ensure that sites containing assets of high conservation value are protected through appropriate LEP zoning and controls.

Assets of high conservation value are defined in the SCRCP as including:

1. **Endangered Ecological Communities** – this includes ecological communities listed as endangered or critically endangered under the EPBC Act, TSC Act and *Fisheries Management Act 1994* (FM Act).
2. **Rare vegetation types** - Several vegetation communities found within the South Coast area have a naturally rare distribution. They are generally restricted to geographic features of limited distribution, such as rock outcrops or riparian corridors. Communities with a total distribution of less than 1000 hectares (as mapped by Tozer *et. al.* 2006) are considered to be rare.
3. **Over-cleared vegetation types** - Remnant vegetation comprising those communities with more than 70% of their original extent cleared is regarded as of high conservation value, unless the vegetation is in 'low condition' according to the Biometric condition definitions[1].
4. **Over-cleared Mitchell Landscapes** – Mitchell landscapes that are more than 70% cleared are considered to be high conservation value. In the area covered by the SCRCP only two landscapes, Milton Hills and Bega Coastal Alluvium, qualify as over-cleared. However, the

[1] According to the Biometric condition definitions native woody vegetation is in low condition if the over-storey percentage of foliage cover is less than 25% of the lower value of the over-storey percentage foliage cover benchmark (as defined in the OEH vegetation types database) for that vegetation type or, less than 50% of vegetation in the ground layer is native or more than 90% is ploughed or fallow. Native grassland, shrubland or wetland is in low condition if less than 50% of vegetation in the ground layer is native or more than 90% is ploughed or fallow.

Bega Granites and Bomaderry Plains landscapes, which have been cleared to between 65% and 69% are also considered to need planning protection.

5. **Poorly conserved vegetation communities** – At a minimum, vegetation types that have less than 30% of their original extent within a formal reserve system are considered poorly conserved and need close consideration in regional planning strategies.
6. **Old-growth forests** – Old-growth forests are ecologically mature forests where the effects of disturbance are negligible. Old-growth forests are of high conservation significance as they support a relatively high level of biodiversity, are relatively uncommon and quite fragmented. Certain native plants and animals, such as hollow dependent fauna, may be restricted to or highly reliant on old-growth forest for their habitat requirements.
7. **Threatened and significant species** – Known or potential habitat for threatened species listed under the EPBC Act, TSC Act or FM Act is considered to be of high conservation value under the SCRCP.
8. **Significant aquatic habitats** – This may include marine environments, the inter-tidal zone, estuaries, coastal lakes and wetlands which are particularly important areas for aquatic biodiversity in view of their inherent biodiversity values, including habitat for aquatic plant species as well as critical fish breeding areas.

In addition, the SCRCP includes a wildlife corridor analysis. The SCRCP places environmental corridors into three sub-groups:

i. Corridors that are currently incorporated in statutory and other local plans. These narrow corridors are known to be used by threatened fauna, and they must be maintained if the local populations of these fauna are to be sustained.
ii. Verified regional corridors. These are additional areas identified by the DECCW 2010 analysis for the South Coast as the highest priority for maintaining or improving habitat connectivity.
iii. Riparian corridors. These are generally considered to consist of the channel and the vegetated riparian zone.

The SCRCP includes second order (Strahler 1952) and above streams as corridors. Wildlife corridors are recognised as having high value for biodiversity.

4.7 DRAFT ILLAWARRA REGIONAL GROWTH AND INFRASTRUCTURE PLAN (IRGIP) 2014

The Draft IRGIP is the framework for guiding growth of the Illawarra region towards 2031. Relevant to biodiversity, the Draft IRGIP outlines how important environmental values, sensitive landscapes and cultural assets, and important natural resources can be identified and factored into decisions about where growth should, or should not occur.

Protecting biodiversity assets in the new Nowra-Bomaderry release areas is an important consideration of the Draft IRGIP. When Councils are considering the rezoning of new release areas, this plan requires they ensure a clear and comprehensive understanding of the biodiversity values of the relevant areas.

Figure 4-1 Crams Road 'New Living Area' as identified in the NBSP 2006

5 OBJECTIVES AND OUTCOMES OF THE EXISTING STUDIES

The information presented below provides a summary of the objectives and key outcomes and conclusions of each of the existing five studies investigated in this review. The purpose of providing these summaries is to put the detailed information presented in Section 6 into an appropriate context.

The existing studies can be placed into two categories:

1. General flora and fauna and threatened biodiversity assessments
    - *Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan* (May 2008). Report prepared for Shoalhaven City Council by Allison Hunt and Associates.
    - *Flora and Fauna Assessment and Constraints Analysis* (September 2010). Report prepared for the landowner by Biosis Research.
    - *Review of Conservation Significance of Lands at Warrah Road, North Nowra* (October 2011). Report prepared for the landowner by OMVI.
2. Assessments specifically relating to hollow-bearing trees
    - *Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan* (May 2008). Report prepared for Shoalhaven City Council by Allison Hunt and Associates.
    - *Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey* (April 2011). Report prepared for the landowner by Biosis Research.
    - *Review of Hollow Bearing Tree Assessment of Lands at Warrah Road* (May 2011). Report prepared for the landowner by OMVI.

The following summaries and the detailed analysis in Section 6 utilise these two categories.

Note: The AHA 2008 report is included in both categories as the broader assessment included a detailed investigation into hollow-bearing trees.

5.1 GENERAL FLORA AND FAUNA ASSESSMENTS AND THREATENED BIODIVERSITY ASSESSMENTS

Allison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan - May 2008

Objective

Alison Hunt & Associates Pty Ltd was commissioned by Shoalhaven City Council to undertake a threatened species and biodiversity assessment of Crams Road and Cabbage Tree Lane New living Areas to assess the potential for Biocertification of these investigation areas. The information obtained was to be used to inform Council of the steps that would be required for biodiversity certification of a draft LEP for the Nowra Bomaderry Structure Plan area. The study was a broad study and focused at the strategic planning level. It covered areas outside of the subject land and only approximately 50% of the subject land itself (Figure 5-1).

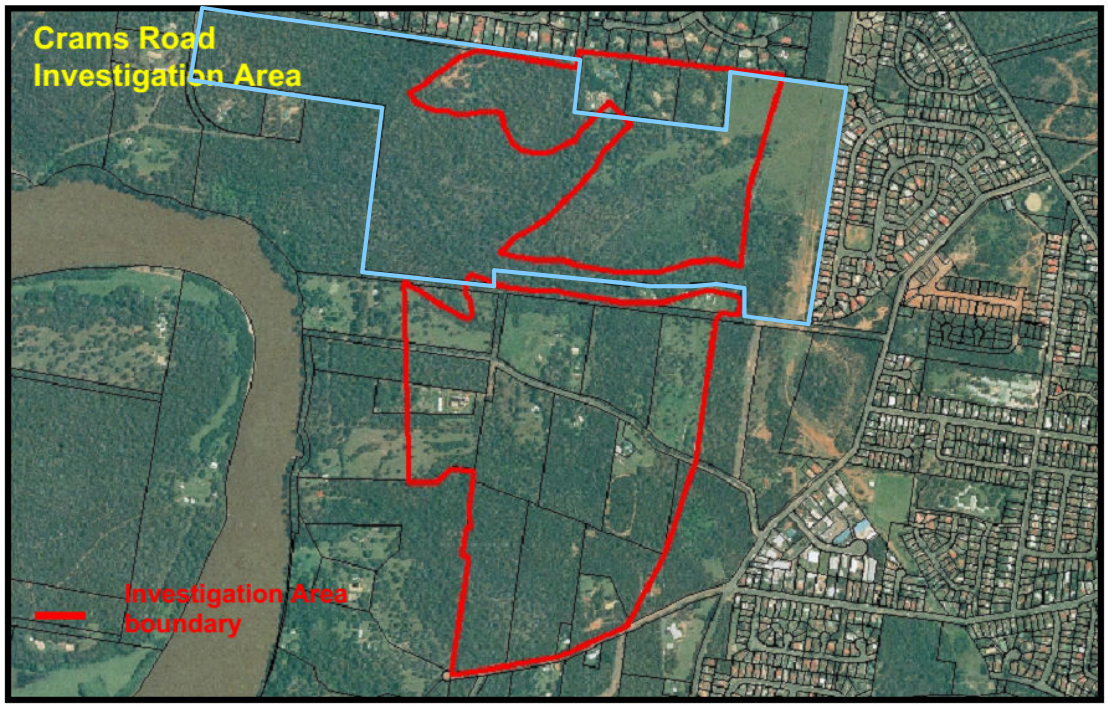

Figure 5-1 Crams Road Investigation area as identified in the AHA 2008 report. The general area of the subject land in this review has been identified in blue.

Key outcomes

The main features of the Crams Road Investigation Area identified in the report are:

- Areas of open woodland, woodland with heath, sedgeland and grassy woodland.
- Watercourses, rocky ridgelines and hollow-bearing trees also provide important habitat for fauna.
- Habitat diversity is high.
- Habitat provided for a number of threatened and regionally significant flora.
- Good connectivity, forming part of an important vegetation corridor throughout the Shoalhaven.

The report identifies that the majority of the site is considered constrained due to the extensive native vegetation cover and presence of a number of watercourses and threatened species and threatened species habitat. It also states that:

> "*constraints to development associated with fragmentation and isolation within the Crams Road IA would mean that development across much of the site would conflict with the maintenance of connectivity and would fragment an important vegetation corridor north of the Shoalhaven River*".

It identifies areas that may be developed in the north of the investigation area which includes the subject land "*near current residential development and the cleared powerline easement*".

The final constraints mapping produced from the AHA report for the Crams Road Area is shown in (Figure 5-2).

Biosis Research - Flora and Fauna Assessment and Constraints Analysis - September 2010

Objective

Biosis Research were commissioned by the owners of the subject land to undertake a terrestrial flora and fauna assessment of the subject land to determine the presence of, or potential for, threatened species, populations (and their habitats) or ecological communities that either occur on, utilise or that may be reliant on the subject land. The report aimed to identify terrestrial biodiversity constraints that would guide future rezoning of the subject land and provide recommendations for further assessments that may be required to determine the likelihood of impacts to threatened entities as a result of future development. This study was focused on the subject land and included a study area which encompassed a 1 km buffer of the site.

Key outcomes

A number of threatened flora and fauna were considered to have a high or moderate likelihood to occur on the subject land.

The report concluded that areas of highest constraint are those that:

- Have a high conservation value due to the presence of the broadest range of significant or threatened biodiversity or its potential habitat.
- Are considered to form the minimum area and network of vegetated corridors to maintain wildlife corridor functions within the subject site, extending to the study area and more broadly through the locality [2].

Other habitat for threatened flora and fauna either known, predicted to occur on, or with a moderate to high likelihood to utilise the habitats of the subject site was identified as a moderate constraint, mostly due to its potential to support a narrower range of threatened species.

[2] Subject site is synonymous with subject land, in this review. Study area and locality include broader areas immediately surrounding the subject land.

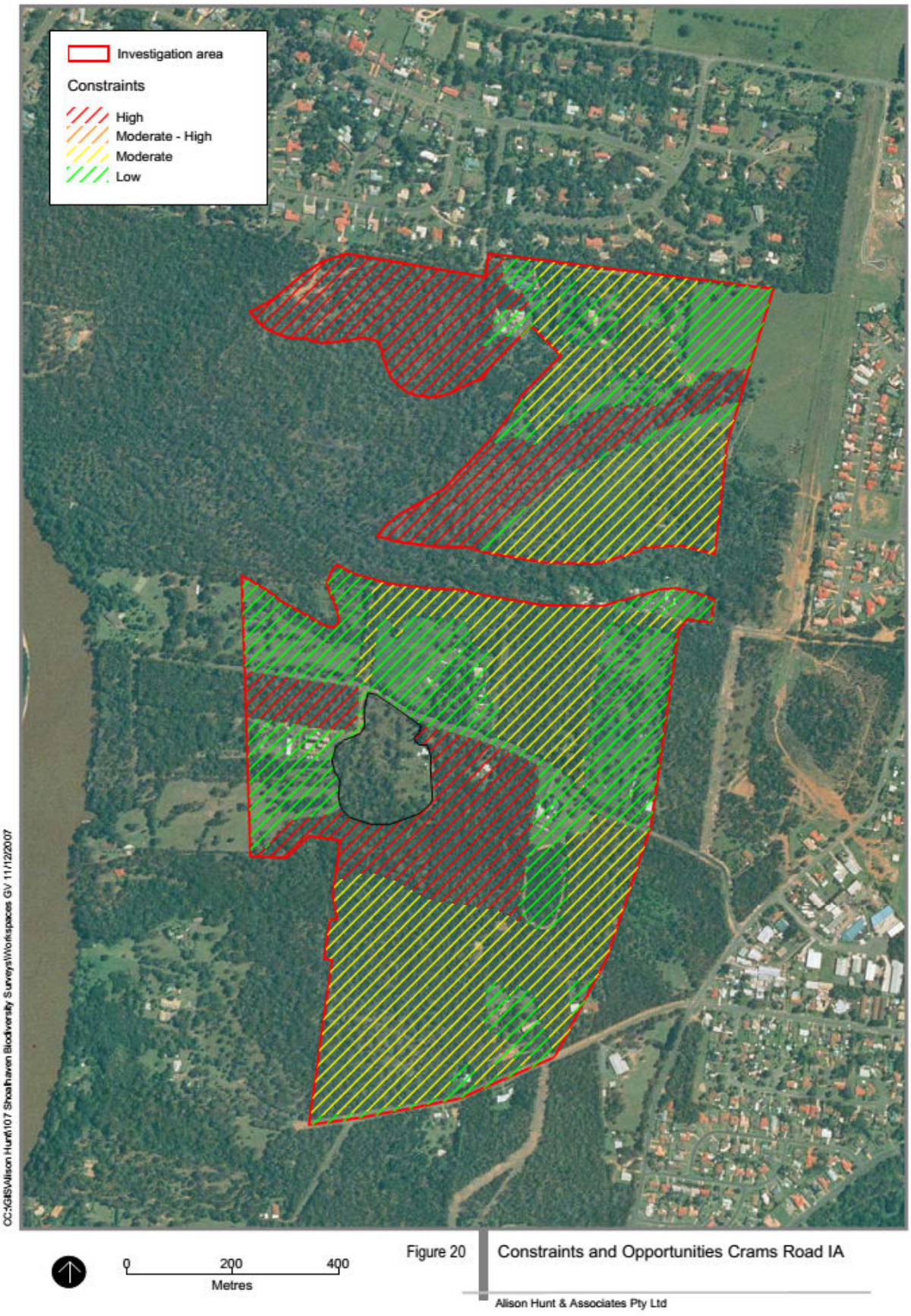

Figure 5-2 Constraints mapping for the Crams Road Investigation Area (sourced directly from: AHA 2008)

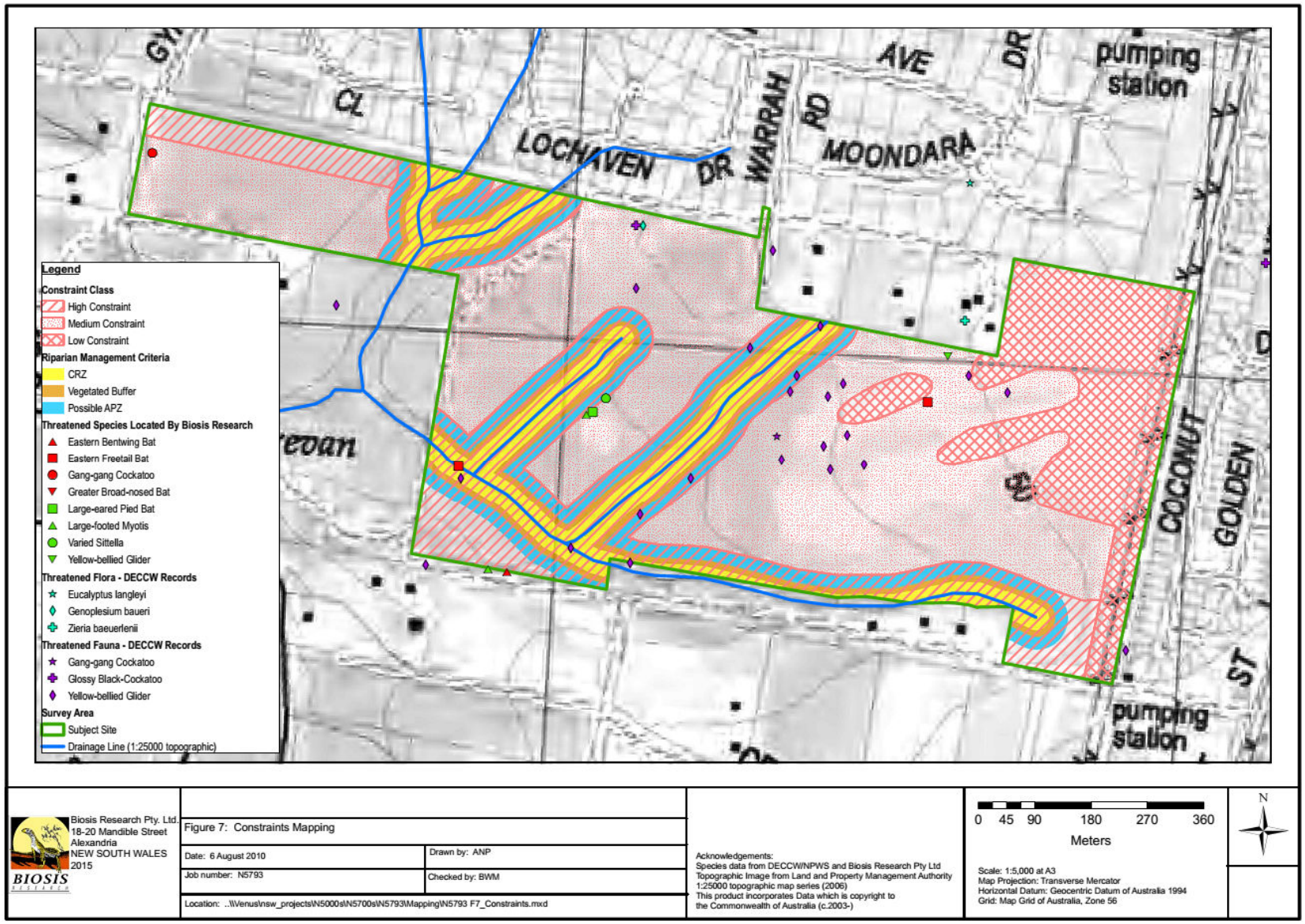

Figure 5-3 Constraints mapping for the subject land (sourced directly from Biosis 2011)

OMVI - Review of conservation significance of lands at Warrah Road, North Nowra - October 2011

Objective

OMVI was commissioned by the landowner to undertake a review of the two relevant ecological assessments of lands between Crams Road and Warrah Road, North Nowra, to determine the relative conservation significance of Lot 24 DP714096. This was undertaken in response to concerns regarding recent changes in zoning under the draft Shoalhaven City Local Environment Plan (LEP). The review of the conservation significance of the site in relation to the proposed zoning relied on the information provided in the reports of AHA and Biosis Research as well as a two day site visit by OMVI to review the data collected by both organisations and to independently survey for the key habitat features across the site that appeared to have driven the conclusions for each of the differing constraints analyses.

