Biodiversity Assessment Method 2020 Operational Manual – Stage 2

Department of Planning and Environment

NSW GOVERNMENT

Cover photo: Brush-tailed rock-wallaby (*Petrogale penicillata*), Oxley Wild Rivers National Park. John Spencer/DPE

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Shortened forms

Abbreviation	Description
ALA	Atlas of Living Australia
AOBV	Area of Outstanding Biodiversity Value
APZ	asset protection zone
AVH	Australasian Virtual Herbarium
BAR	Biodiversity Assessment Report: includes Biodiversity Development Assessment Reports (BDARs); Biodiversity Certification Assessment Reports (BCARs); and Biodiversity Stewardship Site Assessment Reports (BSSARs)
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BCAR	Biodiversity Certification Assessment Report
BCD	Biodiversity Conservation Division (of the department)
BCT	Biodiversity Conservation Trust

Abbreviation	Description
BDAR	Biodiversity Development Assessment Report
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BOAMS	Biodiversity Offsets and Agreement Management System
BRW	biodiversity risk weighting
BSA	biodiversity stewardship agreement
BSSAR	Biodiversity Stewardship Site Assessment Report
BMP	biodiversity management plan
CEEC	critically endangered ecological community
DIWA	Directory of Important Wetlands in Australia
EEC	endangered ecological community
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (C'th)
IBRA	Interim Biogeographic Regionalisation for Australia, Version 7
LLS	NSW Local Land Services
LLS Act	*Local Land Services Act 2013* (NSW)
LMBC	land management and biodiversity conservation
the manual	Biodiversity Assessment Method 2020 Operational Manual
NSW	New South Wales
the department	NSW Department of Planning and Environment
PCT	plant community type
SAII	serious and irreversible impact
the Scheme	Biodiversity Offsets Scheme
SEPP	State Environmental Planning Policy
SEED	Sharing and Enabling Environmental Data
SMART	specific, measurable, achievable, realistic, timebound
SSD	state significant development as defined by the EP&A Act
SSI	state significant infrastructure as defined by the EP&A Act
TBDC	Threatened Biodiversity Data Collection
TEC	collective term for threatened ecological communities (VECs, EECs, CEECs)
VEC	vulnerable ecological community
Veg-C	BioNet Vegetation Classification
VI	vegetation integrity
VMP	vegetation management plan
VZ	vegetation zone

Introduction

The NSW *Biodiversity Conservation Act 2016* (BC Act), and Biodiversity Conservation Regulation 2017 (BC Regulation) provide the framework for addressing impacts on biodiversity from development and clearing. The framework requires a proponent to avoid, minimise and offset impacts on biodiversity from these actions using the Biodiversity Offsets Scheme (the Scheme).

The Scheme establishes biodiversity stewardship agreements (BSAs), which are voluntary in perpetuity agreements entered into by landholders. BSAs are the mechanism used to secure offset sites where the improvement in biodiversity values is used to offset the loss incurred by development and clearing of native vegetation elsewhere in New South Wales.

The Scheme includes the Biodiversity Assessment Method 2020 (BAM), which is enabled by s 6.7 of the BC Act. The BAM provides:

- a transparent, consistent, and scientific approach for the assessment of biodiversity values on a proposed development, clearing or biodiversity stewardship site
- guidance on how a proponent can avoid and minimise potential biodiversity impacts
- a method for calculating the number and class of biodiversity credits that need to be offset to meet the standard of 'no net loss' of biodiversity.

At a proposed biodiversity stewardship site, the BAM is used to assess the biodiversity values on the site, identify the types of management actions and activities that must be undertaken as part of the management plan, and determine the number and class of biodiversity credits that can be created based on those management actions.

The types of development and clearing proposals that are assessed using the BAM include:

- applications for development consent under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), other than an application for state significant development or for a complying development certificate (see s 7.13(1) of the BC Act), and the modification of such consents
- applications for development consent for state significant development or for approval for state significant infrastructure under the EP&A Act (see s 7.14(1) of the BC Act), and the modification of such consents
- Part 5 activity under the EP&A Act, where the proponent has elected to obtain a biodiversity development assessment report (BDAR), under Division 2 of the BC Act (see s 7.15(1) of the BC Act), and the modifications of such approvals
- biodiversity certification of land (see ss 8.2 and 8.7(1) of the BC Act)
- applications to clear native vegetation on rural land under Division 6 of Part 5A of the NSW *Local Land Services Act 2013* (LLS Act) that do not meet the requirements of allowable activities or the Land Management (Native Vegetation) Code 2018
- clearing of native vegetation in urban areas and environmental conservation zones under the *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (i.e. clearing that does not need development consent under the EP&A Act), that exceeds the offset thresholds.

Applying the BAM does not preclude the obligation to separately consider the requirements of other related legislation. Where applicable, proponents must comply with the requirements of the Scheme as well as other legislation or statutory

instruments (e.g. State Environmental Planning Policies). Whether offset requirements under the Scheme will satisfy the requirements of other legislation will be a matter for the decision-maker[1] to decide. This will depend on the context, characteristics and impacts of the specific proposal.

Where an action will impact on an Australian Government listed entity that is not listed under NSW legislation, the Australian Government will set the assessment requirements and consent conditions for that entity (refer to the *Aligning Biodiversity Assessments* fact sheet). The BAM can be used to assess impacts from a proposal on an entity listed only under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and these should be clearly documented in the BDAR. However, biodiversity credits cannot be created or traded under the Scheme for these entities because they are not listed under the Schedules of the BC Act. Biodiversity credits can only be created for NSW-listed entities. Any biodiversity credit output displayed in a BAM-C credit report for entities listed under the EPBC Act but not listed under the BC Act is invalid. The BAM-C credit reports have messaging that reflects this situation, referring the proponent to the Australian Government. Note that the requirements relating to serious and irreversible impacts (SAII) (clause 6.7 of BC Regulation) will not apply to EPBC Act only listed entities.

[1] 'Decision-maker' includes: consent authorities for development applications under Part 4 of the EP&A Act; the Minister for Planning and Public Spaces for activities under Part 5.1 of the EP&A Act; determining authorities for activities under Part 5 of the EP&A Act; the Native Vegetation Panel for approvals for clearing native vegetation under s. 60ZF of the LLS Act and permits under clause 14 of the *State Environmental Planning Policy (Native Vegetation) 2017*; the Minister for Environment and Energy in relation to biodiversity certification under Part 8 of the BC Act and BSAs under Part 5.5 of the BC Act (BAM 2020, Glossary).

BAM Operational Manual

Purpose of the manual

The BAM Operational Manual (the manual) provides operational guidance to assist decision-makers, applicants and accredited assessors in the application of the BAM. The manual is a companion document to the BAM. As it does not generally repeat text in the BAM, the 2 documents should be read together. The manual may also reflect updates to administrative structures, position titles and data sources since the BAM was last gazetted.

Structure of the manual

The manual reflects the 3 stages of the BAM. Each stage is presented as a separate document to enable easy access to relevant information when implementing the BAM.

Stage 1: Biodiversity assessment identifies the types of biodiversity values on land, such as:

- land proposed as a development site, including for a Part 5 activity
- land subject to a vegetation clearing proposal that is required to be assessed by BAM under the LLS Act
- land proposed to be biodiversity certified
- land proposed as a biodiversity stewardship site under a BSA.

Stage 1 focuses on the assessment of the landscape context, the vegetation integrity (VI) of native vegetation[2], and habitat suitability for threatened species.

Stage 2: Impact assessment (biodiversity values and prescribed impacts) applies the avoid, minimise and offset hierarchy and assesses direct, indirect and prescribed impacts associated with the development or clearing proposal. It is used to determine the offset requirements for all residual impacts on biodiversity values at a proposed site. In general, these are measured as ecosystem credits and species credits. Stage 2 determines the number, class and offset trading group of biodiversity credits.