OMVI clearly states that their assessment was made difficult as they were not provided with data from the entire area assessed by AHA in 2008 nor the printed mapping from the AHA 2008 report. It considers that given the separate and independent report from Biosis that states vastly different results in terms of conservation significance, that the zoning proposed in the draft SLEP 2014 (as exhibited) is largely unsupported and unsubstantiated by the data and information available to the author at the time.

Key outcomes

The report clearly disagrees with some of the conclusions of the AHA 2008 report particularly with regard to the defining of high conservation areas based on unsubstantiated and indirect evidence of threatened species.

The general conclusions of the report is that SCC:

1. *"Re-assess the Crams road release area through a structured biometric analysis using the ratified methodologies and not support an arbitrary offsetting ratio as has been applied in the AHA report.*
2. *Use all the available and current data of species presence / absence, rather than third party data to calculate conservation significance.*
3. *Apply the analysis evenly and consistently across all the investigation areas using the same weighting for the presence of threatened species EEC's.*
4. *Consider the history of the site, particularly the uses of Lot 24 as a dumping ground and cattle grazing property.*
5. *Consider current land uses in an urban matrix, and analyse the best edge to area ratio for future management (including costs of management and ownership), to better derive a practical outcome for Lot 24."*

The report also recommends that the eastern half of the subject land be further examined for suitability for residential housing.

Following the survey by OMVI, the report favours the conclusions of the Biosis report stating:

> "*the Biosis Research Report conclusions of conservation significance appear to be more correct, given the historical and current disturbance regimes, the absence of EEC, absence of threatened flora and limited threatened fauna habitat (which would need further clarification) and apart from the creeklines, much of the eastern and central sections of Lot 24 would be ranked as low to moderate in conservation value based on development potential as mapped in their report (Biosis Research, 2010).*"

The report concludes that if assessed again under the SCRCP HCV verification criteria, much of the areas would be classified as presented in the Biosis report and that a greater area for residential development than that exhibited in the Draft SLEP 2014 would be justified.

5.2 SPECIFIC HOLLOW-BEARING TREE ASSESSMENTS

Allison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan - May 2008

Objective

The Hollow-bearing tree survey and assessment completed by AHA in 2008 was part of the broader threatened biodiversity survey and assessment completed on behalf of SCC. The context of this is discussed in Section 5.1 above.

Key outcomes

The hollow-bearing tree assessment found that hollow-bearing trees were wide spread throughout the investigation area. A total of 190 hollow-bearing trees were identified on the subject land (Figure 5-4). Of these, 4 hollow-bearing trees were considered to be suitable for threatened owls and 13 hollow-bearing trees suitable for breeding by the Glossy Black Cockatoo (Figure 5-4).

Biosis Research - Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey - April 2011

Biosis Research was commissioned by the land owner to undertaken a comprehensive hollow-bearing tree survey to inform rezoning investigations of the subject land. The surveys followed on from the previous, broader flora and fauna constraints assessment completed by Biosis in 2010 which documented the occurrence of numerous hollow-bearing trees. It was noted the AHA had surveyed a portion of the site in 2008 and also documented numerous hollow-bearing trees.

A total of 412 hollow-bearing trees were recorded on the subject land (Figure 5-4). The value of the hollow-bearing trees was determined by employing a scoring system based on that of Gibbons and Lindenmayer (2002). In general, hollows occurring in large, remnant Hard-leaved Scribbly Gum and Grey Gum located near waterways were considered to be of highest conservation significance. Due to little past clearance in these areas, many of the hollow-bearing trees were found to contain large branch and truck hollows. Trees containing larger hollows suitable for forest owls and large arboreal mammals were located in remnant vegetation along creeklines and in the north-west arm of the subject site.

Hollow-bearing trees located in the regenerating or younger Scribbly Gum Woodland were found to contain many small pipe and spout hollows due to the branch-shedding nature of Hard-leaved Scribbly Gum. These hollow-bearing trees were considered generally of lower conservation significance.

Based on the updated hollow-bearing tree mapping and the results of the previous Biosis Assessment in 2010, proposed environmental conservation zones and residential zones were proposed (Figure 5-5).

OMVI - Review of Hollow Bearing Tree Assessment of lands at Warrah Road - May 2011

Objective

OMVI were commissioned by the landowner to undertake a peer review of the of the hollow-bearing tree assessments of the subject land. The review focused on the adequacy of the assessment and conclusions of the Biosis report 2011, as this was the only comprehensive survey of the entire subject land.

Key outcomes

The review concluded that the results of the AHA 2008 and Biosis 2011 reports were comparable. It considered the assessment methodology of Gibbons and Lindenmayer 2002 used by Biosis as being "*recognised as a suitable assessment for many forested ecosystems but does have some bias toward species that occupy mature forest and woodland with limited reference to heathland. In regard to Warrah Road some of the key conservation significant fauna that rely on hollows prefers smaller hollows in dryer heaths*

and woodlands such as the Eastern Pygmy Possum. The Gibbons and Lindenmayer weighting for larger hollows along creeklines possibly under ranks the smaller more suitable hollows for such species as has been recorded across the Scribbly Gum Woodland of the Warrah Road site which is largely proposed to be zoned environmental".

The review concluded that there was potential for threatened species to utilise the hollow resources within the subject land and that the majority of hollows suitable for these species were contained within the environmental protection zone proposed in the Biosis 2011 report. The report states that "given the presence of several hollow-dependant threatened species on the Warrah Road site or nearby, such as the Yellow-bellied Glider, Glossy Black Cockatoo and Powerful Owl, the larger slower produced hollows will likely be the main limiting resource within suitable foraging habitat" but goes on to acknowledge that "*the Eastern Pygmy Possum prefers the small to medium sized hollows, up to 9 hollows within their home range (Ward 1990), within heathlands and heathy woodlands such as the Scribbly Gum Woodland. More than half would be included in the proposed environmental zoning and this includes the western area of Lot 24 which adjoins the same vegetation type to the west and north-west on other lots as well as south and south west to the Shoalhaven River*".

OMVI clarifies that the hollow-bearing trees themselves do not represent the conservation significance of an area and the density size or number become relevant only with occupation of hollow-dependant conservation significant fauna.

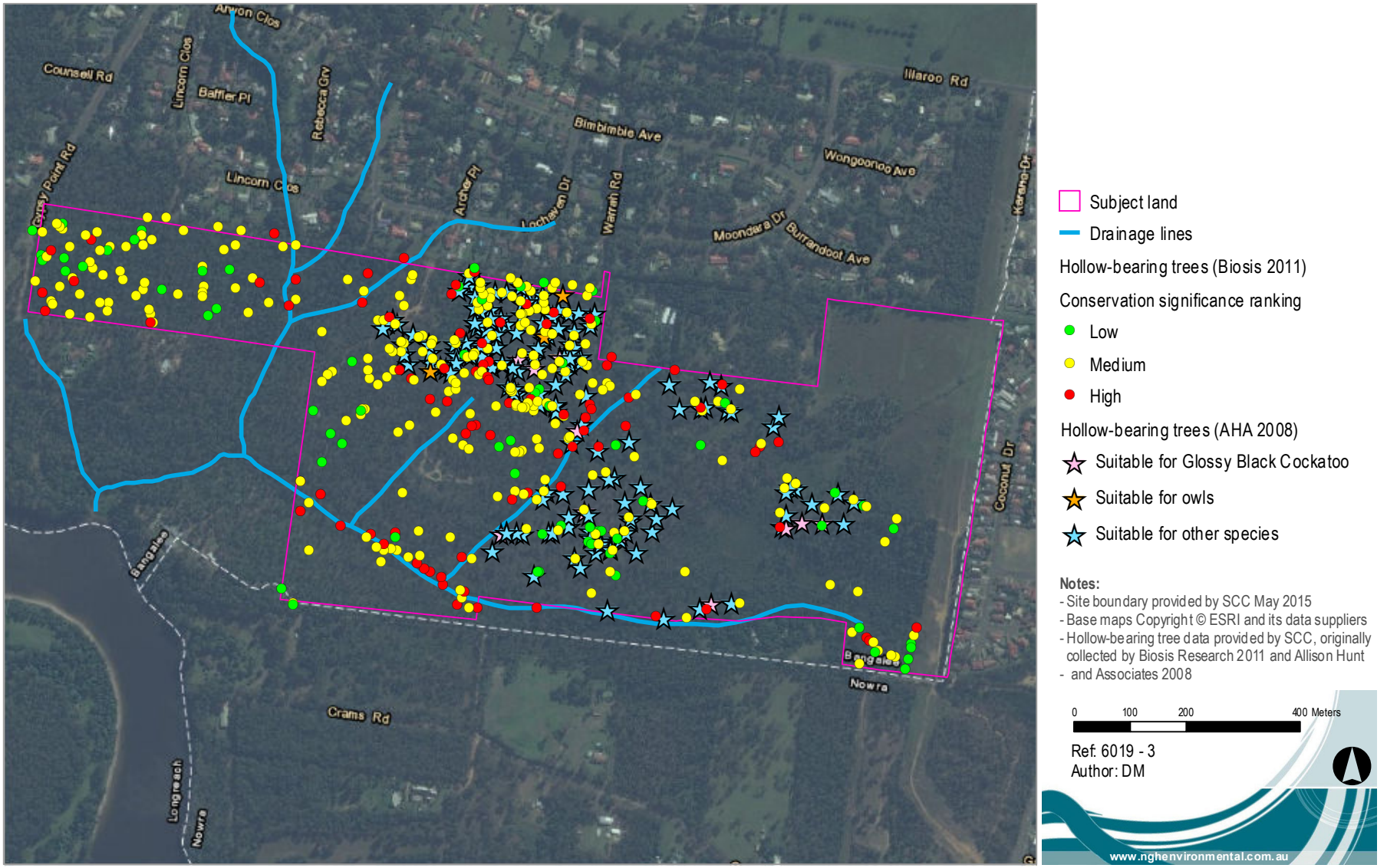

Figure 5-4 Hollow-bearing trees on the subject land recorded by AHA 2008 and Biosis 2011

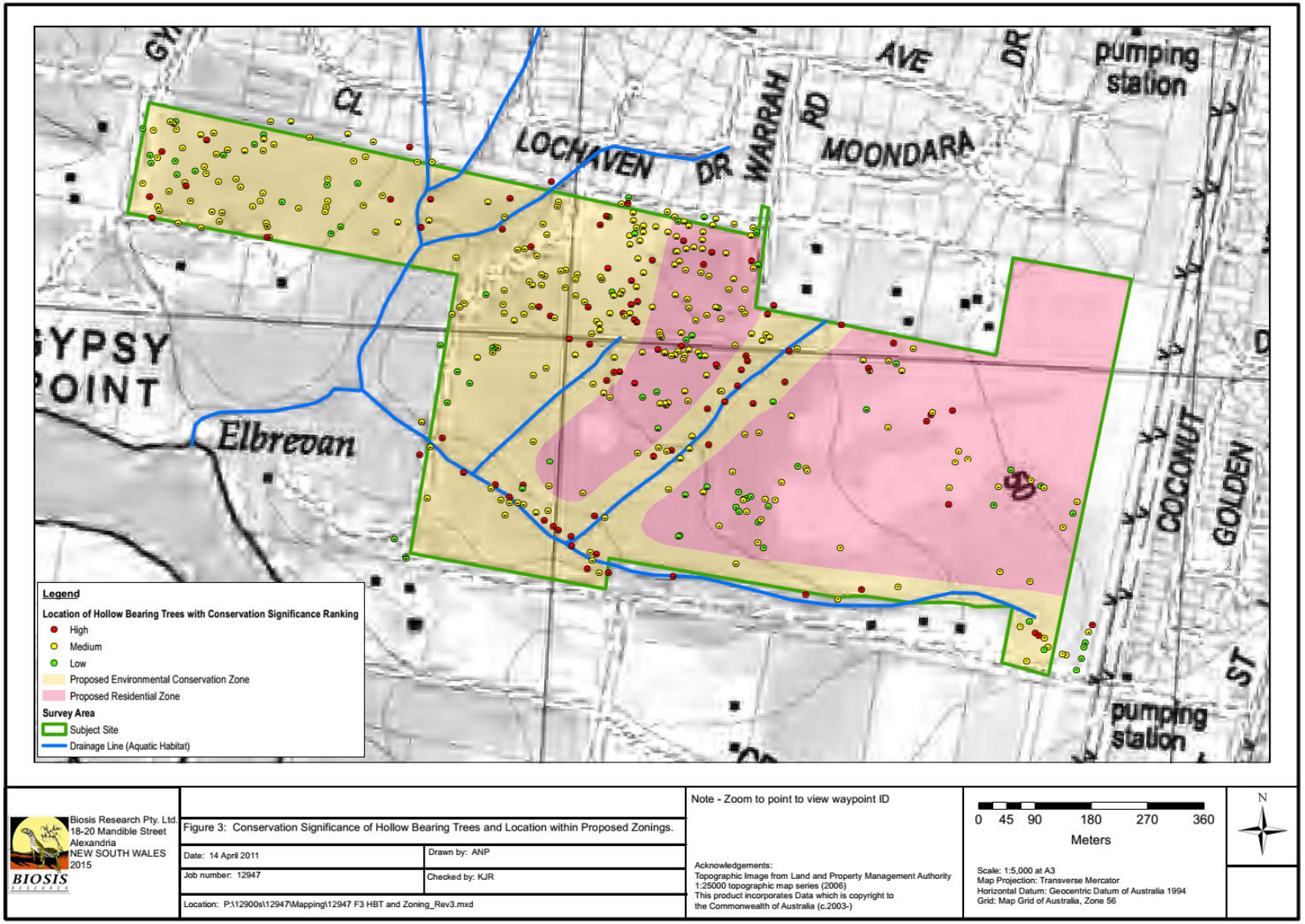

Figure 5-5 Hollow bearing trees recorded by Biosis 2011 and proposed environmental and development zones.

6 DETAILED ANALYSIS OF THE EXISTING STUDIES AND REPORTS

The following tables detail an objective analysis of the approach and results of each of the existing studies. The methods employed by each of the studies are compared with the working draft *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities* (DEC 2004) which aims to provide a consistent and systematic approach to survey and assessment of threatened biodiversity. These guidelines detail the current preferred survey approach by the NSW OEH.

The results of the studies are compared with a focus on aspects that relate to assets on the subject land that have been or would be considered to contribute to defining areas of HCV. The Biometric analysis components of the AHA 2008 and OMVI 2011 are not analysed as they are outdated relevant to current BioBanking or Biocertification methodologies and do not influence the determination of areas of HCV according to the SCRCP.

It should be noted that survey methods and effort for the AHA 2008 report is for the entire Crams Road New Living Area not just the subject land. Where identifiable, this has be clarified by identifying survey effort on the subject land based on mapping in the report. As mentioned in Section 5.1, the area surveyed by AHA only constitutes approximately 50% of the entire subject land.