Stage 2 is the focus of this document.

Stage 3: Improving biodiversity values is used to assess the anticipated improvement (or gain) in the VI of native vegetation and habitat suitability for threatened species, the management actions, and preparation of a management plan at a stewardship site. The stage is also used to determine the number of biodiversity credits created at the site from the anticipated improvement in biodiversity values.

Streamlined assessment modules are set out in BAM Appendices B, C and D and may be used where the proposal impacts on scattered trees, a small area or planted native vegetation, respectively. Guidance for *Streamlined assessment module – planted native vegetation* (Appendix A) is available. Further guidance to support implementation of the streamlined assessment modules is in preparation.

[2] Native vegetation is defined under s. 60B of the LLS Act as plants native to NSW (trees, under-storey plants, ground cover, plants occurring in a wetland), established in NSW before European settlement.

BAM Stage 2: Impact assessment (biodiversity values and prescribed impacts)

Introduction to Stage 2

The purpose of BAM Stage 2 is to assess the impact on biodiversity values within and surrounding the land proposed for development, activity, clearing or biodiversity certification. The assessment relies on the outcomes of Stage 1, which determines the biodiversity values within the subject land, current VI score and habitat suitability. BAM assessments must be undertaken by a specialist ecological consultant who has accreditation to apply the BAM (provided for under s 6.10 of the BC Act). This accredited person is referred to as an assessor.

Under the BAM, the proponent must apply the key principle of **avoiding and minimising** the **direct, indirect and prescribed** impacts on biodiversity values. A biodiversity offset is determined for the residual direct impacts on biodiversity values.

The manual differs from the BAM in that it does not include comprehensive descriptions of the method or any processes that are completed automatically by the BAM Calculator (BAM-C). For this information, refer to the relevant sections of the BAM.

Resources

A range of online resources are available to assist assessors applying the BAM. Key resources are available on the BAM Assessor Resources webpage (Appendix A). All online resources and websites referred to in the manual are listed in Appendix A.

Biodiversity Offsets and Agreement Management System (BOAMS)

- The case management system used to administer the Scheme
- Assessors must use the BAM-C in BOAMS to apply the BAM. BOAMS is also used to submit BAM related applications, generate a credit obligation or apply to sell or retire credits
- The BOAMS case must be included with the application to the decision-maker
- Assessors may also use BOAMS to submit an expression of interest for a BSA on behalf of a landholder or submit a credit wanted listing on behalf of a development proponent
- Important habitat maps are available for those species for which the habitat constraint in the Threatened Biodiversity Data Collection (TBDC) refers to a mapped area
- For more information about how to use the BOAMS, the user guide can be accessed from the 'Frequently Asked Questions' module after logging in to BOAMS

Biodiversity Assessment Method Calculator (BAM-C)

- The tool that operationalises the BAM. The BAM-C stores survey data recorded by the assessor and calculates the number and type of credits required to offset the impacts of development on, or credits generated from improvements in, biodiversity values
- Two versions of the BAM-C exist:
  - a public standalone version (open to all but will not save data or print reports)

  - a password protected version accessed through the BOAMS for the use of assessors and decision-makers when preparing or reviewing BAM related proposals (see above)
- The case in the BAM-C for the proposed development, activity, clearing, biodiversity certification or stewardship site must have a finalised status before it can be submitted to the decision-maker
- For linear developments that cross more than one Interim Biogeographic Regionalisation of Australia (IBRA) subregion, create separate BAM-C cases for each subregion within a single 'parent' BOAMS case
- Updates to the biodiversity data referenced by the BAM-C, including to the underlying species and native vegetation data held in BioNet, occur periodically. All registered users of the BAM-C will be notified accordingly
- Refer to the BAM-C User Guide for information on how to use the application. This can be accessed through the information tab in the BAM-C

BOS Help Desk

- The BOS Help Desk is available if you need support, want more information, or to send feedback on the Scheme and BAM. Contact information is available on the BOS Help Desk webpage (Appendix A)
- To receive a timely and accurate response from the BOS Help Desk, provide specific information, including:
  - type of development (e.g. sub-division, biodiversity certification)
  - location (LGA at a minimum)
  - DA number or SSD/SSI identifier (according to the NSW Planning Portal – Major Projects)
  - time constraints (e.g. proposed date of BAR submission to the consent authority, survey dates)
  - other relevant information that provides context for the query (e.g. PCT identifiers, threatened entities names, BAM-C/BOAMS case number). This will assist the help desk to identify a Scheme subject matter officer

BioNet Atlas

- A publicly accessible online database that contains biodiversity observation data for New South Wales
- Ecological consultants need to request a login that gives access to full location data and the ability to submit species sightings and survey data
- Supporting manuals, quick guides, information sheets and datasheets are available on the BioNet Resources webpage

BioNet Threatened Biodiversity Data Collection (TBDC)

- The database contains information for listed threatened species, populations and ecological communities such as survey requirements and habitat constraints that can guide identification of species polygons
- It houses information and data used in the BAM-C and to support SAII assessments

BioNet Systematic Flora Survey

- Systematic vegetation survey data (VIS data) for New South Wales, including full floristic survey sites, rapid sites and site vegetation condition information

BioNet Vegetation Classification (Veg-C)

- The database contains information on plant community types (PCTs) described for New South Wales including general location, floristic composition and structure, condition benchmarks and per cent cleared information
- All users must request a login
- Veg-C is the primary source for defining equivalent or part equivalent associations between PCTs and threatened ecological communities (TECs)
- The Plot to PCT Assignment Tool is a web application supporting identification of PCTs in eastern NSW
- Supporting power queries are available on the BioNet Resources webpage (e.g. benchmarks, TEC to PCT associations)

BioNet web services

- NSW biodiversity data held in BioNet that has been made available via an Open Application Programming Interface
- It enables organisations and individuals to directly integrate biodiversity data into their software systems

Areas of Outstanding Biodiversity Value (AOBV)

- Declared Areas of Outstanding Biodiversity Value (AOBV) can be found in the Areas of Outstanding Biodiversity Value register. Links to declarations of these sites are recorded within the register

Sharing and Enabling Environmental Data (SEED)

- SEED is a shared resource for environmental data that includes public access to the datasets of the NSW Department of Planning and Environment (the department)
- Available spatial datasets include:
    - NSW (Mitchell) Landscapes – version 3.1
    - Interim Biogeographic Regionalisation of Australia (IBRA regions and sub-regions) – Version 7
    - NSW soil profiles
    - hydrogeological landscapes
    - acid sulfate soils risk maps
    - digital cadastral database
    - BioNet Vegetation Map Collection (previously called the Vegetation Information System Maps)

PlantNET NSW

- An online database of the flora of New South Wales that contains the currently accepted taxonomy for plants found in the state, both native and exotic
- Online keys for plant identification, as per the published Flora of NSW (Harden 1990–2002) and updates
- Plant taxonomy and naming in Biodiversity Assessment Reports (BARs) must be consistent with the Flora of NSW, as per PlantNET

1. Documenting outcomes

1.1 Requirements for Biodiversity Assessment Reports

BAM Stage 2 assessment outcomes are documented in a BDAR or Biodiversity Certification Assessment Report (BCAR) – referred to as BARs for the purpose of this manual. The BAM Stage 2 assessment does not apply to Biodiversity Stewardship Site Assessment Reports (BSSARs).

BAM Stage 2 results in submission of a BAR, including the finalised BAM-C case(s) and submission of the BOAMS case to the decision-maker. Final reports and digital data are to be submitted using the 'Upload Files' function in BOAMS (see Section 3.3.3 of the BOAMS user guide). Digital files include:

- final BAR and appendices
- digital datasets for all map components in the BAR
- digital copies (scanned hardcopies) of all field datasheets for the VI assessment
- survey results in a format that can be analysed (e.g. MS Excel).

Refer to Appendix D for further details of digital data requirements.

The BAM details the minimum information required in a:

- BDAR or BCAR in Appendix K (Table 25)
- BDAR or BCAR applying the streamlined assessment modules in Appendix L (Table 26–28).

Other resources for preparing a BAR include the:

- Biodiversity Development Assessment Report Template
- Guidance for the Biodiversity Development Assessment Report Template

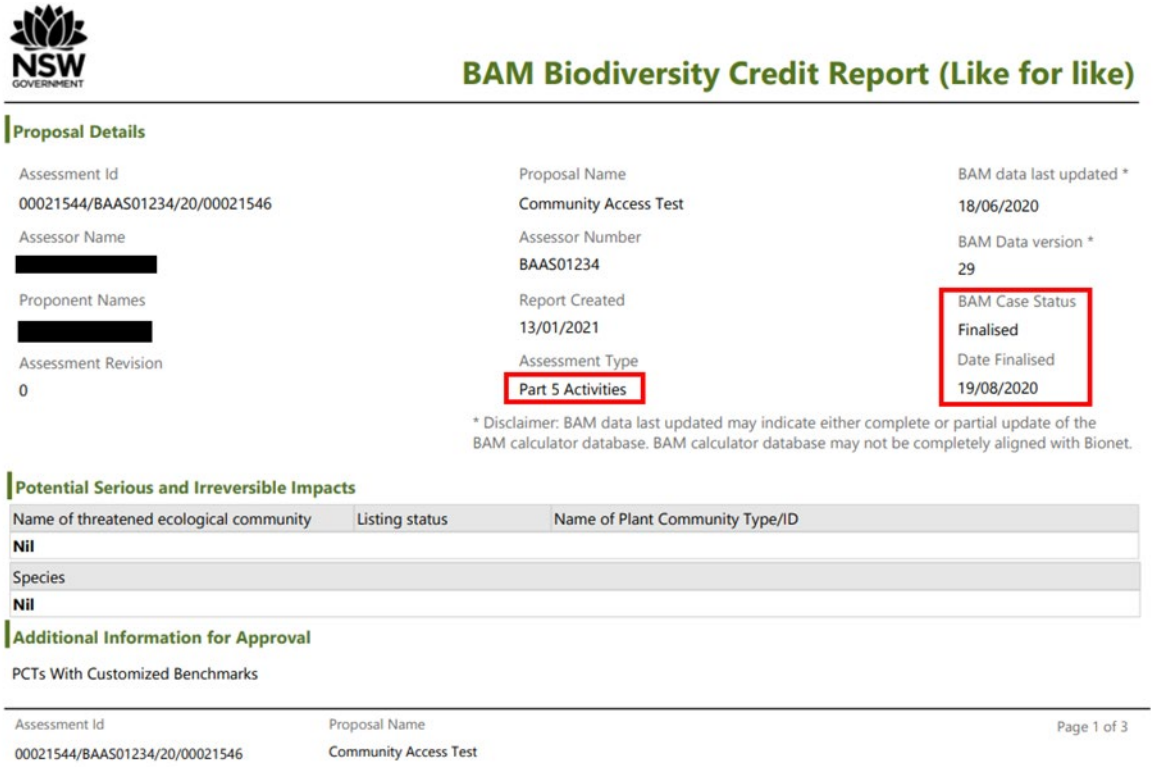
Refer to Appendix A for further details.

1.2 Currency of the Biodiversity Assessment Report

To meet the requirement of the BC Act (s 6.15(1)), the assessor must certify (for instance by signing the first page) that:

- the current version of the BAR was prepared based on the requirements of (and information provided under) the BAM at a specified date
- that date is within 14 days of the date the BAR is submitted to the decision-maker.

In addition, the BAR must be submitted to the decision-maker within 14 days of the date on the relevant finalised credit report(s) generated by the BAM-C (Figure 1). The date the assessor signs the BAR does not need to match the date on the finalised credit report. To be considered valid, however, the BAR must be submitted within 14 days of the date the credit report was finalised.



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00021544/BAAS01234/20/00021546	Proposal Name Community Access Test	BAM data last updated * 18/06/2020
Assessor Name [redacted]	Assessor Number BAAS01234	BAM Data version * 29
Proponent Names [redacted]	Report Created 13/01/2021	BAM Case Status Finalised
Assessment Revision 0	Assessment Type Part 5 Activities	Date Finalised 19/08/2020

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCTs With Customized Benchmarks

Figure 1 **Example of a finalised biodiversity credit report from the BAM-C**

1.3 Requirements for maps

The BAR must include 2 maps of the subject land – the Site Map and the Location Map – based on digital aerial photographs, such as ADS40 or best available imagery. Minimum map requirements are outlined in BAM Appendix K and L, and include:

1. **Site Map** at a capture scale of 1:1,000 or finer showing the:
   - property boundary
   - subject land boundary
   - cadastre boundaries within the subject land (including labelling of Lot and DP, or section plan if relevant)
   - landscape features identified in BAM Subsection 3.1.3
2. **Location Map** at a capture scale of 1:1,000 or finer showing the:
   - subject land boundary
   - assessment area, including the subject land and a:
     - 1,500 m buffer from the subject land's boundary, and/or
     - 500 m buffer either side of the centre line for a linear-shaped proposal (e.g. highway or major road)
   - landscape features identified in BAM Subsection 3.1.3
   - additional relevant details, such as local government area boundaries and Local Land Services boundaries.

Capture scale refers to the scale of the digital dataset.

All maps must be easy to read with clear headings, keys, unambiguous colour ramps, symbols and geo-references (e.g. a scalebar and north arrow). Important features or boundary lines can be represented as spatial point(s) with GPS coordinates referenced on the corresponding legend.

Printed maps may be produced at a different scale to the above requirements if all relevant features and text are readable. For example, if edges are clearly defined, the map may be presented at a scale suitable for display on an A4 page. Multiple maps on A4 pages may be used to present landscape features in detail, providing each map is the same scale for comparison. Use insets to show each map location relative to the subject land.

2. Types of biodiversity impacts

The BAM defines different types of impacts occurring within and beyond the subject land (Box 1). Impact types may not be exclusive to one category; for example, the impact of wind turbine strikes on protected animals is both a prescribed and uncertain impact. The BAM requires that impacts on biodiversity values once identified, must be avoided or minimised, then residual impacts offset.

Box 1. Defining the subject land

Under the BAM, the **subject land** is defined as:

land subject to a development, activity, clearing, biodiversity certification or biodiversity stewardship proposal. It excludes the assessment area which surrounds the subject land [i.e. the 1,500 m or 500 m buffer zone described in BAM Subsection 3.1.2(b)]. *In the case of a biodiversity certification proposal, subject land includes the biodiversity certification assessment area.*

2.1 Direct impacts

Direct impacts are 'impacts on biodiversity values and threatened species habitat that relate to clearing native vegetation and impacts on biodiversity values prescribed by the BC Regulation'. Loss of vegetation through initial clearing and final land use must be considered.

These impacts:

- are predictable
- occur on the subject land
- can be readily identified during the planning and design phases of a development
- can result from construction and/or operation of a development, whether permanent or temporary
- may result in partial clearing (e.g. ground cover, litter and functional attributes such as logs removed but all other structural components of the vegetation remain) or complete clearing.

2.2 Indirect impacts

Indirect impacts are 'impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the subject land or within retained areas. This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts'.

Examples include increased noise, dust, light spill, weeds, pathogens, dumping rubbish and edge effects that can be reasonably attributed to the development. Indirect impacts:

- may have a lower or variable intensity compared to direct impacts
- may be harder to predict spatially and temporally
- may have unclear boundaries.

Despite variability, indirect impacts must still be avoided or minimised in the site selection, design and operational phases of a project.