It is acknowledged that the purpose of the OMVI survey was not to undertake detailed flora and fauna surveys but to gain a general understanding of the habitat values of the subject land and identify key habitat values that were driving the constraints identified by the AHA 2008 and Biosis 2010 reports.

Key analysis notes are made by this review in the right hand column of Table 6-1, Table 6-2 and Table 6-3 and further discussed in Section 7.

6.1 GENERAL FLORA AND FAUNA ASSESSMENTS AND THREATENED BIODIVERSITY ASSESSMENTS

Table 6-1 Detailed analysis of the survey methods and effort of the existing flora and fauna and threatened biodiversity assessments

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
Survey methods and effort				
Timing of surveys	- Detailed flora surveys and targeted koala searches (2 ecologists) 17 – 21 January 2007; - Detailed fauna surveys (4 ecologists) 12 – 19 February 2007; - Spring surveys (2 ecologists) 24 – 30 September 2007; - Targeted orchid surveys (2 ecologists) 4 & 6 October 2007; and - Targeted orchid surveys (2 ecologists) 5 & 6 December 2007.	- All terrestrial diurnal and nocturnal flora and fauna surveys were carried out on the subject land and immediate surrounds of the study area from 12 - 14 April 2010.	- 13, 20 and 21 September 2011.	- The timing of the surveys for each of the existing studies is considered adequate in meeting the specific objectives of each study. - It is noted that the timing of the Biosis 2010 surveys would not have been adequate for detecting a number of threatened flora species such as orchids nor optimal for detecting spring or summer flowering species.
Weather conditions	- Temperatures exceeding 35 °C were experienced during the vegetation surveys undertaken in January 2007. - Heavy rain was experienced during the week preceding the fauna surveys which took place in February 2007, making conditions optimal for amphibian surveys. Daytime temperatures averaged 26 °C and during night surveys, temperatures were around 18 °C. - Rain was experienced during the week preceding the spring survey period (24 – 30 September 2007).	- Weather conditions during the site inspection were cool to mild and clear. Minimum air temperatures ranged between 8.2 and 17.2ºC and maximum air temperatures ranged between 19.8 and 27ºC. - There was no rainfall during the survey period, but high rainfall occurred in the days preceding the survey.	- Details not provided in the report.	- Weather conditions for the AHA 2008 and Biosis 2010 surveys are generally considered to be favourable. The high temperatures experienced during the AHA January 2007 surveys are considered unlikely to have negatively impacted the detailed flora surveys or Koala surveys such that it would have influenced the results of these surveys.

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
	However, conditions during the survey period were warm and clear with daily temperatures averaging approximately 24 °C with night temperatures averaging 16 °C.			
General flora survey	- Surveys were conducted according to the DEC (2004) guidelines. Vegetation quadrats (20 m x 20 m) were placed arbitrarily within each of the vegetation communities. The numbers and overall location of quadrats were stratified to vegetation community and area. - Vegetation mapping was based on a review and ground truthing of mapping produced by Mills (1996).	- Flora surveys involved a combination of 20m x 20m quadrats, transects, spot locations and random meanders throughout the subject land to formulate a species inventory and to assess the distribution of plant communities. - Brief inspections of nearby areas of remnant vegetation and conservation reserves were also carried out. - Formal flora surveys on the subject land were carried in the following stratification units: • Cleared and disturbed areas • Shrublands • Open woodlands • Open forests on drainage lines.	- Targeted flora surveys are not documented in the report.	- Based on the information provided, survey effort is generally regarded as adequate for both the AHA 2008 and Biosis 2010 surveys.
Threatened flora survey	- Targeted surveys were undertaken at appropriate times for the species targeted involving a random meander over at least one hour for each 50 ha of habitat per vegetation community. - 13.5 person hours in total with 10 trees at each of three sites (two on	- Threatened flora species previously recorded in the study area, on the subject land and with potential to occur on the subject land and immediate surrounds were targeted in the quadrats and random meanders including at locations of previous records on the subject land.	- Targeted flora surveys are not documented in the report.	- The targeted surveys conducted by AHA 2008 are generally considered adequate according to DEC 2004 but did not provide a comprehensive survey of the subject site (being limited to the Crams Road Investigation Area). - Surveys conducted by Biosis 2010 were not at suitable time of year for

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
	the subject land) searched for the underground orchid.	- Targeted surveys at appropriate times not undertaken		a number of target species. Locations of previous records were prioritised but no specific targeted searches were undertaken. The survey effort is likely to be adequate to detect species identifiable at the time of the survey. - Both the AHA 2008 and Biosis 2010 studies included habitat assessment to account for all threatened flora species with potential to occur in the study area.
General fauna survey/ habitat assessment	- General recording of habitat resources and direct and indirect evidence of fauna. Scats were analysed by a specialist in scat analysis. - Fauna surveys were based on the DEC (2004) guidelines where considered appropriate.	- Fauna habitat assessment conducted across the subject land recording a wide range of characteristics to define habitats into good, moderate or poor categories. - All the field survey techniques utilised in the surveys were based on the recommendations by DEC (2004). - The subject land was divided into two major stratification units; open woodland and open forest on drainage lines.	- The subject land was traversed in a series of parallel transects between 10 and 50 metres apart, (depending on vegetation structure). - The survey focused on identifying signs of threatened fauna species such as the Glossy Black Cockatoo (chewed cones) and Yellow-bellied Glider (feed scars). - Any other evidence of threatened fauna species such as diggings, scats, or other traces was recorded. - Termite mounds were also recorded.	- The general approach to fauna habitat assessment by the AHA 2008 and Biosis 2010 studies is considered to be adequate. - The approach by OMVI 2011 is considered adequate to meet the objectives of that study. - Both the AHA 2008 and Biosis 2010 studies included habitat assessment to account for all threatened fauna species with potential to occur in the study area. - Both the AHA 2008 and Biosis 2010 studies based their fauna surveys on the DEC 2004 draft guidelines. This is discussed in more detail for each target group below. - Only the Biosis 2010 study clearly identified stratification of the study area. However, the study did not map the survey locations. As such, it was not possible to make an

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
				analysis of the suitability of the locations. - Total survey effort i.e. person hours, was not provided in the Biosis report making direct comparison of survey effort difficult in some instances. - The study area was not clearly stratified, for all surveys (e.g. no mention of stratification for mammal surveys but bird surveys were stratified by vegetation type). However, survey sites were mapped and are considered to be appropriate for the AHA 2008 study.
Targeted fauna surveys • **Ground-dwelling and small arboreal mammals**	- Conducted during summer (12 – 19 Feb 2007). - Cage traps spaced approximately 20 m apart – 40 trap nights (2 out of 4 sites on the subject land). - Elliot A traps at intervals of 20 m - 240 trap nights (2 out of 4 sites on the subject land). - Hair tubes were placed adjacent Elliot A trap line – 240 trap nights (2 out of 4 sites on the subject land). - Pitfalls were spaced approximately 5 m apart (One line at Crams Road IA as this site supported suitable habitat for the Eastern Pygmy Possum and had a substrate in which pitfalls could be dug) – 20	- Elliot A and cage traps were placed in each of the stratification units. - Eighty-five Elliot A trap nights were conducted across the Subject land, comprising 45 in open woodland and 40 in open forest on drainage lines. - Thirty-nine cage traps were distributed across the Subject land, comprising 23 cage trap nights in open woodland and 16 cage trap nights in open forest on drainage lines. - One motion activated camera was positioned in areas of high fauna activity (e.g. diggings, pads, water access) in each of the stratification units for two nights. The camera was directed at buried bait	- Targeted fauna surveys are not documented in the report.	- Survey techniques are considered appropriate for both the AHA 2008 and Biosis 2010 studies. Pitfall and hair tube trapping was only undertaken for the AHA 2008 study and camera trapping only by the Biosis 2010 study. - According to the DEC 2004 guidelines minimum survey effort for each method is as follows: • Elliot trapping - *Sampling effort per stratification unit must equate to at least 100 trap nights. The recommended approach involves 25 traps placed for four nights. If variation of this approach is proposed it should be noted that*

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
	trap nights (2 out of 4 sites on the subject land).	containing rolled oats and peanut butter, with the surrounding trees, shrubs and ground sprayed with honey water to assist in attracting fauna.		*traps must be open for a minimum of three nights.* • Cage trapping - *Sample effort per stratification unit is 24 trap nights, preferably using six traps for a minimum of four nights.* - The required sampling effort for Elliot trapping was not met by the Biosis 2010 study and is unlikely to have been met by the AHA 2008 study when considering stratification. - The required sampling effort for cage trapping was almost met by the Biosis 2010 study and again unlikely to have been met by the AHA 2008 study when considering stratification.
• **Arboreal mammals**	- Elliot B traps were mounted on the trunks of trees, 10 traps at intervals of approximately 20 m along each trap line – 40 trap nights (2 out of 4 sites on the subject land). - The trunk of each tree was drenched with a honey and water mix sprayed as an attractant onto the trunk of the tree each day. - Stagwatching for arboreal mammals emerging from tree hollows on dusk, hollow-bearing trees were watched for at least 30 minutes from dusk until dark for the emergence of arboreal mammals	- A total of 26 arboreal Elliot A trap nights were conducted across the Subject land, including 14 in open woodland and 12 in open forest on drainage lines. - Nocturnal Playback was completed for the Yellow-bellied Glider and Koala. - An initial listening period was carried out for 20 minutes, followed by 15 minutes of spotlighting. - The calls of each of the aforementioned target species were played intermittently for 5	- Targeted fauna surveys are not documented in the report. - Feed signs for the Yellow bellied Glider were recorded throughout the parallel transect survey.	- The Elliot trapping methodologies employed by both the AHA 2008 and Biosis 2010 study are considered appropriate. There is no clear recommendations on minimum sampling effort specifically for arboreal trapping. - Stagwatching for the AHA 2008 study meets the pre dusk requirements but there was no clarification if stags were watched for the recommended 60 mins after sunset. - Call playback for the Biosis 2010 study is considered appropriate

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
	and microchiropteran bat species – 5.75 hours. - Spotlighting was conducted throughout the site using 100 Watt spotlights, each vegetation community was traversed after dark – 11.5 person hours (3 out of 6 sites on the subject land).	minutes, followed by a further 10 minute listening period. - 15 minutes of additional spotlighting was conducted after call playback was completed. - Spotlighting was also conducted throughout the Subject land over two nights. Spotlighting was done using a 75W spotlight at each of the systematic survey locations for one hour on foot using a hand-held spotlight and from a vehicle traversing vehicular tracks. Foot and vehicle traverses involved two observers within each stratification unit at a speed not exceeding 5 km/h.		however it is not clear how many surveys were conducted. - Spotlighting conducted by the AHA 2008 and Biosis 2010 surveys is considered appropriate. The DEC 2004 guidelines state that spotlighting should be conducted on at least two separate nights. This is achieved by the Biosis 2010 study but not clearly stated in the AHA 2008 report.
• **Koala**	- Surveys conducted in accordance with the Lower Hunter Central Coast Regional Environmental Strategy (LHCCREM) Flora and Fauna Survey Guidelines (2002). - Identification of Koala Feed Trees in accordance with Schedule 2 of SEPP 44. - Areas supporting potential Koala habitat mapped. - Spot Assessment Technique (Port Stephens Council 2002) conducted in mapped areas – 5 plots (2 on the subject land).	- Call playback was completed for the Koala. - An initial listening period was carried out for 20 minutes, followed by 15 minutes of spotlighting. - The call of the Koala was played intermittently for 5 minutes, followed by a further 10 minute listening period. - 15 minutes of additional spotlighting was conducted after call playback was completed.	- Targeted koala surveys are not documented in the report.	- Both the Spot Assessment Technique and call playback are considered appropriate for surveying Koalas. - Timing can affect the success of call playback techniques for detecting Koala's however, previous studies have successfully detected vocalisations in autumn (Jurskis *et. al.* 1994). - The two plots conducted as on the subject land during the AHA 2008 study are very close together. It would have been preferable to have separated the two plots to more broadly sample the available habitats.

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
• **Megachiropteran Bats**	- Spotlighting and listening for vocalisations was undertaken in conjunction with spotlighting for other mammals. Within suitable vegetation stratification units a traverse of at least 1 km was completed.	- Targeted flora surveys are not documented in the report.	- Targeted bat surveys are not documented in the report.	- Spotlight searches combined with listening for audible calls and movements in trees in recommended for species such as the Grey-headed Flying Fox. - Surveys conducted by both the AHA 2008 and Biosis 2010 studies are considered appropriate.
• **Microchiropteran bats**	- Stagwatching in conjunction with nocturnal mammal surveys – 5.75 hours. - Ultrasonic Anabat Detection recorders (Z-Caim) placed in suitable flyways across investigation areas within a variety of vegetation – 5 nights (3 sites on the subject land). - Communities including riparian areas and along tracks activated just before dusk and retrieved each morning. - Recordings analysed by a specialist.	- One Anabat Z-CAIM Detector (Titley Electronics) were set for two nights in each of the two habitat types to record microbat echolocation calls. - The Anabat devices were positioned in potential microbat flyway or foraging areas (near streams). - The graphic signature of the microbat calls was examined in the program ANALOOK and these were compared against a reference library of calls to determine the species present (Churchill 2008).	- Targeted bat surveys are not documented in the report.	- Ultrasonic echolocation detection is considered appropriate by the DEC 2004 guidelines but it is stressed that the identification of bats by their echolocation calls is not straightforward and there is considerable subjectivity in the analysis of calls and the subsequent identification of bats. - Calls recorded during the AHA 2008 surveys were sent to a specialist for analysis and were returned with a confidence rating on the identifications. It is not clear who analysed the Biosis 2010 survey results nor the confidence in the identifications.
• **Diurnal bird surveys**	- Undertaken according to DEC (2004) employing 20 min searches of 1 ha areas in each vegetation stratification unit during spring – 14 person hours (2 out of 8 sites on the subject land). - On most occasions survey periods were extended up to 60 mins.	- A 30-minute bird survey was conducted along the trapping transects in each of the stratification units, shortly after dawn for two days. - Birds were recognised by calls, flight patterns and plumage	- Bird surveys are not documented in the report	- Both studies sampled the range of habitat types within their study areas. - The AHA 2008 study based their survey on the generally recommended 20 min, 1 ha searches in the draft guidelines (DEC 2004) but it is noted that there

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
	- All incidental observations recorded - Surveys were undertaken during the morning (0600 – 0950 hours) and afternoon (1700 – 1950 hours) (Alison Hunt pers. comm. 13.05.15)			is no clear minimum effort recommended in the DEC 2004 guidelines and as such both approaches are considered appropriate. - Time of day for the surveys is considered appropriate for the Biosis 2010 survey (just after dawn) and AHA 2008 survey (early morning and late afternoon).
• **Nocturnal bird surveys**	- Pre-survey listening by observers undertaken for approximately 10 minutes prior to call playback as a number of nocturnal bird species are known to give their distinctive calls at dusk. - Call playback: Pre-recorded calls of nocturnal birds for which potential habitat was present in the area were broadcast through an amplifier after dusk in order to elicit a response. Each species call was broadcast separately, with a gap before commencing the calls of the next species. Species targeted: • Masked Owl • Powerful Owl • Sooty Owl • Barking Owl - Post-survey listening: After conducting call playback a quiet listening and watching period of 10 minutes was undertaken for any	- Call playback was completed for the: • Masked Owl • Powerful Owl • Sooty Owl - An initial listening period was carried out for 20 minutes, followed by 15 minutes of spotlighting. - The calls of each of the aforementioned target species were played intermittently for 5 minutes, followed by a further 10 minute listening period. - 15 minutes of additional spotlighting was conducted after call playback was completed.	Targeted fauna surveys are not documented in the report	- Initial listening period considered appropriate for both the AHA 2008 and Biosis 2010 studies however only the Biosis 2010 study details the recommended minimum of 10 mins spotlighting following the initial listening period. - Call playback is likely to have been adequate for both the AHA 2008 and Biosis 2010 studies however, the exact timing for playing the calls and listening is only provided by the Biosis 2010 study and this meets the recommendations of the guidelines (DEC 2004). - Both studies conducted the recommended post call playback spotlighting. - The DEC 2004 guidelines state that: • *at least 5 visits per site, on different nights are required for the Powerful Owl, Barking Owl and the Grass Owl;*

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	nocturnal birds that may respond to the calls. - Spotlighting: Habitat within approximately 50 m radius of the call playback site was spotlighted by two observers. - 6 person hours survey effort (1 out of 2 surveys conducted on the subject land). - All incidental observations recorded.			• *at least 6 visits per site for the Sooty Owl, and 8 visits per site for the Masked Owl are required.* None of the studies met these requirements. - The AHA 2008 study only included recommended day habitat searches - None of the studies conducted targeted stagwatching as recommended in the guidelines (DEC 2004).
• **Glossy Black Cockatoo habitat mapping**	- Habitat mapping was completed based on evidence of: • Hollow-bearing trees with large vertical spouts or trunks with a diameter of at least 15 cm provide potential nesting habitat for this species. • The preferred feed tree within south-eastern NSW *Allocasuarina littoralis.* • Chewed cones left by feeding Glossy Black-cockatoos.	Specific habitat mapping was not completed for this species.	All Allocasuarina sp. trees with fruit, observed across Lot 24, were inspected for evidence of foraging, such as chewed cones or cut branches. Transects were spaced so that almost the entire site was examined and all possible feed trees for Glossy Black-cockatoos were also examined.	- Habitat mapping by the AHA 2008 study is considered appropriate for identifying **potential** breeding and foraging habitat for the Glossy Black Cockatoo. - There is no requirement for specific threatened species habitat mapping in the DEC 2004 guidelines.
• **Targeted surveys – Regent Honeyeater and Swift Parrot**	- 20 minute, 1 hectare searches during winter at various times during the day undertaken at sites containing flowering trees. - Call playback for the Regent Honeyeater, as recommended in the LHCCREMS (2002) Flora and Fauna Survey Guidelines, was	Targeted surveys were not undertaken for these species.	Targeted bird surveys are not documented in the report	- The survey methodology employed in the AHA 2008 study is consistent with recommendations in appropriate guidelines (DEC 2004, LHCCREMS 2002). - Timing was considered appropriate for the target species.