2.3 Prescribed impacts

Prescribed impacts are identified in clause 6.1 of the BC Regulation and BAM Stage 1, Chapter 6 (see also BAM Operational Manual – Stage 1); they are the impacts of:

- development on the following habitat of threatened species or ecological communities:
  - karst, caves, crevices, cliffs, and other geological features of significance
  - rocks
  - human-made structures
  - non-native vegetation
- development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- development on movement of threatened species that maintains their life cycle
- development on water quality, waterbodies and hydrological processes that sustain threatened species and TECs (including from subsidence or upsidence resulting from underground mining or other development)
- wind turbine strikes on protected animals
- vehicle strikes on threatened species of animals or on animals that are part of a TEC.

Prescribed impacts may affect biodiversity values in addition to, or instead of, impacts from clearing native vegetation. They can be direct and/or indirect impacts. These impacts may be difficult to quantify or offset, as they often affect biodiversity values that are irreplaceable; **consequently, avoiding or minimising such impacts is critical.**

2.4 Uncertain impacts

Uncertain impacts are those impacts – typically indirect and prescribed – that are infrequent or difficult to measure prior to development (BAM Section 8.5). An adaptive management approach can be used to quantify and respond to these impacts during different phases of the development.

Examples of uncertain impacts include:

- wind turbine strike on protected bird and bat species
- collision (powerline strike), electrocution, and exposure to electrical and magnetic fields of threatened birds and bats due to installation of powerlines
- changes to vegetation structure and/or floristic composition resulting from modifications to the hydrological regime that impact on a threatened entity
- disruption of threatened fauna breeding cycles from noise and vibration
- increased predation caused by changed environmental conditions (e.g. tracks increasing fox and cat access to threatened fauna habitat, powerline corridors providing nesting and hunting habitats for raptors).

3. Avoiding or minimising impacts on biodiversity values

(BAM Chapter 7)

The BC Act establishes a legal framework for avoiding and minimising before offsetting residual biodiversity impacts. The Act provides that measures to offset or compensate for impacts on biodiversity values may only be undertaken **after** steps are taken to avoid and minimise those impacts.

In practice, this means proponents (guided by their assessors) must first seek to avoid direct, indirect and prescribed impacts from the proposed development on biodiversity values, including:

- native vegetation
- threatened species and TECs
- habitat for threatened species and TECs.

Proponents must then minimise any remaining impacts before offsetting them.

Demonstrable exploration of reasonable avoid and minimise measures on developable land is necessary to meet the avoid and minimise provisions of the BAM and BC Act. Assessors document the analysis and evolution of avoid and minimise options in the BAR (see Section 3.3 of the manual) to provide transparency and support decision-making. Failure to demonstrate genuine and robust exploration of reasonable avoid and minimise measures can compromise the approval of a proposed development.[3,4]

Reasonable measures will vary with the circumstances of each proposal and may be somewhat subjective. This provides decision-makers with discretion to consider each proposal on merit.

The information collected in Stage 1 of the BAM and any other relevant information is used by the proponent and assessor to design and plan the proposal to avoid and minimise impacts. This may be an iterative and evolving process of information collection, analysis, planning, design and consultation with the consent authority to determine the final proposal.

Assessors should:

- obtain accurate information about all aspects of the proposal
- identify all activities/outcomes of the proposal and the effect of each on biodiversity by asking questions such as:
  - how do threatened species currently use the site?
  - how will the proposal change threatened species habitat and site utilisation?
  - will the proposal result in long-term changes to vegetation structure and ecological function by benefitting some species and impairing others?
- establish and maintain early, regular contact with the proponent and consent authority to ensure changes to the proposed concept or design details are fully assessed in the BAR, particularly where constraints are identified as the assessment of the proposal proceeds

[3] IRM Property Group (No. 2) Pty Ltd v Blacktown City Council [2021] NSWLEC 1306

[4] Planners North v Ballina Shire Council [2021] NSWLEC 120

- evaluate changes to current land management, such as cessation of grazing, and proposed land management practices that may alter biodiversity impacts
- ensure all measures evaluated, even those not selected for implementation, are documented in the BAR.

The following principles should be applied when determining measures to avoid and minimise impacts of a proposal on biodiversity values:

- actions are applied as early as possible in the project life cycle, to inform potential development decisions (see Box 2)
- impacts and corresponding reasonable measures have been identified over the life of the project, from site selection and planning through to the operational and rehabilitation phases
- reasonable measures are supported by implementation approaches that seek to maintain the biodiversity values of avoided land; for example, consent conditions, conservation agreements or similar covenants that prevent disturbance and degradation.

Box 2. Project planning to avoid and minimise impacts on biodiversity values

The BAM identifies 2 key areas of project planning to avoid and minimise direct, indirect and prescribed impacts:

- proposal location – locating the development away from the highest biodiversity values
- proposal design – retaining biodiversity values through design features that limit vegetation clearing or reduce the amount of development within the footprint.

Identifying opportunities to avoid and minimise at an early stage in project planning can provide the greatest opportunities to reduce impacts on biodiversity and therefore reduce overall development costs.

Locating developments in cleared areas or sites with non-native vegetation will achieve savings in time (shorter review time by the decision-maker) and/or costs (e.g. less requirement for targeted surveys, lower offset requirements).

Use an interactive planning approach to respond to biodiversity information collected during the assessment process. Document refinements or changes to project location and design throughout the assessment process to demonstrate the avoid and minimise hierarchy has been applied.

3.1 Avoiding biodiversity impacts

The assessor must clearly present information in the BAR on how potential impacts on biodiversity values have been avoided.

Avoidance of direct, indirect and prescribed impacts must be demonstrated. Examples of measures to avoid impacts on biodiversity values include:

- alternatives for the location and design of the proposal have been evaluated with evidence of analysis of social, economic and environmental considerations
- consideration of alternative technologies to achieve the same outcome with reduced impacts (e.g. horizontal directional drilling instead of trenching to avoid surface disturbance)

- details of constraints that have influenced the selection of the proposal's location (e.g. areas of biodiversity, wind modelling for a wind farm development, location of resource deposits for a mine development)
- constraints for matters other than biodiversity that might restrict the availability of alternative sites or footprints (e.g. areas of flooding, proximity to neighbours with odour or noise concerns, zonings)
- consideration of whether the areas of impact are focused away from threatened species habitat (e.g. karst systems, waterbodies, vegetation corridors) or vegetation with a high VI score
- whether the proposed development makes the best use of space (e.g. overlapping infrastructure to minimise impact area)
- mechanisms to assure biodiversity values in avoided areas are not degraded or lost (e.g. a biodiversity management plan (BMP) or vegetation management plan (VMP) required by consent conditions or a conservation agreement).

Avoidance is of key importance to prescribed impacts as these often involve habitat features that generally cannot be readily replaced or offset.

Where the Scheme has been triggered, the BAM requires impacts to be avoided, regardless of the type and scale of the development or size of the site. On some highly constrained or small sites, it may be challenging or prohibitively costly to undertake some types of development, particularly if the biodiversity values of the subject land are high. It benefits proponents, assessors and consent authorities alike to apply the avoid and minimise hierarchy and identify these situations early.

3.2 Minimising biodiversity impacts

Impacts that cannot be avoided must be minimised. Where an impact cannot be avoided, reasonable measures must be identified to minimise the proposed impact.

In considering this step the assessor should report on:

- industry best practices and standards (citing appropriate references)
- the proportion of the total cost of the development that is dedicated to biodiversity protection, including the costs to undertake the onsite measures and the cost of fulfilling the offset requirement for residual impacts
- the likely efficacy and risk of failure of each reasonable minimisation measure. Timing, frequency and funding of activities as well as those responsible for carrying them out may be relevant to demonstrating and justifying efficacy and risk.

Any measures proposed to minimise impacts must be set out and justified in the BAR; examples include:

- clearly marking and protecting areas of retained vegetation on the site during the construction phase
- designing fencing to prevent fauna vehicle strike along roads
- designing wind turbines to reduce the chance of collision with bird and bat species; for example, increasing turbine visibility, deterring perching, installing strike mitigation technologies
- implementation of hygiene protocols to minimise the spread of weeds and pathogens by staff/machines/vehicles into areas of retained native vegetation or threatened species habitat
- mapping of high-threat weeds for future management.

Further examples of avoiding and minimising impacts on biodiversity are provided in BAM Chapter 7.

See Appendix B of this manual for avoid and minimise case studies. An additional guide for avoiding and minimising under the BAM is also being prepared.

3.3 Demonstrating avoid and minimise decisions

The BAR must clearly document:

- the evolution of the proposal to avoid biodiversity values on developable land
- thorough exploration of the feasibility of alternative options (including cost–profit analyses)
- spatial identification of relevant avoided areas (including maps and digital files)
- analyses (including data), and explanations or justifications to support avoid and minimised decisions.

Measures or options considered but **not implemented** because they are not feasible and/or practical (e.g. due to site constraints) must be documented, as this will provide the decision-maker with confidence that the proponent has fully complied with the BAM.

Where a BAR is prepared for a modification of a development consent under the EP&A Act, or for biodiversity certification, include the measures already undertaken to avoid and minimise impacts and clearly distinguish them from the measures proposed to be undertaken.

For modification of a biodiversity certification provide a revised version of the BCAR and identify whether any areas of land proposed to be added to the biodiversity certification were subject to approved measures under the original certification to avoid or minimise biodiversity impacts.

3.4 Conditions of consent

Section 7.13(3) of the BC Act provides that if granting consent for Part 4 projects, other than for SSD/SSI, the conditions of consent **must** require retirement of biodiversity credits to offset residual impacts. For SSD/SSI projects, under s 7.14(3) the consent or approval conditions **may** require retirement of biodiversity credits to offset residual impacts. In both cases, the residual impact is defined as follows:

> the impact after the measures that are required to be carried out **by the terms or conditions** of the consent or approval to avoid or minimise the impact on biodiversity values of the proposed development.

In practice this means that to be considered to be reducing impacts and to subsequently reduce offset obligations, the avoid and minimise measures for these types of projects must be required by the consent conditions.

For Part 5 developments the approval may require the retirement of credits to offset residual impacts, but the residual impact is defined slightly differently from the above, as *the impact after measures required to avoid or minimise impacts on biodiversity values* (see s 7.15(3) of the BC Act).

4. Assessing the impacts of the proposal on biodiversity values

(BAM Chapter 8)

Once the location and extent of the proposal are finalised (Section 3 of this manual), the direct and indirect impacts on native vegetation and the habitat of threatened entities, as well as prescribed and uncertain impacts, are assessed. This will require information and data gathered in BAM Stage 1.

4.1 Assess direct impacts

(BAM Section 8.1)

Direct impacts on native vegetation and habitat of threatened entities are assessed within the subject land (Section 2.1 of this manual).

4.1.1 Scoring full loss of vegetation

The BAM-C automatically calculates the future VI score for each vegetation zone (and any management zones) using BAM Appendix H, Equations 25–30.

Where complete clearing of native vegetation is associated with a development proposal (including biodiversity certification), the future value of each VI attribute is recorded as zero in the BAM-C.

4.1.2 Scoring partial loss of vegetation

The assessment of partial loss allows for situations where direct impacts may not result in the complete loss of all vegetation. In an Asset Protection Zone (APZ), for example, some trees will be retained resulting in partial loss. Where partial clearing is proposed and the remaining vegetation in the area of partial clearing will be maintained (i.e. not degraded further over time), the future values of the relevant VI attributes may be determined to be greater than zero, but cannot exceed their current value (see Table 1).

In vegetation zones with partial clearing of attributes, determine the *future value* for those attributes that will be retained (i.e. not scored as zero). Where a mixture of complete and partial clearing occurs in the same vegetation zone the assessor must map and identify these as different management zones. The *BAM Calculator User Guide* provides instruction on entering this information into the BAM-C for biodiversity stewardship sites. The same method can be applied to a development site where it is used to characterise different impacts within individual vegetation zones (for an example, see Box 3).

Scoring of partial loss in the BAM-C must include a reduction in VI score that is proportional to the amount or degree of partial clearing and associated future management. It must reflect any likely degradation from changed land-use patterns (e.g. increased threats) and/or future management proposed (e.g. to enable recruitment). When assessing the impacts of partial clearing, the assessor must refer to the average values in the original plot data and the benchmark value for each of the condition attributes.

Include evidence-based justification in the BAR for scoring of partial loss (e.g. recruitment will be inhibited, threats will be increased, weed management is only proposed for a certain period). In addition, provide a clear outline of the proposed ongoing management of the vegetation being retained to maintain the expected future VI value. Provide information consistent with that provided for minimising biodiversity

impacts, such as management methods, timing and frequency of management activities (see Section 3.2). This may form part of the avoid and minimise section of the BAR.

An additional guide for scoring partial loss under the BAM is being prepared.

Box 3. Management zones – assessing complete and partial clearing impacts

Development of a poultry production complex has been proposed within a paddock used for stock grazing. The proposed subject land includes native vegetation, comprising 2 PCTs (Figure 2):

- PCT 16 – grassy open woodland (Black Box grassy open woodland wetland of rarely flooded depressions in south western NSW) in moderate/good condition (VZ 1)
- PCT 45 – native grassland (Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion), resulting from a long-term, conservative grazing regime in the paddock. Most of PCT 45 is in good/high condition (VZ 2), except a small patch in poor condition (VZ 3), located near a watering point.

The proposed development includes clearing for construction of 2 poultry sheds, adjoining infrastructure and a single-lane access road from the sheds to the site boundary. An APZ is required inside the boundary of the proposed development, which must be mown twice a year.

The eastern side of the subject land is at risk of flooding, preventing infrastructure development in this area. Consequently, direct impacts on biodiversity values in VZ 1 will be avoided. Construction of the access road is located in VZ 3 due to its lower vegetation condition – this area will be completely cleared. In VZ 2, direct impacts to biodiversity values will fall into 3 categories:

- no clearing (no impact) – vegetation retained and managed under a VMP
- partial loss of structural and floristic attributes in the firebreak due to mowing (partial impact – mowing)
- total clearing for construction of the shed, ancillary infrastructure and road (total impact).

The areas of varying direct impact in VZ 2 are mapped as separate management zones (Figure 3). Labels for identifying vegetation zones and management zones must be used consistently across the BAM-C, the BAR and supporting spatial data.

The likely change to VI attributes due to each impact is included in the future value score for management zones (refer to the BAM-C User Guide).

Note: The scenario described above is fictional (including Figures 2 and 3), created to demonstrate correct use of the BAM and BAM-C.