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	undertaken at locations across the investigation areas in autumn where eucalypts were in flower. - Surveys started with an initial listening period of 15 minutes and then calls were broadcast for five minutes. This was followed by a 10 minute listening period. - Specific survey effort not specified.			
• **Diurnal amphibian surveys**	- All frogs heard calling incidentally were recorded. - Diurnal searches of suitable habitat for the Green and Golden Bell Frog and Giant Burrowing Frog were undertaken during summer. - Surveys for the Green and Golden Bell Frog included a visual search for basking individuals within the vegetation around the waterbody / watercourse as well as on instream vegetation (if any). - 2 person hours total in active searches all on the subject land.	- A 1-hour combined diurnal reptile and amphibian survey was conducted in areas of potential sheltering, foraging, basking, breeding and roosting habitat such as riparian zones and rock outcrops.	- Targeted fauna surveys are not documented in the report	- Neither the AHA 2008 nor Biosis 2010 studies are likely to have met the DEC 2004 guidelines. The guidelines state that a survey effort of at least 1 hour within the relevant habitat of each survey stratification unit searching all aspects of the watercourse and adjacent areas should be undertaken. - The survey undertaken for the AHA 2008 study was somewhat more comprehensive and was targeted towards amphibians compared to the Biosis 2010 study.
• **Nocturnal amphibian surveys**	- Conducted for the Green and Golden Bell Frog (summer survey period) and Giant Burrowing Frog (spring and summer survey period) just after dusk during the summer survey period. - Surveys started with an initial listening period of 15 minutes and then calls were broadcast for five	- A 30-minute searching and listening period was conducted in riparian zones for amphibians on one night.	- Targeted fauna surveys are not documented in the report	- Both the AHA 2008 and Biosis 2010 studies incorporated nocturnal amphibian surveys as recommended by DEC 2004. However, only the AHA 2008 study targeted threatened species using call playback and surveyed explicitly following wet weather events. - The single 30-minute search and listening survey by Biosis in 2010 in

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	minutes followed by a 10 minute spotlighting and listening period. - 2.5 person hours spent on call playback surveys all on the subject land. - Spotlight searches were also conducted at night along tracks and roads during rain events for the Giant Burrowing Frog.			one riparian zone on one night is not considered adequate for the extent of habitat within the subject land.
• **Diurnal reptile searches**	- Rolling of logs and rocks in the afternoon to search for reptiles across the investigation areas – 4 person hours. - Pitfall traps in conjunction with mammal surveys – 20 trap nights.	- A 1-hour combined diurnal reptile and amphibian survey was conducted in areas of potential sheltering, foraging, basking, breeding and roosting habitat such as riparian zones and rock outcrops.	- Targeted fauna surveys are not documented in the report	- Neither study meets the DEC 2004 guidelines for diurnal reptile surveys which requires 30-minute active searches on two separate days per stratification unit before mid-morning. - The AHA study did incorporate pitfall trapping as recommended in the guidelines where the Biosis 2010 survey did not. - The timing of the Biosis survey (mid-April) is outside of the recommended survey window for reptiles (November to March, DEC 2004).
• **Nocturnal reptile searches**	- Nocturnal searches for reptiles were conducted during the standard spotlighting for mammals – 11.5 hours combined.	- The report does not specifically mention nocturnal reptile searches however it is assumed that reptile species would have been detected during the spotlighting for mammal species.	- Targeted fauna surveys are not documented in the report	- Both the AHA 2008 and Biosis 2010 studies meet the recommended survey effort for nocturnal reptile surveys.

Table 6-2 Detailed analysis of the survey results and conclusions of the existing flora and fauna and threatened biodiversity assessments

Key issues and discrepancies identified within the existing studies are highlighted.

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Survey results and conclusions				
General vegetation types	Vegetation types were mapped based on a classification created by the author which somewhat aligns with the descriptions used in the SCC vegetation mapping (2002). Vegetation types mapped within the subject land included: • Scribbly Gum / Red Bloodwood Woodland – heath understorey • Scribbly Gum Open Woodland • Sedgeland • Disturbed areas • Grey Gum / Stringybark Open Woodland Comparative vegetation types were given according to Mills 1996.	Vegetation types were mapped based on a classification created by the author which somewhat aligns with the descriptions used in the SCC vegetation mapping (2002). Vegetation types mapped within the subject land included: • Scribbly Gum Woodland • Grey Gum Woodland • Spotted Gum Forest • Shrubland • Closed Grassland	No comment on the adequacy of the vegetation classification and mapping by AHA or Biosis is made in the report.	It is considered preferable when defining and mapping vegetation types to use the most recent recognised and published vegetation classification system. Although the vegetation classifications used in the AHA 2008 and Biosis 2010 studies somewhat align with the SCC 2002 mapping more recent and detailed classifications such as Tozer et. al. 2006 were available at the time of the studies. The Tozer *et. al*. 2006 classification is also utilised in the SCRCP in defining areas of HCV. In general, the vegetation mapping by both the AHA 2008 and Biosis 2010 studies is considered to be reflective of the vegetation across the subject land observed in 2015. It is the opinion of the reviewer, that the vegetation at the subject land is equivalent to the following vegetation types as defined by Tozer *et. al*. 2010 (Tozer *et. al*. 2010 is the accepted updated classification of the 2006 Version 1 classification.

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				This is discussed further in Section 8.1): • DSF p148 Shoalhaven Sandstone Forest (equivalent to the Scribbly Gum and Grey Gum Woodlands). • DSF p85 Currambene - Batemans Lowland Forest (equivalent to the Spotted Gum Forest).
Over-cleared rare or poorly conserved vegetation types	- The report identified the Scribbly Gum / Red Bloodwood Community present within the north western part of the Crams Road IA as a poorly conserved vegetation type within the Shoalhaven region which should be protected from further clearing and disturbance. The report noted this area has also been identified as forming part of a habitat corridor and is known to provide habitat for the threatened Squirrel Glider (*Petaurus norfolcensis*).	- The report did not identify any of the vegetation communities within the subject land as over-cleared, rare or poorly conserved.	- The report reiterates that with the exception of the sedgeland all the vegetation types are listed as common in the AHA report. - Acknowledges that most except the Currambene Lowland Forest are less than 15% cleared. - In relation to the Scribbly Gum/Red Bloodwood community identified as poorly conserved in the AHA report the report states that "Poorly conserved does not mean rare and as we know from the current zoning of Lot 24, zoning of such vegetation types determines development potential". - Applies the Tozer et. al. 2006 equivalent vegetation type for this community (Shoalhaven Sandstone Woodland) and identifies that the modified Scribbly Gum / Red Bloodwood Communities represented on Lot 24 are likely to represent only a small proportion of	- The Scribbly Gum / Red Bloodwood Forest is considered to be equivalent to DSF p148 Shoalhaven Sandstone Forest as described by Tozer et. al. 2010. This vegetation type is not over-cleared, rare or poorly conserved according to the criteria in the SCRCP (refer to Section 8.1). - As stated in the OMVI report, the other vegetation type (according to Tozer *et. al*. 2010) that occurs on the subject land; DSF p85 Currambene - Batemans Lowland Forest is more than 15% cleared however, this doesn't qualify it as an area of HCV according to the SCRCP. It does qualify as a HCV as a 'poorly conserved vegetation type with less than 30% of its original extent in formal conservation reserves (refer to Section 8.1).

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			these vegetation types in the locality and region, approximately 37576 ha mapped in the Shoalhaven LGA and approximately 4656 ha mapped within 10 kilometres.	
Endangered Ecological Communities	No Endangered Ecological Communities are considered to occur.	No Endangered Ecological Communities are considered to occur.	The report does not disagree with the conclusions of the AHA 2008 or Biosis 2010 reports.	As verified in the 2015 site inspection, no Endangered Ecological Communities listed under the TSC Act, EPBC Act or FM Act are considered to occur on the subject land.
Threatened flora	- No threatened flora species recorded during surveys despite targeted surveys at the appropriate time. - Identified that there were past records within or very close to the investigation area. Relevant to the subject land these included • Bauer's Midge Orchid • Bomaderry Zieria • Albatross Mallee - Identified potential habitat for a wide range of other threatened flora by did not identify any as highly likely to occur.	- No threatened flora species recorded. - An assessment of the likelihood of threatened flora species to occur identified: • High likelihood for Bauer's Midge Orchid • Moderate likelihood for Leafless Tongue Orchid, Dean's Paperbark, Illawarra Greenhood, Nowra Heath Myrtle and Bomaderry Zieria. • Low likelihood for another 12 species.	- The report acknowledges that no threatened plants were recorded by AHA or Biosis or during the OMVI survey. - The report states that surveys would be required in any future development applications to clarify potential occurrence and location of any threatened flora species and thus will affect the conservation significance of areas. - The report questions why when there is a record of Bauer's Midge Orchid in Lot 23 to the north of the subject land why is it zoned residential and not environmental conservation. - The report states "*The presence of G. baueri should result in an E2 zoning as the habitat for this species*	- Both the AHA 2008 and Biosis 2010 reports identify Bauer's Midge Orchid as a threatened flora species likely to occur on the subject land. Mapping by Biosis in 2010 (Figure 6-1) identifies a record of the species near the northern boundary of the subject land however mapping undertaken by NGH Environmental as part of this review (Figure 6-2) identified this same record as occurring along a drainage line within the subject land. This was confirmed by online mapping on the OEH's Bionet site (Figure 6-3). The record is relatively recent (2006) and given the relatively undisturbed nature of the vegetation in that area, it is considered likely that the orchid may still occur there.

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			would be highly conservation significant" - The report states "*The assumption of presence of this and other threatened flora species based on vegetation type within Lot 24 is not justified and clarifying the presence of species such as G. baueri locally is a part of the recorded strategies for its recovery, like all terrestrial orchids. An E2 zoning will most likely inhibit further efforts for survey by the land owner*"	- Given the levels of survey undertaken by AHA and Biosis, it is considered unlikely that the Albatross Mallee, Dean's Paperbark, Nowra Heath Myrtle and Bomaderry Zieria would have been detected if present at the site. - Habitat is considered suitable for the Leafless Tongue Orchid and there are nearby records for this species. Given the cryptic nature of this species, surveys to date are not considered adequate to rule out the presence of this species.
Threatened fauna **Ground dwelling and arboreal mammals**	- The Squirrel Glider was recorded during the surveys from Elliot B traps and during spotlighting. - Extensive evidence of use of the site for foraging by the Yellow-bellied Glider was observed particularly on Red Bloodwood and grey Gum trees. 11 Yellow-bellied Glider feed trees were identified during the survey. - Circumstantial evidence (although not recorded during the surveys) and potential habitat for the Eastern Pygmy Possum. - Potential habitat for the Koala (discussed in more detail under SEPP 44 below) and the Brush-tailed Phascogale was noted, although no previous records occur in the area.	- Evidence of feeding activity by the Yellow-bellied Glider in the form of sap-feeding incisions were observed on Red Bloodwood trees within the Open Woodland habitat throughout the subject land. - Acknowledged that the Yellow-bellied Glider (or foraging and breeding habitat) has been previously recorded over 60 times within the subject land and over 95 times in the study area for the report. - The Eastern Pygmy Possum was assessed to have a high likelihood of occurrence within the study area for the report on the basis of previous records and suitable foraging and breeding habitat.	The report acknowledges that there are a number of threatened fauna species recorded across Lot 24, the Crams Rd IA and across the locality. The report focuses on the Yellow-bellied Glider and the Squirrel Glider. **Yellow-bellied Glider** - 36 records on the subject land, 35 by an unknown surveyor in 2005/06 and one by Biosis in 2010. Almost all incised trees, only one observation. Species not actually 'observed' in AHA or Biosis surveys. - Questions the validity of the previous records and surveys by a SCC threatened species officer. - Report states the species is generally obvious within an area,	- It is acknowledged that the majority of the records for the Yellow-bellied Glider are from the one survey in 2005/06 by an unknown surveyor and most records are based on indirect evidence (sap-feeding incisions) - In recent searches of the Wildlife Atlas there is a record of a den tree, five records of call recognition and two observations from the same 2005/2006 survey (Figure 6-4). - Correspondence from SCC (Michael Park pers. comm. 08.05.15) confirms that the 2005/2006 survey results were not lodged by SCC and were lodged with OEH by someone else with a scientific licence. - Both AHA and Biosis recorded indirect evidence (feeding incisions)

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	- No threatened ground dwelling mammals were recorded during the surveys however, potential habitat was identified for: • Eastern Pygmy-possum • Spotted-tailed Quoll • Southern Brown Bandicoot • Long-nosed Potoroo • White-footed Dunnart	- No threatened ground dwelling mammals were recorded during the surveys however, potential habitat and a moderate likelihood of occurrence identified for: • Spotted-tailed Quoll • Southern Brown Bandicoot • Long-nosed Potoroo	and is readily detected from vocalisations during nightly migration and often following call playback of both glider calls and of large forest owls. - In survey by OMVI, considered that very few of the incisions recorded could be strictly attributed to the Yellow-bellied Glider. - Report states the proposed re-zoning of Lot 24 based on the presence of threatened fauna species including the Yellow-bellied Glider needs justification if this is the data on which usage of the site by this species is assumed.	of the Yellow-bellied Glider. The OMVI review states that very few of the incised trees could be attributed to the Yellow-bellied Glider which implies that some of them were attribute to this species. The Biosis reports concludes a high likelihood that this species occurs at the site. - Recent searches of the Wildlife Atlas also show two observations of the Yellow-bellied Glider in 2010 in the north of the subject land (refer Figure 6-4). - Based on the results of the existing studies and current evidence of records, it is a conclusion of this review that the Yellow-bellied Glider occurs on the subject land. - This review agrees with the Biosis 2010 conclusion that there is a high likelihood of the Eastern Pygmy Possum utilising the habitats within the subject land.
			Squirrel Glider - The report focuses on the fact that the Squirrel Glider is very similar in appearance to the Sugar Glider and difficult to distinguish particularly while spotlighting. "Slight differences in colouration in both species can differ within a population. There is an overlap in body length between species, being 170 – 240 mm 160-200mm	- The recording of the Squirrel Glider in the surveys by AHA was based on trapping as well as spotlighting. The species was trapped at sites 4 and 6 in Elliot B traps. - Detailed measurements, hair samples and photographs were provided to Ross Goldingay who concurred on the Squirrel Glider identification (Alison Hunt pers. comm. 11.05.2015). This is

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			respectively and there will be great overlap in body weight when comparing juveniles against adults of the other species. This makes the identification between species difficult even for the ecologists experienced in surveying for these species". - Notes that the record is not listed on the NSW Wildlife Atlas. - The report concludes that "the proposed re-zoning of Lot 24 based partly on the presence of the Squirrel Glider also needs justification if this remains the data on which SCC wholly or partly relies for the high conservation significance afforded to most of the eastern half of Lot 24".	considered to be a positive identification of the species within the subject land.
• **Megachiropteran and microchiropteran bats**	- The Grey-headed Flying Fox and 6 species of microchiropteran bat (ranging from possible to probable Anabat analysis confidence levels) were recorded during the surveys including: • Eastern False Pipistrelle (Possible) • Little Bentwing-bat (Probable) • Eastern Bentwing-bat (Possible) • Eastern Freetail-bat (Possible)	- Grey-headed flying Fox considered to have a moderate likelihood of occurrence. Concluded that given the close proximity of known camps to the study area; the study area is likely to be utilised on a regular basis by this species when blossom and/or fruit is available. - The Eastern Freetail-bat and the Greater Broad-nosed Bat were recorded during the surveys. - The other forest microbats Eastern False Pipistrelle and Yellow-bellied Sheathtail-bat were assessed to	- The report briefly mentions that the significance of habitat for the threatened microbats recorded in the AHA 2008 study is not assessed in the report.	- It is agreed that the grey-headed Flying Fox is likely to utilise the subject land on a regular basis for foraging purposes only. - Based on the results of the existing studies, it is a conclusion of this review that threatened forest microbats occur on the subject land.. The subject land provides abundant foraging and roosting habitat for these species and it is considered likely that threatened microbats occur widely across the subject land.