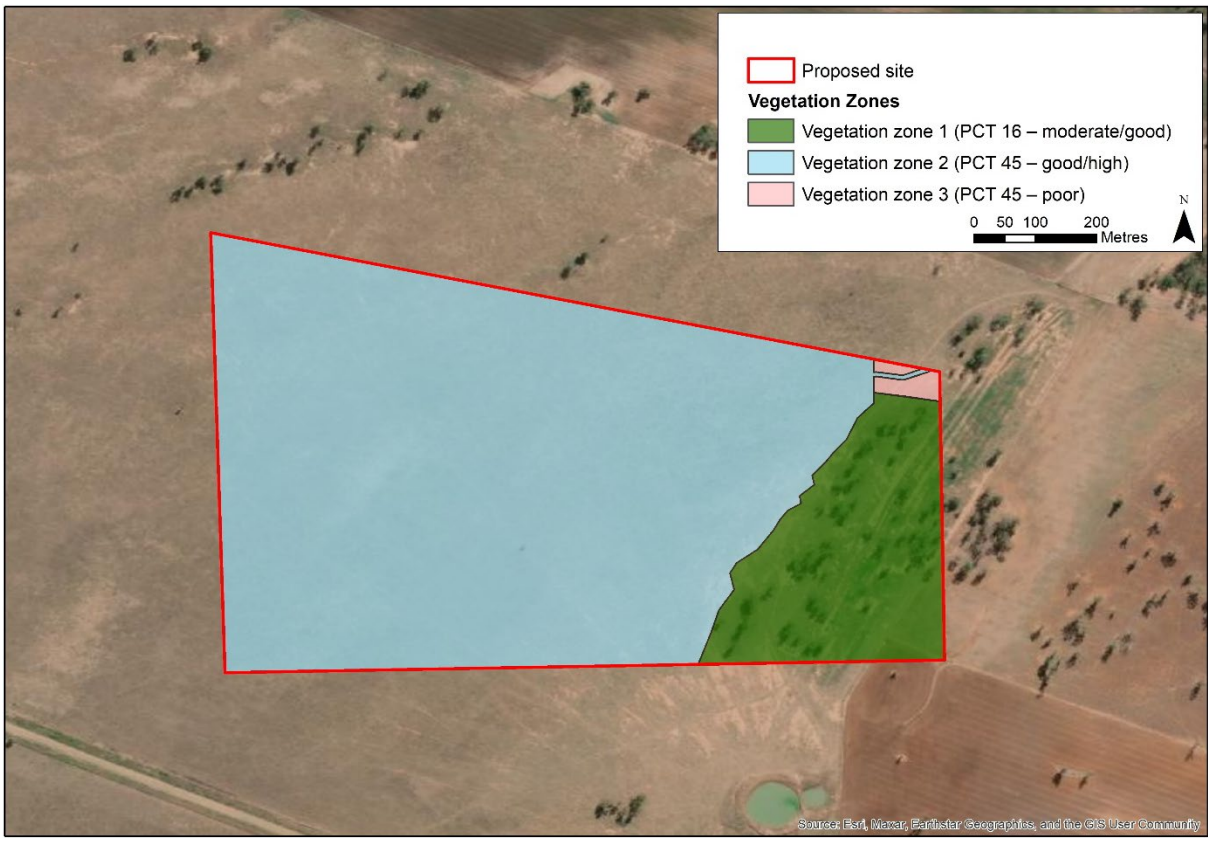


Figure 2 **Vegetation zone mapping for proposed development (Box 3 example)**

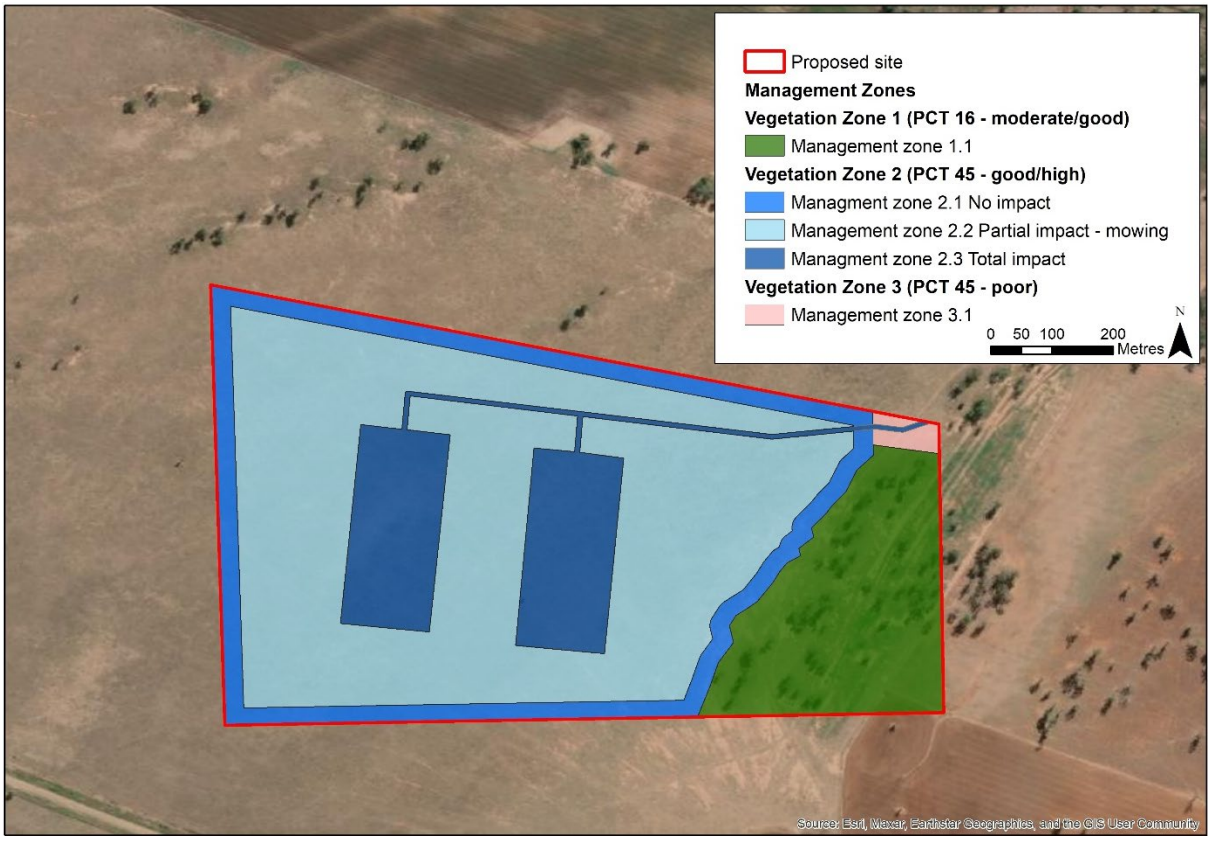


Figure 3 **Management zone mapping to identify impacts of complete and partial clearing on proposed development (Box 3 example)**

Table 1 **Partial vegetation clearing – examples of future VI scores for relevant attributes**

Clearing activity	Attributes affected	Attributes not affected
Asset Protection Zone (APZ) (e.g. slashing or mowing understory vegetation to a specified height, trampling by machinery)	Shrubs and other growth form groups that typically occur in the under and mid-storey will be cleared: VI attribute score = 0 Tree cover and species richness attributes will be retained but could decline due to ongoing vegetation thinning from maintenance work: VI attribute score = >0 but below current condition	Cover attributes for grass and forb growth form groups and functional attributes (e.g. large trees) may retain current condition scores, if unaffected by APZ maintenance and if managed appropriately Specific habitat features or specific threatened species may be targeted for retention
Easements for services (e.g. electricity transmission lines, telephone lines)	Removal of tree and shrub growth forms: • richness attribute score = 0 • cover attribute score = 0 • function attribute score (number of large trees, tree regeneration, tree stem size class) = 0 Other function attributes may be partially retained: Function attribute score (litter cover, fallen logs) = < current condition	Richness and cover attributes for grass and forb growth form groups may retain current condition scores, if unaffected by easement clearing or digging In sections of the easement where no clearing or digging is required, VI attribute scores may be retained at current condition scores if managed appropriately. Ongoing management should ensure maintenance of the easement does not increase exotic species cover in the retained vegetation
Recreational open space (e.g. community park; example is increase in visitor access)	Loss of grass and forb growth forms (replaced by turf): All attribute scores = 0 Loss of large trees (considered unsafe): All attribute scores = 0 Shrubs may be partially retained: • cover attribute score = < current condition • richness attribute score = < current condition	Retention of attributes will be highly site-specific. Scores must reflect the potential ongoing decline of remaining attributes due to increased human disturbance (e.g. rubbish, trampling, weed invasion) and/or if ongoing management is proposed
Airfield – maintaining line of sight (e.g. tree thinning)	Removal of the tree growth form group is likely, to accommodate 'obstacle limitation surface': All attribute scores = 0 (or very low)	VI attributes for remaining growth form groups may be retained at current condition scores if managed appropriately

4.2 Assess indirect impacts

(BAM Section 8.2)

Indirect impacts are defined in Section 2.2 of this manual.

Identify all indirect impacts to native vegetation, threatened entities and their habitat beyond the subject land in the BAR. Examples of indirect impacts for consideration are listed in BAM Section 8.2(2.). This list is not exhaustive and requires assessors to use their best judgement when assessing indirect impacts of a proposal.

For each indirect impact identified, describe the following characteristics (see Table 2 for examples):

- nature of the impact
- impacted entities
- extent
- frequency
- duration
- timing
- likelihood
- consequences.

Indirect impacts may occur at different stages of the development (e.g. construction or operation) or post-development, from changed land-use patterns (e.g. increased likelihood of threats or changed hydrological processes). Consider both short and long-term impacts. Where possible, provide evidence-based justification for impact predictions and discuss any limitations to the data and assumptions.

Examples of short and long-term indirect impacts include:

- increased exotic species or regrowth of aggressively colonising native shrubs caused by disturbance facilitating penetration of the vegetation assemblage
- a localised reduction/loss of the stored aerial and soil seed bank from removal and disturbance of topsoil, leading to loss of serotinous flora species
- a localised change in microclimate (e.g. changes in temperature, wind, light and humidity) caused by loss of the canopy cover in the vegetation assemblage
- a localised change in hydrology of the vegetation assemblage and habitat (e.g. changes in surface water flows from the loss of structural features capturing surface water)
- a localised change in soil conditions of the vegetation assemblage and habitat (e.g. increased sedimentation and nutrient availability due to direct impact to the soil profile and removal of stabilising vegetation)
- a localised change in species interactions such as pollination and seed dispersal.

Table 2 Indirect impacts – examples and information required in the BAR

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase / timing of impact	Likelihood and consequences
Dam construction: Changed hydrology from dam construction	PCT 16 (Black box woodland)	VZ 1 (PCT 16)	Ongoing	Long-term	Pre-construction to post-construction	Highly likely. Loss of species richness and cover in impacted vegetation
Dam construction: Changed hydrology from dam construction	PCT 66 (Artesian springs wetland)	VZ 7 (PCT 66)	Ongoing	Long-term	Pre-construction to post- construction	Highly likely. Loss of species richness and cover in vegetation downstream of the proposal site
Dam construction: Erosion and sediment deposition in downstream habitats	TEC wetland and floodplain vegetation	VZ 7 (PCT 66)	Ongoing	Long-term	Pre-construction to post-construction	Likely. Loss of species richness and cover in impacted vegetation
Dam construction: Erosion and sediment deposition in downstream habitats	Booroolong frog habitat	Streambed	Ongoing	Long-term	Pre-construction to post-construction	Highly likely. Loss of Booroolong frog (*Litoria booroolongensis*) habitat leading to population decline
Subdivision: Construction of informal walking tracks through adjacent vegetation to the beach	Littoral rainforest TEC	Adjacent to VZ 4	Ongoing	long-term	Post-construction and open to public	Highly likely. Reduction in TEC condition, causing increased light penetration, weed and pathogen incursion, and soil compaction from walking tracks
Subdivision (with minimal open space): Trampling and weed spread due to recreational pressure on nearby natural areas	Box-gum woodland TEC	Native vegetation corridor between proposal and an existing subdivision	Ongoing	Long-term	Post-construction	Highly likely. The subdivision site is on previously agricultural land and is weedy. Reduction in TEC condition, loss of native species richness and structure, and associated decline in fauna habitat

Indirect impact	Impacted entities	Extent	Frequency	Duration	Project phase / timing of impact	Likelihood and consequences
Subdivision: Increase in predation of native fauna from companion animals	Threatened woodland birds and hollow-dependent fauna	Adjacent native vegetation	Ongoing	Long-term	Post-construction (occupation)	Highly likely. Death of individuals and loss of local population viability
Highway construction: Construction of multi-lane highway through forest	Masked owl, sooty owl, powerful owl, barking owl	Forest and woodland on both sides of the highway	Ongoing	Short-term (1–2 breeding seasons)	Construction	Likely. Depends on distance to nest and if nearby roost trees have been lost due to construction
Highway operation: Operation of multi-lane highway	Masked owl, sooty owl, powerful owl, barking owl	Forest and woodland on both sides of the highway	Ongoing	Long-term	Post-construction	Highly likely. Highways can act as a population sink for large forest owls, which are vulnerable to collision with vehicles

4.3 Assess prescribed biodiversity impacts

(BAM Section 8.3)

Prescribed impacts often affect biodiversity values that are irreplaceable – therefore, avoiding or minimising them is critical. These impacts are highly likely to be scrutinised by the decision-maker and carefully considered in approval decisions, including conditions of consent.

Prescribed impacts are defined in Section 2.3 of this manual.

Identify all prescribed impacts to native vegetation, threatened entities and their habitat within or beyond the subject land in the BAR. For each prescribed impact identified, describe the following characteristics:

- impacted entities
- nature of the impact
- extent
- frequency
- duration
- timing
- consequences.

Where a potential prescribed impact is considered unlikely to affect biodiversity values on and surrounding the subject land, provide evidence to support this decision in the BAR.

The *Addendum to NSW Biodiversity Offsets Policy for Major Projects: upland swamps impacted by longwall minimum subsidence* (Appendix A) provides additional guidance for prescribed and other impacts associated with longwall mining.

4.3.3 Entities likely to be impacted

To generate a list of entities likely to use feature(s) identified as a prescribed impact in Stage 1 (BAM Chapter 6), consider:

- the list of candidate species produced by the BAM-C for the subject land
- BioNet records within the vicinity of the subject land – this aims to capture any species not included in the candidate species list by the BAM-C due to an absence of PCTs associated with that species on the subject land
- information on species and TEC occurrence, from previous surveys, published and unpublished literature, local government data layers and other relevant sources
- information gained from field reconnaissance and site visits
- for wind farms, bird and bat species resident in, or likely to fly over, the subject land.

Describe in the BAR how the list of threatened entities was generated. Also address the importance of the habitat feature to each threatened entity (e.g. how the feature is likely to be used).

4.3.4 Characteristics of the impact

Similar to indirect impacts, consider the types of impacts that could occur as a result of the various phases of development (e.g. operational, construction), whether these impacts will be permanent (e.g. rocky habitat is removed, water flow is redirected,

alteration of cave microclimates due to loss of vegetation surrounding the entrance, removal of a shed used as a roost or breeding site for threatened bats) or temporary (e.g. short-term change in water flow, partial loss of connectivity between patches of vegetation that will be restored in the post-operational phase of the development). Document the estimated duration of temporary impacts in the BAR.

The location of the prescribed impacts, including polygons identifying the extent of the impact, must be mapped on the Site and Location maps included in the BAR. For example, where a proposal may result in vehicle strike on threatened fauna or animals that are part of a TEC, identify potential impact locations on the Site Map.

4.3.5 Consequences of the impact

For each prescribed impact, predict the likely consequences of the impact on all relevant species, ecological communities or their habitat. Consider the effect on the species or community at the local, bioregional and state scales. Cumulative impacts – from the proposed development and other large-scale or similar developments within the region – should also be considered and discussed in the BAR. Check the department's registers and local government registers, and consult the decision-maker.