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	• Yellow-bellied Sheathtail Bat (Probable) • Greater Broad-nosed Bat (Possible) - The Grey-headed flying Fox was observed to be particularly active during February within areas containing flowering Red Blood Wood Trees. No camp sites were recorded. - One microbat roost tree identified and extensive habitat for across the investigation area. - Potential habitat also present for: • Large-eared Pied Bat • Large-footed Myotis	have a moderate likelihood of occurrence within the study area. - Acknowledged that the study area provides foraging and roosting habitat for all four of the above mentioned species. - Concluded that roosting habitat for cave dwelling species such as the Large-eared Pied Bat and the Eastern Bentwing-bat is likely to occur outside the Study Area within the sandstone escarpment above the Shoalhaven River and not on the subject land. - Large-footed Myotis recorded during the surveys and foraging and breeding resources present on the subject land. Only one other record of this species in the locality.		
• **Birds**	- The Glossy Black Cockatoo was the only threatened bird recorded within the investigation area during the surveys. The White-bellied Sea Eagle and White-throated Needletail were observed flying over. - Evidence of foraging activity by the Glossy Black Cockatoo was identified within the investigation area but not on the subject land. - Potential foraging habitat was identified within the investigation area on the subject land with the highest density in the northern	- The Gang-gang Cockatoo and Varied Sittella were recorded during the survey. - Foraging habitat present for the Gang-gang but unlikely to be preferred breeding habitat. - High likelihood of occurrence of the Glossy Black Cockatoo based on the presence of foraging and breeding habitat and previous records within the study area. - Powerful Owl assessed as having a high likelihood of occurrence on the basis of the high number previous	The report focuses on the potential occurrence and habitat for the Glossy Black Cockatoo and Powerful Owl. **Glossy Black Cockatoo** - The survey found that most Allocasuarina are regrowth from the fires in October 2003 and very few mature trees with fruit exist across the property but there was no clear evidence of foraging. The broad mapping of the GBC habitat across lot 24 by AHA, appears to be unjustified considering the very few	- Records from the OEH Wildlife Atlas identify the Glossy Black Cockatoo as being recorded on the site in 2004 and 2006. This is post the 2003 fires discussed in the OMVI (2011) review suggesting that this may not have affected the habitat to a degree that would preclude the species. - During the site assessment conducted by the reviewer, a number of young Allocasuarina trees were supporting cones. It is acknowledged however, that a number of surveys (including that

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	section. 13 hollow-bearing trees suitable for nesting by this species were also identified on the subject land. - Identified potential habitat for numerous other avifauna including • Regent Honeyeater • Pink Robin • Bush Stone-curlew • Swift Parrot • Turquoise Parrot • Gang-gang Cockatoo • Barking Owl • Masked Owl • Powerful Owl • Square-tailed Kite	records, and the presence of suitable foraging and breeding habitat for this species within the Study Area. - Other species assessed as having a moderate likelihood of occurrence include: • Masked Owl • Sooty Owl • Swift Parrot • Little Lorikeet • Square-tailed Kite	mature trees with fruit observed in 2011. - The report notes that within the few areas supporting mature *Allocasuarina littoralis* trees there was no evidence of Glossy Black Cockatoo foraging. - Glossy Black Cockatoo feeding signs were observed in adjacent properties to the north. - Habitat mapped with presence of *Allocasuarina littoralis* as the only determinant. - The report concludes that the proposed re-zoning of Lot 24 based partly on the presence of the Glossy Black foraging habitat and potential breeding hollows needs justification if this remains the data on which SCC wholly or partly relies for the high conservation significance afforded to most of the eastern half of Lot 24.	by the reviewer) have failed to detect recent foraging activity on the subject land which suggests that it is not an area regularly utilised by the species for foraging.
	- Three hollow-bearing trees suitable for nesting by owls occur on the subject land. The Powerful Owl and Masked Owl were identified as being recorded within 5 km of the investigation area. - Identifies Red Bloodwood, Spotted Gum, Swamp Mahogany, Blue-leaved Stringybark & Banksia as key wintering flowering resources for		**Powerful Owl** - Report acknowledges that a roosting area and breeding hollow for a resident pair of Powerful Owls has been recorded immediately west of Lot 24 and this has been well documented since at least 2005 - Given the home range of a resident pair of Powerful Owls the whole	- The AHA 2008 report identified potential habitat for the Powerful Owl and Biosis 2010 concluded a high likelihood of occurrence of this species. - This review agrees that the subject land is likely to provide high quality foraging habitat for this species given the close proximity to a known breeding location and the abundance of hollows and potential

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	migratory birds such as the Swift Parrot and Regent Honeyeater - The Regent Honeyeater and Swift Parrot were not identified during targeted surveys.		locality is likely to represent foraging habitat. - Given the established breeding site (since 2005) and territorial nature of the Powerful Owl, breeding sites unlikely on the subject land. Apparent hollows suitable for owls used to determine conservation value of hollow-bearing trees and of vegetated areas. - The level of foraging activity in lot 24 and the Crams Road area requires conformation to determine the conservation value of the site for this species rather than assumed. **Regent Honeyeater and Swift Parrot** - The report comments that another misleading assumption informing the conservation significance is the presence of winter flowering habitat across the subject land; Red Bloodwoods are not winter flowering as stated in AHA winter flowering species are sparse across the site.	prey species on the subject land. Sugar Gliders, Greater Gliders, Brush-tailed Possums and grey-headed Flying Fox were all recorded on the subject land and are known prey species for the Powerful owl (DEC 2006). - The subject land may not be actively being utilised for breeding at present however, the large hollows required for breeding by this species are unlikely to be common in the area. The importance of these resources should not be discounted based on the absence of current breeding activities by the Powerful owl on the subject land. - It is agreed that Red Bloodwoods are mostly not winter flowering (generally flowering January – April, Brooker and Kleinig, 2006) and that other winter flowering Eucalyptus favoured by the Swift Parrot and Regent Honeyeater are not widespread across the site. The subject land is not considered to provide particularly important foraging habitat for these species.
• **Amphibians**	- The report identified that the subject land supported suitable potential habitat for the Giant Burrowing Frog and Littlejohn's Tree Frog along the unnamed creek that traverses the south of the	- The report concluded that there was a moderate potential for the Giant Burrowing Frog to occur on the subject land on the basis of previous records in the locality and the presence of marginal foraging, sheltering and breeding habitat	- The report does not address the previous assessments with regard to amphibians.	- This review agrees with the conclusions of the Biosis 2010 study in that there is a moderate potential for the Giant Burrowing Frog to occur on the subject land.

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	subject land and one of its tributaries. - Potential habitat for the Green and Golden Bell Frog was also found to be present in a small dam along the powerline easement. - Report acknowledged that targeted surveys failed to detect these species and that there are no records in close proximity to the investigation area.	(four unnamed creek lines) within the study area.		- There is some potential for the Green and Golden Bell Frog to occur in the areas identified by AHA 2008 but habitats for this species are marginal.
• **Reptiles**	- The report identified breeding habitat for Rosenberg's Goanna on the subject land however, acknowledged that this species had not been recorded in the locality.	- The Broad-headed snake was the only reptile species considered by the report and this was assessed as having a low likelihood of occurrence.	- The report does not address the previous assessments with regard to reptiles.	- This review agrees that there is a low likelihood of threatened reptiles occurring on the subject land.
Corridors	- The report identified the investigation area as part of a north-south corridor across the Shoalhaven River connecting with more extensive habitats to the south. - The investigation area was also identified as stepping Stone Habitat in North Nowra. The creeks on the subject land were identified as important wildlife corridors. It is acknowledged in the report that HCV mapping by the DECC had mapped small sections within the investigation area as a proposed habitat corridor of which the subject land is a part.	- No specific assessment of wildlife corridors was undertaken in the report however, riparian zones were identified in the constraints analysis as providing the core movement corridors for fauna.	- States that, with the exception of the regional wildlife corridor along the western side of the subject land, habitat corridors throughout the locality are disjunct and fragmented. - Considers that the eastern portions of the subject land provide little benefit to connectivity and would incur large costs to make functional. - Acknowledges that the western areas of the subject land are in considerably better condition and would require less funding to rehabilitate/manage. - Considers that a level of development could occur in the	- This review agrees that the riparian areas within the subject land are important as local wildlife corridors. - The western and southern portions of the subject land also contribute to connectivity along the Shoalhaven River Corridor. - It is agreed that the eastern portions of the land (particularly the north-eastern) provide little benefit to connectivity across the wider locality. -

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
			east without greatly impacting on the connectivity along Shoalhaven River or the broken corridor through the residential development to the east to Bomaderry Creek Regional Park.	
SEPP 44	- Identified two species of Koala feed trees present at the site. Surveys in mapped potential habitat areas did not detect Koalas and no records were within close proximity to the study area. The report concluded that the area was unlikely to support a Koala population.	- Acknowledged feed trees are present on the subject land but concluded that the Koala is unlikely to occur in the study area on the basis of previous records and the fragmented nature of the landscape. -	- Koalas are not discussed on this report.	- Based on the results of the surveys to date and paucity of records for this species in the locality, this review agrees that the subject land is unlikely to support a Koala population.
Constraint areas	The report identifies high levels of constraint across the investigation area due to: - The presence of threatened species on the site and their habitats. Particular emphasis is placed on: • The presence of the Squirrel Glider and Yellow-bellied Glider and the loss of family groups. • Extent of foraging habitat and occurrence of hollow-bearing trees suitable for breeding by the Glossy Black Cockatoo. - Good connectivity and wildlife corridors associated with the Shoalhaven River.	The report identifies high constraint areas as: - Areas that have a high conservation value due to the presence of the broadest range of significant or threatened biodiversity or its potential habitat. - Areas on the subject land that are considered to form the minimum area and network of vegetated corridors to maintain wildlife corridor functions within the subject site, extending to the study area and more broadly through the locality. - The report considers the DWE (2008) guidelines for the determination and management of	- The report states that there are areas of high conservation significance across Lot 24 and additional areas with little conservation significance. - Report considers that there is enough doubt in the occupation of the site by threatened species to warrant further investigation before rezoning the land. - The report states: "*If the only verification rule triggered to establish HCV across Lot 24 is the presence and utilisation of these lands by threatened species, which have been examined earlier in this document, then the classification as HCV is unjustified*"..	- The primary purpose of this review is to identify areas of HCV using the verification rules of the SCRCP. These rules would see all areas important to supporting viable populations of threatened species nominated as HCV areas. An analysis of HCV areas is provided in Section 8.1, based on data known for the site, as presented in the five relevant reports being reviewed herein. - This review considers that the *high constraint areas* proposed by both the AHA 2008 and Biosis 2010 studies are largely justified when considered in the context of the objectives of those studies. It is noted that *high constraints* are not

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
	The presence of riparian corridors. The report recommends meeting riparian objectives.	riparian zones in its definition of high constraint areas. - Moderate constraints were identified as areas that have conservation value primarily in relationship to the presence of, or habitat for, threatened flora and fauna either known, predicted to occur on, or with a moderate to high likelihood to utilises the habitats of the subject site.	- Considers the high conservation areas defined by AHA 2008 and the resulting zoning in the exhibited draft SLEP 2014 as an overestimation of the HCV of the subject land. - The report states "*Following the current survey across Lot 24, the Biosis Research conclusions of conservation significance appear to be more correct… If assessed again under the verification rules for the South Coast Regional Conservation Plan, or a complete biometric calculation, I believe that much of the same area would classify similarly*".	necessarily synonymous with *HCV* as defined under the SCRP. In defining HCVs, this review: - Questions the extent of the AHA high constraint in the north east of the subject land. This review considers the large edge area and limited connectivity lower the value of habitat resources located in this area, in terms of their importance to viable populations of threatened species. - Questions why habitat known to support threatened species is only be considered a moderate constraint in the Biosis 2010 report; in some of these areas, this review considers that these areas should be considered important to supporting viable populations of the nominated species and has included them as HCV. - Considers that OMVI 2011 does not appropriately utilise the precautionary approach stated in the DEC 2004 guidelines and relevant to this project, it being based on limited survey effort. The OMVI report appears to take the approach that threatened species should be demonstrated to occur at the site at the present point in time to justify defining areas of HCV

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Flora and fauna Assessment and Constraints Analysis – September 2010	OMVI – Review of conservation significance of lands at Warrah Road North Nowra – October 2011	**NGH Environmental** analysis
				based on threatened species habitat.
Old growth forests	- No old growth forests are identified in the report	- No old growth forests are identified in the report	- No old growth vegetation is considered to occur on the subject land.	- This review concurs that there are no areas of old growth forest on the subject land.
Significant aquatic areas	- No significant aquatic areas are identified in the report although the presence of riparian areas and dams are noted as important habitat resources.	- No significant aquatic areas are identified in the report although riparian areas are identified as important habitat resources.	- Significant aquatic areas are not discussed in the report.	- This review concurs that there are no significant aquatic areas on the subject land.

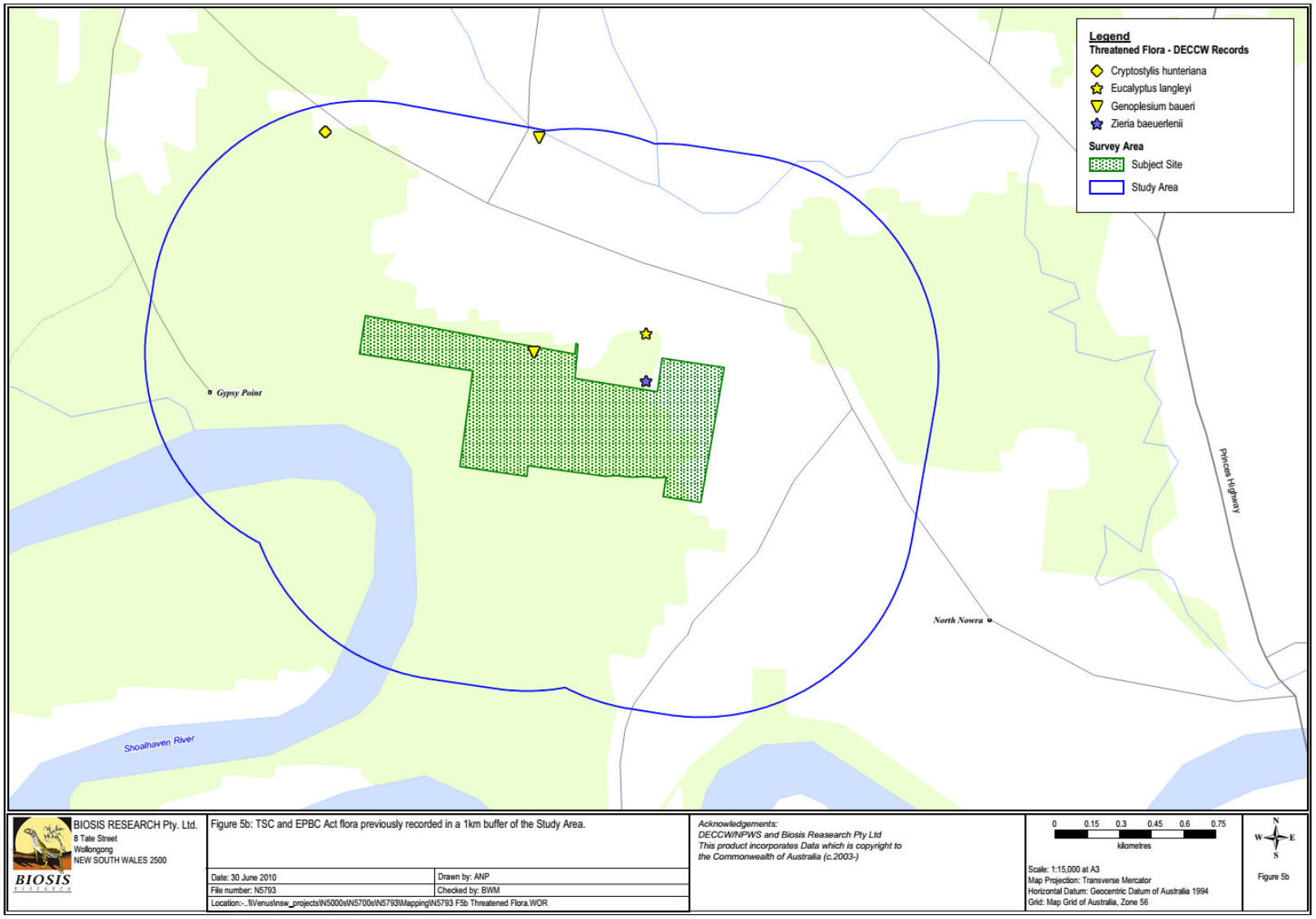

Figure 6-1 Threatened flora records mapping from Biosis 2010

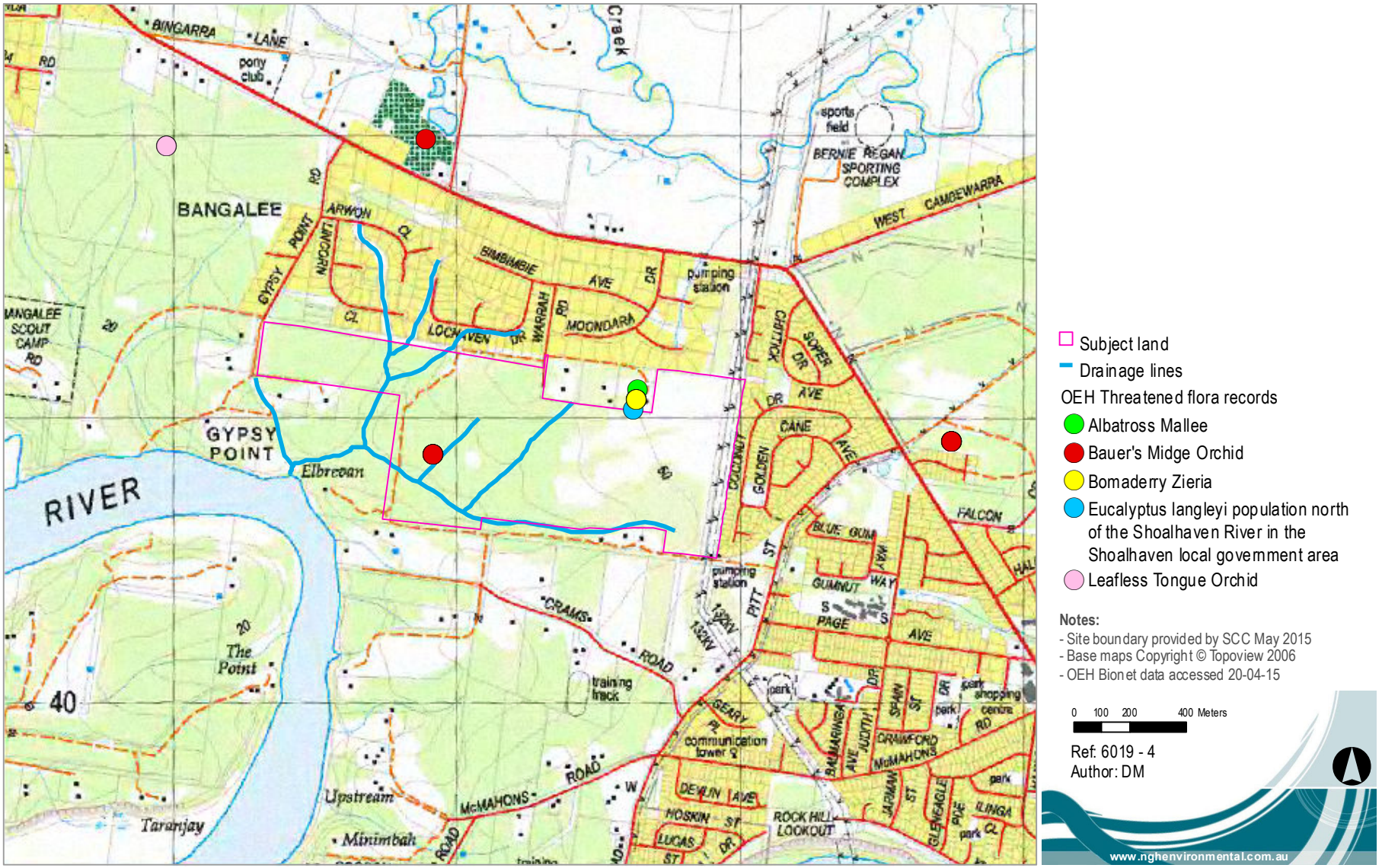

Figure 6-2 OEH Threatened flora records mapping by nghenvironmental 2015

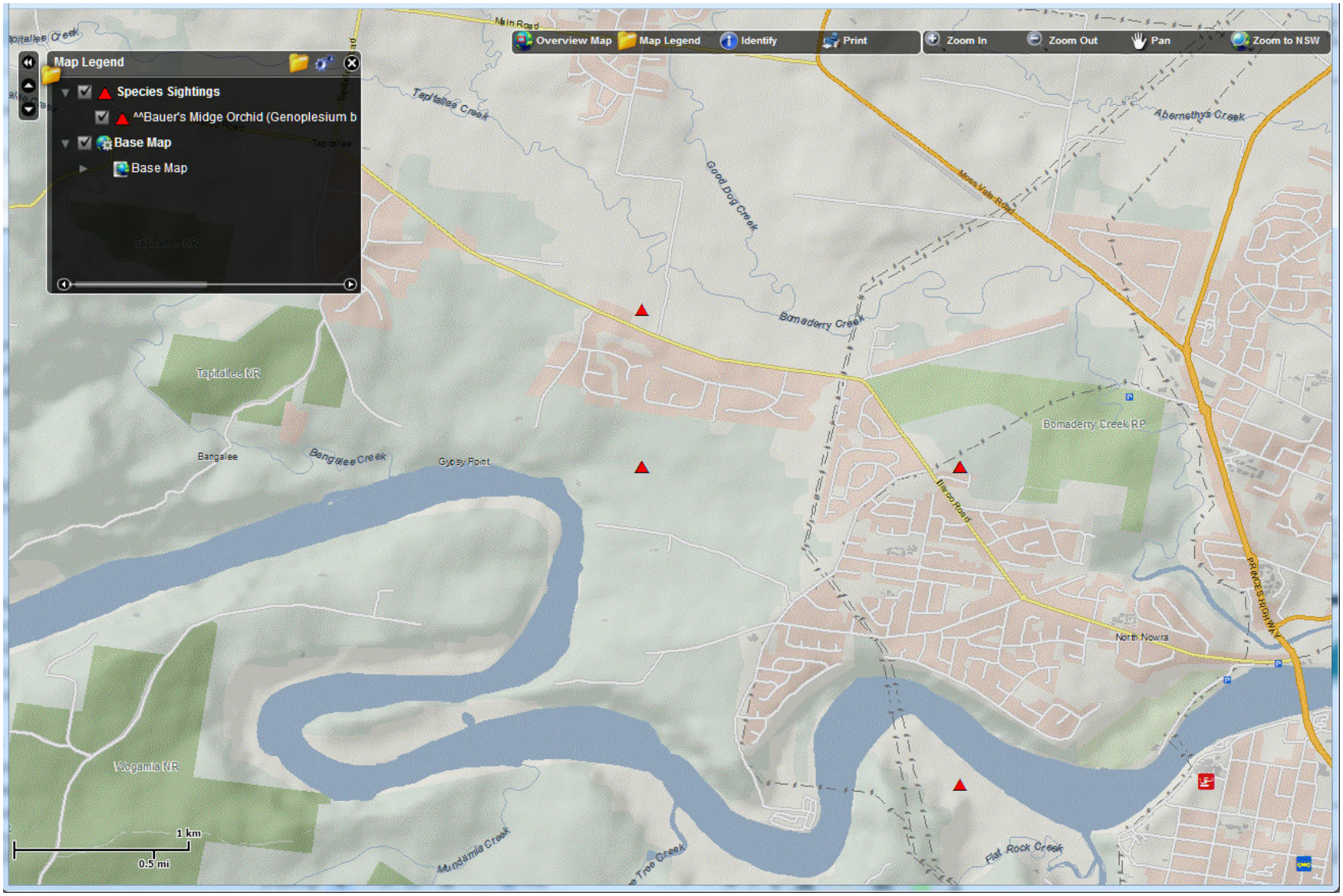

Figure 6-3 Mapping for Bauer's Midge Orchid accessed on Bionet, 8 May 2015

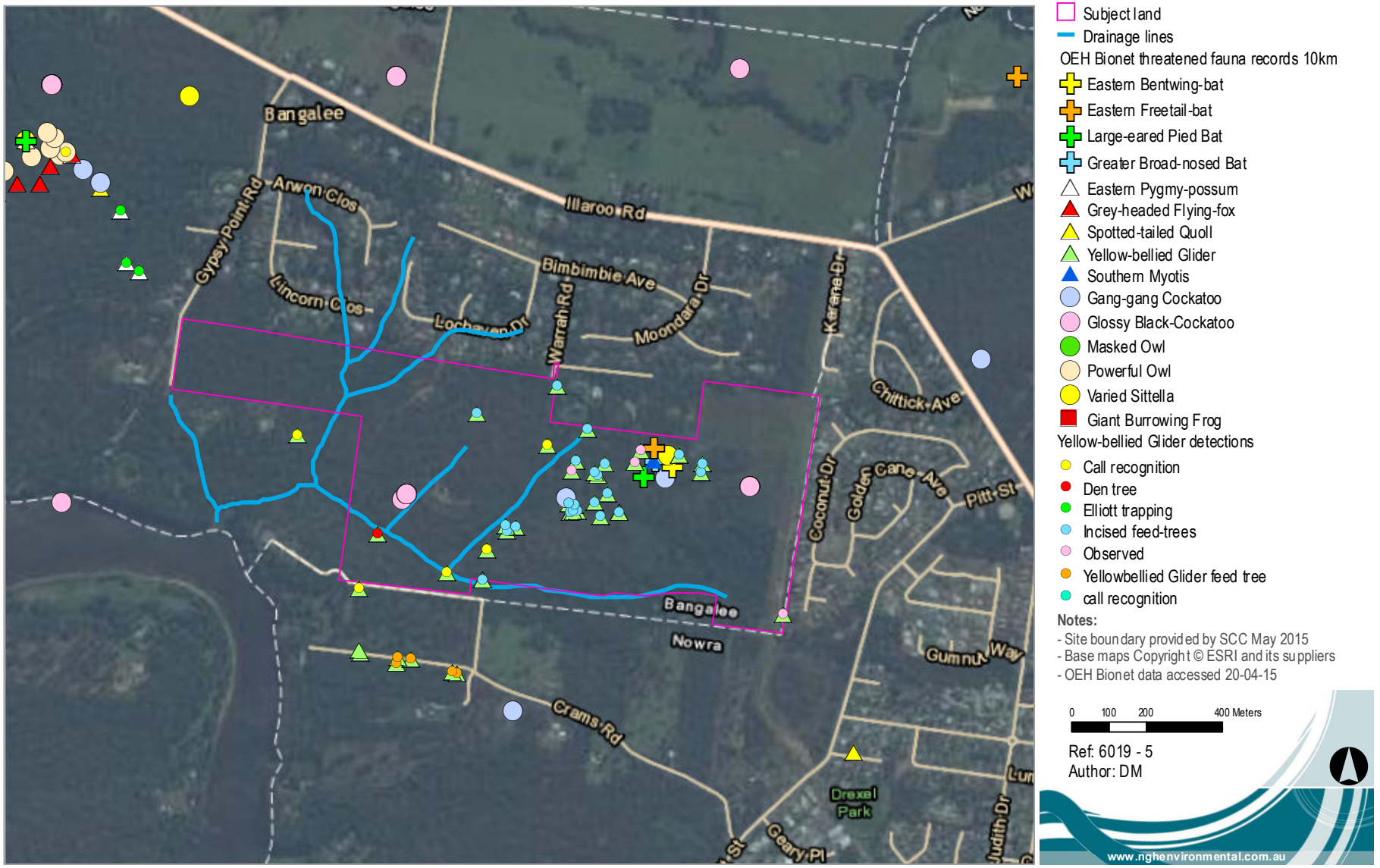

Figure 6-4 OEH Threatened fauna records within and surrounding the subject land

6.2 SPECIFIC HOLLOW-BEARING TREE ASSESSMENTS

Table 6-3 Detailed analysis of survey methods and effort, results and conclusions of the existing hollow-bearing tree assessments

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey – April 2011	OMVI – Review of Hollow Bearing Tree Assessment of Lands at Warrah Road – May 2011	Reviewers analysis
Survey methods and effort				
Timing	- Surveys undertaken in autumn 2008.	- Surveys undertaken mid to late summer 2011.	- No surveys were undertaken as part of the review by OMVI	- The timing of all surveys is considered adequate.
Methodology	- No specific methodology specified. - Only a portion of the subject land was surveyed (refer Section 5.1).	- A structured parallel-line foot-based traverse of the Subject Site was undertaken (46 person hours). - Survey effort was focused on areas supporting significant habitat features with a representative sample of vegetation communities across the site being surveyed. - All dead and alive HBTs observed were recorded where they met the following criteria: • Hollow entrance visible • Hollow appears to have depth • Hollow appears to be at least 1 metre above the ground.	As above.	- The survey methodology of Biosis 2011 is considered appropriate and robust.
Target species	• Glossy Black Cockatoo • Threatened Owls	- No specific target species identified. Potential for use by any threatened species noted.	As above.	- Both studies have considered the potential for the hollow-bearing tree habitat resources on the subject land to be utilised by threatened species. However, the AHA 2008 study only focused on two particular species whereas the Biosis 2011 study considered threatened species more broadly.

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey – April 2011	OMVI – Review of Hollow Bearing Tree Assessment of Lands at Warrah Road – May 2011	Reviewers analysis
Information recorded	- Tree species. - Fauna species for which the hollow(s) would be suitable. Owls and Glossy Black Cockatoo hollows were noted specifically, all others were grouped into be suitable for small birds and arboreal mammals. - GPS location. - The ground beneath hollows suitable for owls was searched for evidence of use (pellets, white wash). - Noted that other factors which would determine the likelihood of a species using that tree (e.g. an isolated paddock tree may contain large hollows but may not be a preferential breeding site due to its isolation) were not considered in determining suitability of a hollow for a particular species.	- Tree status (i.e. living or dead). - Diameter at Breast Height (DBH). - Number of visible hollows per tree. - Size of hollows. - Evidence of fauna occupation. - Proximity to creek-line. - Suitability for threatened species to use as nesting habitat.	As above.	- The data collected by Biosis 2011 is considered more typical of that which should be recorded during a full hollow-bearing tree inventory and is considered adequate.
Specific details regarding threatened fauna	- Glossy Black Cockatoo nesting spouts were considered to be those trees with vertical spouts / trunks of 15 cm in diameter. - Powerful Owl hollows were considered to be those that are > 35 cm in diameter with an overhanging lip that allows the owl to perch on the hollow rim.	None provided.	As above.	- The diagnostic features used in the AHA 2008 report are considered reasonable for identifying hollows that area **potentially** suitable for the Glossy Black Cockatoo and Powerful Owl.

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey – April 2011	OMVI – Review of Hollow Bearing Tree Assessment of Lands at Warrah Road – May 2011	Reviewers analysis
Further data analysis	- None.	- Information was incorporated into the scoring system established by Gibbons and Lindenmayer (2002) to assist in identifying trees with the highest conservation significance across the Subject Site.	- Considers the assessment methodology of Gibbons and Lindenmayer (2002) as suitable but acknowledges some bias towards species that occupy mature forest and woodland. - Report notes that the Gibbons and Lindenmayer (2002) methodology weighting for larger hollows along creeklines may under-rank the smaller more suitable hollows for species such as the Eastern Pygmy Possum.	- This review considers the methodology applied by Biosis 2011 as a reasonable indication of the overall conservation significance of hollow-bearing trees across the subject land and agrees with the limitations of the methodology identified in the OMVI 2011 report.
Survey results and conclusions				
Distribution of hollow-bearing trees	- Hollow-bearing trees supporting large and small sized hollows, branch spouts, trunk hollows and vertical spouts were present across much of the investigation area. - The report identified that there was a clustering of this resource within the Scribbly Gum – Red Bloodwood Woodland in the north western section of the investigation area. This area is located on the subject land. The report calculated 14.4 hollow-bearing trees per hectare in this area.	- Hollow-bearing trees were generally restricted to the woodland and open forest habitats of the study area with the two main clusters in the western and central areas.	- When comparing the smaller area surveyed in the AHA 2008 and complete coverage of the Biosis 2011 reports, the report considers that the number and type of hollows appear to be very similar and the densities of hollow-bearing trees appear to be similarly concentrated.	- Based on the site assessment undertaken by the reviewer, both surveys appear to align with the actual distribution and density of hollow-bearing trees across the subject land.

Aspect	Alison Hunt and Associates - Threatened Biodiversity Survey and Assessment, Nowra Bomaderry Structure Plan – May 2008.	Biosis Research – Lot 24 Warrah Road, North Nowra, Hollow Bearing Tree Survey – April 2011	OMVI – Review of Hollow Bearing Tree Assessment of Lands at Warrah Road – May 2011	Reviewers analysis
Hollow-bearing trees suitable for threatened species	- A total of 190 hollow-bearing trees were identified on the subject land. Of these, 4 hollow-bearing trees were considered to be suitable for threatened owls and 13 hollow-bearing trees suitable for breeding by the Glossy Black Cockatoo.	- A total of 412 hollow-bearing trees were recorded supporting 1106 individual hollows.	- Given the presence of several hollow-dependant threatened species on the Warrah Road site or nearby, such as the Yellow-bellied Glider, Glossy Black Cockatoo and Powerful Owl, the larger slower produced hollows will likely be the main limiting resource within suitable foraging habitat. - It is likely that the Yellow-bellied Gliders recorded near the site will utilise the larger hollows in denser forest of the gullies and toward the Shoalhaven River over the dryer open woodlands such as the Scribbly Gum Woodland. - The majority of hollows suitable for threatened species are contained within the environmental zone proposed by Biosis 2011. - Clarifies that the hollow-bearing trees themselves do not represent the conservation significance of an area and the density size or number become relevant only with occupation by hollow-dependant conservation significant fauna.	- The conclusions reached by all studies are considered to be reasonable. - With regard to the OMVI conclusion, it is noted that threatened species records for the site show several hollow dependent fauna have been verified to occur and thus a precautionary approach would be to assume that suitable breeding and roosting habitat identified on the subject land would on occasion be occupied by threatened species.

7 SUMMARY OF THE RESULTS OF THE DETAILED ANALYSIS

The detailed analysis completed in Section 6 identified the key methodologies and results of the five existing studies relevant to the subject land. Generally, there were minor variations in the survey methods and scope, but several key differences in the results obtained and how these results were interpreted in defining *high constraint* or *HCV* areas.

As stated previously, it is noted that *high constraints* are not necessarily synonymous with *HCV* as defined under the SCRP and that the objectives of the reviewed reports differed in this regard.

The key points of this review are summarised below.

7.1 SURVEY METHODOLOGIES EMPLOYED

In general, the methodologies applied by all studies are considered to be adequate in meeting the specific objectives of each study. The AHA 2008 and Biosis 2010 studies stated in their reports that the surveys were based on the draft *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities* (DEC 2004) and this was found to be the case with regards to the methodologies employed however, survey effort did not always comply with the minimum survey effort recommended in the draft guidelines. This is likely due to the fact that the assessments were mostly aimed at identifying key constraints and not at undertaking a complete and comprehensive impact assessment of a proposed development (for which the guidelines were generally prepared). As such, the levels of survey cannot be taken as a conclusive demonstration of the presence or absence of particular species across the subject land. This is considered particularly relevant to threatened ground dwelling and arboreal mammals which have been previously recorded on the subject land. It is noted that where survey effort is less than recommended by the DEC 2004 guidelines, the precautionary approach (stated in the DEC 2004 guidelines) becomes more relevant. That is, unless good arguments suggest otherwise, it is often more appropriate to assume a species is present in suitable habitat rather than use a lack of conclusive records to justify its absence.

7.2 THREATENED SPECIES SURVEY AND ASSESSMENT RESULTS

The AHA 2008 and Biosis 2010 studies generally came to similar results regarding the potential for threatened species to occur. With regards to threatened flora both studies considered there to be a high likelihood of the occurrence of Bauer's Midge Orchid. Both studies identified potential habitat for a range of other threatened flora species including the Leafless Tongue Orchid.

Both studies identified a high likelihood of occurrence of the Yellow-bellied Glider and Eastern Pygmy Possum on the subject land. The Squirrel Glider was recorded on the subject land during the AHA surveys. This species was not recorded again during the Biosis surveys however, as stated above, the surveys are not considered comprehensive enough to use the absence of the species from the Biosis survey results to determine its absence from the subject land altogether. Both studies identified moderate potential for the Spotted-tailed Quoll, Southern Brown Bandicoot and Long-nosed Potoroo to occur.

Both studies recorded the presence of threatened microbats during the surveys and identified suitable roosting and foraging habitat across the subject land.

Both studies considered the Glossy Black Cockatoo and Powerful Owl as having a high potential to occur on the subject land. The Gang-Gang Cockatoo and Varied Sittella were also recorded during the Biosis surveys.

7.3 INTERPRETATION OF SURVEY RESULTS IN DETERMINING HIGH CONSTRAINT OR HIGH CONSERVATION VALUE AREAS

The AHA 2008 study generally took a precautionary approach. Where a threatened species had been previously recorded or was recorded during the surveys for the study, the potential habitat for this species across the investigation area was identified as a high constraint; assuming that habitat was important and resulting in the broadest area of high constraint of the studies.

The Biosis 2010 and 2011 assessments, took a different approach, identifying the best habitat within the subject land as high constraint and recommending a precautionary staged approach to developing other areas that were of potentially of lesser value. In their 2010 report, they identified known threatened species habitat as a medium constraint which, could potentially support residential development provided TSC and EPBC Act impact assessments for threatened species identified in the report were carried out. Following their hollow-bearing tree assessment in 2011, Biosis increased their high constraint areas. These were still less than the AHA areas; particularly, they excluded the high constraint area in the central east of the subject land and also a large proportion of the high constraint area in the north in the vicinity of the Squirrel Glider den tree.

The OMVI 2011 review considered the constraint area by AHA and Biosis and applied the HCV criteria in their review. However, they appeared to take the view that threatened species should be demonstrated to occur at the site at the present point in time to justify defining any areas of HCV based on threatened species habitat as opposed to relying on outdated and in the view of OMVI, questionable data. In their conclusion OMVI state that:

> "*There is enough doubt in the occupation or even presence of threatened species across Lot 24 to warrant further investigation before rezoning this land. If the only verification rule triggered to establish HCV across Lot 24 is the presence and utilisation of these lands by threatened species, which have been examined earlier in this document, then the classification as HCV is unjustified (see Appendix C for summary). The presence firstly of a number of species needs to be determined and the areas of occupation and habitat utilisation then needs to be ascertained. The presence of old un-used sap feeding sites or suitably sized hollows is not reason enough to classify an area as HCV even under the rules of the South Coast Conservation Plan*".

NGH Environmental are of the opinion that this approach is not consistent with to the precautionary approach, stated in the DEC 2004 guidelines and advocated by the NSW OEH. The NGH Environmental review has subsequently investigated several of these records and considers they should be considered as legitimate and current, with regard to defining HCV areas. Specifically, these include records for:

- Bauer's Midge Orchid
- Squirrel Glider
- Yellow-bellied Glider
- Threatened forest microbats

There is no doubt that numerous threatened species have been recorded on the subject land. It is also clearly identified in the AHA, Biosis and OMVI reports that there is a high likelihood of other threatened species occurring on the subject land including:

- Eastern Pygmy Possum
- Powerful Owl
- Glossy Black Cockatoo

In applying the precautionary principle, it would be assumed that the habitats at the subject site are still suitable for the species that have been recorded there. It is the opinion of this review that areas that provide good quality known habitat for threatened species should be included as areas of HCV unless it can be adequately demonstrated that the known habitat is no longer being utilised. This is the rationale applied in the following delineation of areas of HCV on the subject land.

8 ASSESSMENT OF AREAS OF HIGH CONSERVATION VALUE

The following provides an assessment of areas that meet the criteria of HCV as defined by the SCRCP. Specifically:

- Endangered ecological communities
- **Rare or poorly conserved vegetation types**
- Over-cleared Mitchell Landscapes
- Old-growth forests
- **Threatened and significant species**
- Significant aquatic habitat

Bolded criteria have been considered relevant to the subject site.

The assessment also includes an analysis of the connectivity values of the subject land considering that areas have been identified as Potential Habitat Corridors in previous HCV mapping by DECCW (AHA 2008) and that wildlife corridors are also a focus of the SCRCP and NBSP.

Areas of HCV as delineated by this review are mapped in Appendix C.

8.1 AREAS OF HIGH CONSERVATION VALUE DEFINED BY THE SCRCP

8.1.1 Endangered Ecological Communities

No Endangered Ecological Communities occur on the subject land. No areas of HCV have been defined on this basis.

8.1.2 Rare, over-cleared or poorly conserved vegetation types

The Scribbly Gum – Red Bloodwood community described in the AHA 2008 report was identified as a poorly conserved vegetation type within the Shoalhaven region which should be protected from further clearing and disturbance. Analysis of the vegetation types as classified by Tozer *et. al.* 2010[3], did not reach this conclusion.

The thresholds for determining a vegetation type as rare, over-cleared or poorly conserved as defined in the SCRP are as follows:

- Rare vegetation types are those with a total extent distribution of less than 1000 hectares
- Over-cleared vegetation types are those where greater than 70 percent of the original extent of the vegetation has been cleared
- Poorly conserved vegetation types are those with less than 30 percent of their original extent in formal conservation reserves.

The vegetation types and conservation status as described in Tozer *et. al.* 2010 are listed in Table 8-1.

[3] The verification rules for defining areas of HCV as documented in the SCRCP state that vegetation types and conservation status according to Tozer *et. al.* 2006 should be utilised for this criteria. This review has utilised the information contained in Tozer *et. al.* 2010 as this is the accepted updated version of the classification.

Table 8-1 Conservation status of vegetation types on the subject land

Vegetation type	Extent (hectares)	Percent remaining	Percent in conservation reserves
DSF p148 Shoalhaven Sandstone Forest	56,500	80 – 95	55 – 75
DSF p85 Currambene-Batemans Lowlands Forest	24,700	40 – 55	5 – 20

None of the vegetation types are considered to be rare or over cleared. DSF p85 Currambene-Batemans Lowlands Forest does however, have less than 30 percent of its original extent within conservation reserves and as such, **is a poorly conserved vegetation type and considered to be HCV**. Examples of this community are represented in a number of small conservation reserves though the expansion of Nowra and its satellites and high frequency fires and grazing pose threats to some stands (Tozer et. al. 2010). This community corresponds to areas mapped as Spotted Gum Forest in the Biosis 2010 report and occurs as discrete areas in the far west and south-east of the subject land (refer Appendix C).

8.1.3 Over-cleared Mitchell Landscapes

No over-cleared Mitchell landscapes occur within the subject land. No areas of HCV have been defined on this basis.

8.1.4 Old-growth forests

No old growth forests are considered to occur within the subject land. No areas of HCV have been defined on this basis.

8.1.5 Threatened and significant species

Known habitat of threatened and significant species was mapped in the SCRCP (2010) (refer Figure 8-1 and Map 7 in the SCRCP). While the mapping is coarse and has limitations (particularly with regard to actual survey effort), this mapping was produced through a systematic process where records were reviewed by a DECCW panel of threatened species officers and refined to only those species for which private lands were thought to be important habitat; other species were excluded from further analysis. Records suspected or known to be incorrect or of low spatial accuracy (more than 100-metres inaccuracy) were excluded from further analysis. Remaining records were considered valid. The mapping delineates 'verified habitat' rather than the full extent of actual or potential habitat. The mapping overlaps with at least the western portion of the subject land (refer Figure 8-1).

As discussed in the detailed analysis (Section 6) and Section 7.2, the subject land provides verified habitat for a number of threatened species. Whether these species occupy the subject land at the present time is unknown but the precautionary approach would be to assume this is the case, given the habitat values have been verified as largely the same as at the time of the surveys, for relevant species.

The NGH Environmental delineation of HCV areas for the subject land has considered known threatened flora and fauna on records from OEH, AHA 2008 and Biosis 2010. Species driving the delineation of the HCV areas include:

- Bauer's Midge Orchid
- Yellow-bellied Glider
- Squirrel Glider
- Glossy Black Cockatoo

- Gang-gang Cockatoo
- Varied Sittella
- Grey-headed Flying Fox
- Threatened forest microbats

The verification rules for ground-truthing HCV areas are stated in Appendix B. For threatened fauna, the verification rules require that

> "*until an appropriate survey (DEC 2004) demonstrates otherwise, the mapped habitat should be regarded as important habitat. Important habitat contributes to the viability of local threatened fauna populations and can include, but is not limited to, essential breeding resources, foraging resources and connectivity corridors*".

On this basis, NGH Environmental have identified and mapped important habitat specifically for the subject land. This includes areas supporting higher quality habitats such as known den sites, known foraging sites, riparian areas and higher densities of hollow-bearing trees that include breeding habitat for threatened species. The threatened species that are known to occur at the site are also mostly wide ranging. For example exclusive home ranges of 25 – 85 hectares are utilised by family groups of the Yellow-bellied Glider (Goldingay & Possingham 1995). The important threatened fauna habitat mapped in Appendix C constitutes 50 hectares which would at most provide for two family groups but may not even cover the home range of one. Additional areas that were also considered important for proving connectivity for threatened species have also been identified as areas of HCV (refer to Section 8.2).

The eastern extent of this HCV area largely coincides with a transition from areas that have been subject to higher levels of historical disturbance (note: recent illegal clearing impacts were not considered) in the east to generally more intact, less disturbed and structurally diverse areas to the west. The delineated HCV area does encompass habitat in the central and northern portions of the subject land (south of the three existing rural residential properties) that has been subject to historic grazing however, this type of disturbance would have likely been present at the time that threatened species were recorded in this area. As such this type of disturbance is not considered to diminish the habitat values in this area to the extent that they can be discounted as not important particularly considering this area contains a high density of Yellow-bellied Glider records including two observations from 2010.

Potential habitat for the Leafless Tongue Orchid has also been considered in the mapping of important habitat. The HCV verification rules for threatened flora state that "*Targeted surveys for the identified plant species should occur within the proposed development or planning area*". The Leafless Tongue Orchid is a cryptic species and the targeted threatened flora surveys undertaken to date are not considered adequate to rule out the presence of this species. The larger populations of the Leafless Tongue Orchid typically occur in woodland dominated by *Eucalyptus sclerophylla, E. sieberi, Corymbia gummifera* and *Allocasuarina littoralis*, which is the dominant vegetation type on the subject land. It appears to prefer open areas in the understorey of this community and is often found in association with *Cryptostylis subulata* which was recorded within the Scribbly Gum Woodland with an abundance score of 2 (<5% cover – more than three individuals sparsely scattered) (Biosis threatened species evaluation 2010). Although not detected during the surveys, the nearest record for this species is only 700 metres north-west of the subject land. Given that typical habitat for this species occurs on the subject land and adequate surveys have not been undertaken, it has been considered when defining the HCV area. The majority of better quality areas of habitat for the threatened species known to occur on the subject land also provide habitat for this species and no additional specific areas were included for the Leafless Tongue Orchid.

Protection of the areas mapped as important habitat is considered likely to be adequate to maintain the viability of local populations of the known threatened species that occur within the subject land. It should be noted however, that no assessment of the significance (pursuant to TSC Act or EPBC Act) of the removal of habitat not mapped as HCV has been completed and further studies to support these assessments could provide additional information that could be used to support refinement of the delineated HCV area.

8.1.6 Significant aquatic habitats

No significant aquatic habitats are considered to occur within the subject land. No areas of HCV have been defined on this basis.

8.2 WILDLIFE CORRIDORS AND RIPARIAN ZONES

Both the AHA 2008 and Biosis 2010 reports acknowledge the importance of riparian corridors in providing threatened species habitat and connectivity across the subject land. Riparian areas on the subject land are also identified as having "*significant habitat value worth retaining*" in the NBSP. Indeed, this formed the basis for the definition of the high constraint areas in the Biosis 2010 report. The high constraint riparian zone was based on the DWE (2008) guidelines which included:

- a Core Riparian Zone (CRZ) of 20m either side of a channel (totalling a 40m width);
- a vegetated buffer either side of the CRZ of 10m; and
- a nominal 20m Asset Protection Zone either side of the 10m vegetated buffer.

This provided for a total high constraint area of 50m either side of the channel. This meets the requirements for a Category 1 Environmental Corridor in the SCRCP and is considered adequate.

The SCRCP includes second order and above streams as corridors whereas the high constraint mapping by Biosis 2010 included all stream orders. This was also to capture the higher quality threatened species habitat and as such the original high constraint mapping by Biosis 2010 is considered appropriate and has been incorporated into areas defined as HCV in this review.

As stated in Section 8.1.5, additional areas that were also considered important for proving connectivity for threatened species have also been identified as areas of HCV in this review.

A comparison of the HCV areas identified in this review and the existing mapping of high constraint and environmental conservation areas of AHA 2008 and Biosis 2010 and 2011 is provided in Appendix C. However, it should be kept in mind that the scope of the AHA and Biosis studies was not to define HCV areas as defined in the SCRCP which was an objective of this review.

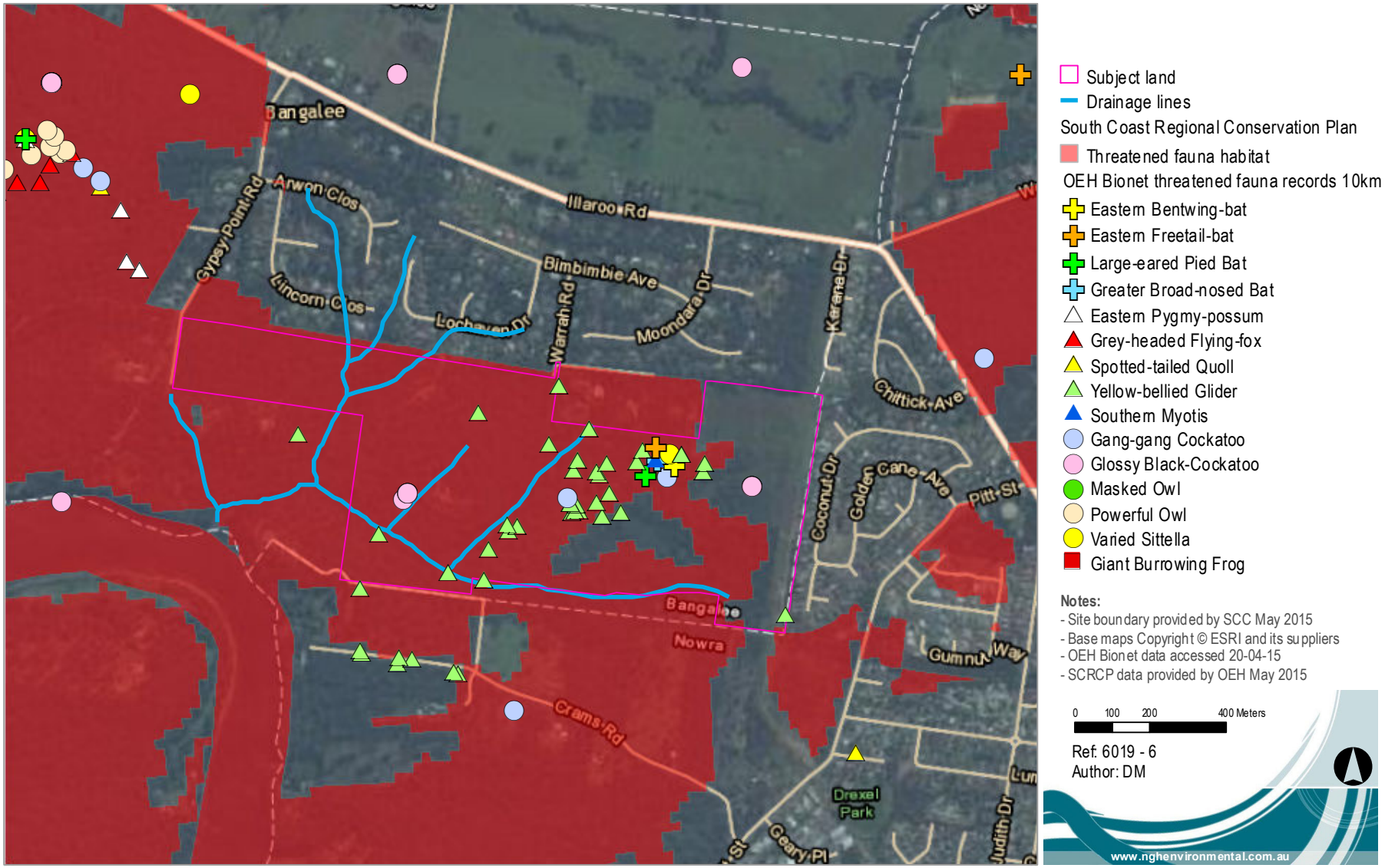

Figure 8-1 Threatened fauna habitat as mapped in the SCRCP 2010

9 CONCLUSION AND RECOMMENDATIONS

This review has independently and objectively assessed five biodiversity studies and reports that pertain to the subject land, Lot 24 DP 714096, Warrah Road, Bangalee. It has critically analysed and documented the consistencies and differences between these studies and compiled this information to make an independent assessment of the conservation value of the subject land, with specific reference to high conservation value land as defined in the South Coast Regional Conservation Plan 2010.

This review has identified that:

- The methodologies employed to survey the subject land were generally consistent with applicable guidelines.
- In general, the studies are in agreement with regard to the likelihood of key threatened species occurring on the subject land and having high potential to occur.
- The definition of the HCV areas for the subject land can be seen to be largely determined by one criterion; that being the presence of verified threatened species habitat, considered important to the viability of local populations. In the absence of exhaustive multi seasonal targeted surveys on and surrounding the subject land and assessments of significance to consider the impact of removal of habitat, the delineation of 'high constraint' and 'high conservation value' areas requires professional judgement and therefore differs across the existing studies. The result is often a result of the differing interpretation of applying the 'precautionary approach'.
- The information contained in the existing studies is sufficient to clearly define areas of high conservation value based on the definitions provided in the South Coast Regional Conservation Plan.

This review has employed the precautionary principle in assessing the conservation values of the land which states that

> "*if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation"*.

In this review, the principle is most relevant to defining important habitat for threatened species, where the DEC (2004) states:

> "*where adequate surveys have not been conducted within a study area due to limitations, the precautionary principle should always be adopted."*

It is the opinion of this review that areas that provide good quality known habitat for threatened species should be included as areas of high conservation value unless it can be adequately demonstrated that the known habitat is no longer important to the relevant threatened species. This would include but may not necessarily be limited to conducting surveys according to the draft *Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities* (DEC 2004) and meeting the survey effort requirements for the species being targeted. Assessments of significance pursuant to the TSC Act or EPBC Act could also be completed to determine the importance of specific areas of threatened species habitat in the context of the broader subject land.

This review recommends that:

1. The areas identified as high conservation value in Appendix C be considered for Environmental Conservation (E2) zoning to protect the biodiversity values contained in

these areas unless it can be adequately demonstrated that loss of these areas would not result in a significant impact, through adequate survey and analysis.

2. That the remaining areas can be considered for an appropriate level of developmental zoning that is consistent with SCC's planning objectives and that any subsequent development applications be assessed with regard to all relevant legislation and planning processes.

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APPENDIX A ASSESSMENT PERSONNEL

Role, staff member	Qualifications and experience
Senior Ecologist (Botany) **Dave Maynard** **Author and field survey**	Dave holds qualifications in science and engineering. He completed his Honours in plant systematics in conjunction with UNSW and the Botanic Gardens Trust, Sydney in 2004. Dave specialises in biodiversity assessment, particularly field based flora surveys and vegetation community mapping. He has experience as Lead Botanist in small and large scale projects for vegetation community mapping including identification and demarcation of endangered ecological communities. He has also led targeted threatened species surveys, such as Leafless Tongue Orchid (*Cryptostylis hunteriana*), East Lynne Midge Orchid (*Genoplesium vernale*) and Crimson Spider Orchid (*Caladenia concolor*). Dave is regularly involved in fauna habitat assessment and survey for projects he is working on. He has been involved in numerous diurnal and nocturnal mammal, reptile and bird surveys particularly targeting threatened fauna species. Dave is based on the NSW far south coast and has extensive experience in this region. Dave is an accredited Biobanking Assessor.
Manager – NSW SE & ACT **Brooke Marshall (CEnvP)** **Senior review**	Brooke has an honours degree in Natural Resources from the University of New England (UNE) where she specialised in wildlife management and ecosystem rehabilitation. Brooke prepares and reviews environmental impact assessment, biodiversity assessment, and environmental management documentation undertaken in the South Coast and ACT regions. Brooke has worked on large scale infrastructure projects including subdivision and land use planning projects. Brooke is an accredited Biobanking Assessor and Certified Environmental Practitioner.
Director – NGH Environmental **Nick Graham-Higgs (CEnvP, FEIANZ)** **Senior technical input and Certification**	Nick has worked as an environmental planning consultant since 1992, specialising in natural resource management. His work demands an in-depth knowledge of current planning and environmental legislation coupled with a comprehensive understanding of development-related impacts. Nick has acquired his knowledge in this field for over 20 years, during which he has worked with a number of land management organisations within and outside Australia. Work undertaken includes the preparation of varied and complex environmental planning, environmental impact assessments, natural resource surveys (biodiversity surveys and assessments) and the preparation of environmental management plans. Nick is a Certified Environmental Practitioner and a Fellow of the Environment Institute of Australia and New Zealand.

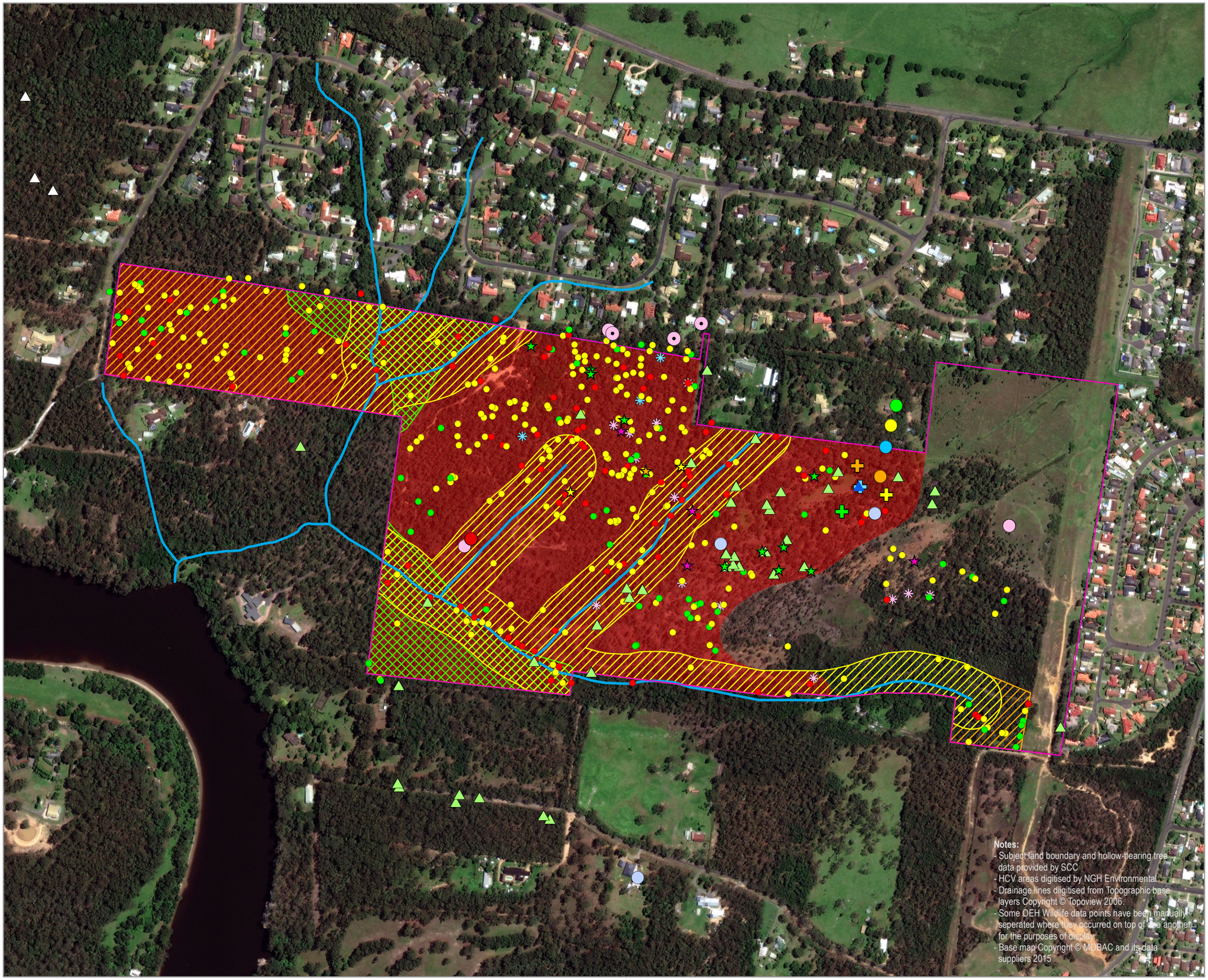
APPENDIX B VERIFICATION RULES FOR IDENTIFICATION OF HIGH CONSERVATION VALUE AREAS

The following are the recommended verification procedures for ground-truthing of mapped high conservation value areas on the South Coast. It is taken directly from Section 8.1.1 of the South Coast Regional Conservation Plan (DECCW 2010)

Value	Verification rules
Vegetation-related values • **EECs** • **rare vegetation types** • **overcleared vegetation types** • **vegetation in overcleared landscapes.**	Vegetation is not of high conservation value if it is in poor condition, as defined in section 5.3. The vegetation community descriptions and listing of diagnostic species and associated environmental parameters in Tozer et al. (2006) should be consulted for on-ground verification of vegetation type. The final determinations for EECs under the TSC Act and EPBC Act are the key documents in deciding whether a patch of vegetation is an EEC.
Old-growth vegetation	Old growth is largely defined by the current canopy structure, which should largely consist of senescing or mature trees. Regrowth should be less than 30% of the canopy. There should also be negligible evidence of disturbances such as logging or catastrophic fires. The old-growth layer in this RCP is probably the least accurate of all information provided. Thus it is suggested the occurrence of mapped old-growth features should be confirmed or checked on the ground.
Threatened fauna	The data provided by the RCP ties verified records to mapped vegetation polygons. The Atlas of NSW Wildlife can be consulted to determine what threatened fauna records are involved. Until an appropriate survey (DEC 2004) demonstrates otherwise, the mapped habitat should be regarded as important habitat. Important habitat contributes to the viability of local threatened fauna populations and can include, but is not limited to, essential breeding resources, foraging resources and connectivity corridors. The Threatened Species Web Tool will provide further assistance in habitat identification and advises what other fauna species should be considered.
Threatened flora	The data provided by the RCP ties verified records to mapped vegetation polygons. The Atlas of NSW Wildlife can be consulted to determine what threatened plant records are involved. Targeted surveys for the identified plant species should occur within the proposed development or planning area. The Threatened Species Web Tool advises what other plant species should be considered.

Value	Verification rules
Significant aquatic habitats • **nationally important wetlands** • **catchments of** • **significant lakes and estuaries** • **habitat of migratory wetland species**	The key question is whether a planning or development decision is within, or affects, the catchment of these environmental assets identified in the RCP, and (as required by the SCRS) whether this impact will have a neutral or beneficial effect.
Statutory conservation protection • **conservation and property agreements** • **declared wilderness** • **SEPP 14 wetlands** • **SEPP 26 rainforest**	These assets have surveyed or described tenure boundaries. Verification is a matter of determining whether the planning or development decision occurs within a defined area

APPENDIX C HCV AREA MAPS



HIGH CONSERVATION VALUE AREAS

Warrah Road Peer Review of Biodiversity Studies 49462E (D14/308516)

- Subject land
- Drainage lines

High Conservation Value (HCV) areas

- Higher quality threatened species habitat
- Poorly conserved vegetation
- Riparian corridors
- Additional areas important for connectivity

Threatened species records

OEH Threatened flora records

- Albatross Mallee
- Bauer's Midge Orchid
- Bomaderry Zieria
- Eucalyptus langleyi population
- Leafless Tongue Orchid

OEH threatened fauna records (includes Biosis)

- Eastern Bentwing-bat
- Eastern Freetail-bat
- Large-eared Pied Bat
- Greater Broad-nosed Bat
- Eastern Pygmy-possum
- Yellow-bellied Glider
- Southern Myotis
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Varied Sittella

AHA 2008 Threatened species results

- Grey-headed Flying Fox
- Squirrel Glider
- Squirrel Glider den tree
- Yellow-bellied Glider feed tree

OMVI 2011 Threatened species results

- Glossy Black Cockatoo feed signs

Hollow-bearing trees (Biosis 2011)

Conservation significance ranking

- Low
- Medium
- High

Hollow-bearing trees (AHA 2008)

- Suitable for Glossy Black Cockatoo
- Suitable for owls

0 50 100 200 Metres

A3 @ 1:6000
Ref: 6019 - 7
Author: DM

Notes:
- Subject land boundary and hollow-bearing tree data provided by SCC
- HCV areas digitised by NGH Environmental
- Drainage lines digitised from Topographic base layers Copyright © Topoview 2006.
- Some OEH Wildlife data points have been manually seperated where they occurred on top of one another for the purposes of display.
- Base map Copyright © MOBAC and its data suppliers 2015

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TOTAL HIGH CONSERVATION VALUE AREA

Warrah Road Peer Review of Biodiversity Studies 49462E (D14/308516)

Subject land
Drainage lines
NGH total high conservation value (HCV) area

0 50 100 200 Metres

A3 @ 1:6000
Ref: 6019 - 8
Author: DM

Notes:
- Subject land boundary data provided by SCC
- HCV area digitised by NGH Environmental
- Drainage lines digitised from Topographic base layers Copyright © Topoview 2006.
- Base map Copyright © MOBAC and its data suppliers 2015

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HIGH CONSERVATION VALUE AREA COMPARISON WITH EXISTING STUDY HIGH CONSTRAINT AREAS

Crams Road Peer Review

Subject land
Drainage lines
NGH High Conservation Value (HCV) area

Previous report study areas
AHA 2008
Biosis 2011 and OMVI 2011

Previous constraint/environmental areas
AHA 2008 - High constraint area
Biosis 2011 - proposed conservation area

Notes:
- Subject land boundary data provided by SCC
- HCV areas digitised by NGH Environmental
- AHA 2008 high constraint area provided by SCC
- Biosis proposed conservation area digitised by NGH Environmental based on Biosis 2011 mapping
- Drainage lines diigitised from Topographic base layers Copyright © Topoview 2006
- Base map Copyright © MOBAC and its data suppliers 2015

0 50 100 200 Metres

A3 @ 1:6000
Ref: 6019 - 9
Author: DM

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