Factors used to predict consequences will depend on the prescribed impact and the target entity. A development that fragments a wildlife corridor, for example, requires consideration of the target species' mobility, home range and life history characteristics, and any barriers to movement. Similarly, for a development with ancillary roads, an estimated rate of vehicle strike would involve an analysis of the target species' abundance, movement patterns, home range and ability to cross barriers. Additional requirements for other prescribed impacts are outlined in BAM Section 8.3.

Support predictions of impact consequences with evidence documented in the BAR. Discuss any limitations to the data, assumptions and predictions.

Evidence could be in the form of:

- appropriate modelling (e.g. collision risk modelling for bird/bat strike by wind turbines)
- relevant literature (e.g. scientific publications), policies and guidelines
- published, peer-reviewed reports
- consultation with species experts (documentation must include name of expert, qualifications, written advice, date advice received).

4.4 Mitigate and manage impacts

(BAM Sections 8.4 and 8.5)

Impacts – direct, indirect and prescribed – that remain after avoiding and minimising (see Section 3 of this manual) must be mitigated and managed. Under the BAM:

- **mitigate** refers to proactive actions aimed at preventing, or reducing the extent/severity of, an impact
- **manage** refers to reactive actions undertaken to reduce the severity of an impact that has occurred, or prevent future impacts of the same nature from occurring.

4.4.6 Mitigate impacts

(BAM Section 8.4; Subsections 8.4.1–8.4.2)

Document measures to mitigate and manage impacts in the BAR. For each impact, detail the proposed mitigation measures, including:

- the type of action
- the detailed method or technique to implement the action
- implementation schedule (timing, frequency and duration)
- the individual, role and/or organisation responsible for undertaking the action
- an evaluation of the risk of failure, including constraints to implementation (e.g. financial, biophysical and resource availability)
- ecologically based criteria or indicators – employing the SMART principles for determining:
  - if the mitigation action(s) are successful
  - when the mitigation action(s) are complete
  - when remedial actions leading to adaptive management is required
- reporting requirements (data, timing and frequency).

To determine whether it is reasonable to apply a mitigation measure, consider:

- industry best practice and standards
- proportion of the total proposal cost dedicated to biodiversity protection
- risk of the measure failing.

Examples of mitigation measures for:

- impacts causing displacement of resident fauna are outlined in BAM Subsection 8.4.1
- prescribed impacts are outlined in BAM Subsection 8.4.2.

An example of the information expected in a BAR for mitigation measures is detailed in Table 3 to Table 5. Additional information may be appropriate depending on the specific development proposal.

These examples are not exhaustive, as each development proposal is unique. Assessors must use their expertise and judgement when considering mitigation measures relevant to the impacts occurring on the subject land.

In some cases, particularly where risk of the mitigation measure failing remains high, adaptive management strategies can also be included (for an example, see Table 5). Where no mitigation measures are proposed to address an impact, an adaptive management strategy must be proposed (see Sections 4.4.7 and 4.4.8 of this manual).

For large-scale developments, proposed mitigation actions must be numbered. Numbering in the BAR must be consistent with the statement of commitments in the Environmental Impact Statement (EIS). This will:

- streamline the decision-maker's review of the proposal
- support consistency between the BAR and EIS
- provide line-of-sight between the BAR and post-approval management plans for auditing and compliance.

Table 3 **Example of proposed mitigation and management measures for impacts (direct, indirect and prescribed) from a solar farm development – residual impact from native vegetation removal and disturbance potentially leading to weed incursion into adjacent retained native vegetation**

Mitigation measure	Method/technique	Timing	Frequency	Responsible	Likely efficacy
Biodiversity measure 1: Undertake targeted weed survey to develop baseline data	Map weed locations, identifying species, cover and extent	Pre-construction	NA	SEO	Moderate–high
Biodiversity measure 2: Control Bathurst burr (*Xanthium spinosum*) to minimise spread of existing cover	Visual inspections to identify weed germination	Pre-construction/ during construction	Weekly	SEO	Low. High risk of failure as the species is not considered manageable
Biodiversity measure 3: Clean all vehicles/ machinery prior to entering site to prevent weed seed transportation	Establish a wash down facility on the site boundary and guidelines for use. Conduct visual inspection of all vehicles/ machinery entering site	During construction	Ongoing	SS	Moderate
Biodiversity measure 4: All imported fill will be certified weed-free	Visual inspection of all filled areas to identify weed germination. Weed seedlings manually removed	During construction	Weekly	SEO	Moderate
Biodiversity measure 5: Sterile exotic crops or ground cover will be used where plantings are required beneath solar panels	Visual inspection	Post-construction	Quarterly – for 2 years post construction Annually – for remaining life of the project	PM	Moderate–high

Mitigation measure	Method/technique	Timing	Frequency	Responsible	Likely efficacy
Biodiversity measure 6: Control of weeds throughout the site and adjacent vegetation over the life of the project	Target species listed in an appendix to the report using ecologically appropriate methods. Visual inspection	During construction	Weekly	SEO & PM	Moderate
	Visual inspection	Post-construction	Quarterly – for 2 years post construction Annually – for remaining life of the project	SEO & PM	Moderate

SEO = Site Environmental Officer; SS = Site Supervisor; PM = Project Manager

Table 4 **Example of performance and completion criteria for mitigation measures for impacts to biodiversity for a solar farm – residual impact from native vegetation removal and disturbance potentially leading to weed incursion into adjacent retained native vegetation (continuing from Table 3)**

Mitigation measure	Performance criteria	Method	Completion criteria
Biodiversity measure 6: Control of weeds throughout the site and adjacent vegetation over the life of the project	Number of infestations of identified weed species equal to or less than baseline dataset Per cent cover for identified weed species in each management zone equal to or less than baseline dataset No occurrences of identified weed species in random plots sampled from adjacent vegetation	Survey at existing infestation locations Transect surveys throughout all areas of disturbance within the project site Permanently marked floristic plot sampling in randomly selected locations in adjacent native vegetation Opportunistic observations by all site staff	Ongoing for the life of the project

Table 5 **Example of triggers for adaptive management to address impacts from a solar farm development – residual impact from native vegetation removal and disturbance potentially leading to weed incursion into adjacent retained native vegetation (continuing from Table 3 and Table 4)**

Measure / action	Performance criteria	Adaptive management threshold	Adaptive management response	Reporting
Biodiversity measure 6: Control of weeds throughout the site and adjacent vegetation over the life of the project		Any infestation in location not on baseline map	Eradication of new weed infestation according to weed management protocol in an appendix to the report	Weed contractor reports to Project Manager Extent polygons and survey results updated and submitted after each monitoring Details included in annual report to the department
	Per cent cover for identified weed species in each management zone equal to or less than baseline dataset	A >5% increase in extent for any mapped polygon	Control weeds according to weed management protocol in an appendix	
	Occurrence of identified weed species in adjacent native vegetation	Any infestation within native vegetation not identified during baseline survey	Eradication of new weed infestation according to weed management protocol in an appendix	

4.4.7 Adaptive management of impacts

(BAM Sections 8.4 and 8.5)

Evaluate the remaining risks and associated consequence for biodiversity after mitigation measures are applied (Section 4.4.6 of this manual). An adaptive management plan is required to quantify and respond to impacts:

- for which mitigation measures have not been proposed
- for which mitigation measures have an uncertain likelihood of success
- that are uncertain.

Adaptive management is an adjustment of actions based on results, to achieve a specified outcome. Adaptive management actions may include:

- adjustments to the activity causing the impact
- adjustments to the mitigation measure, to reduce severity of the impact
- compensatory actions, including:
  - retirement of additional biodiversity credits to offset the impact (above the baseline credit requirement for direct impacts)
  - conservation measures.

Adaptive management plans are underpinned by monitoring programs, which signal if mitigation measures are being implemented as planned. They provide early warning of ineffective measures and/or uncertain impacts occurring. Monitoring programs must be based on current best practice (e.g. published peer-reviewed guidelines) and of sufficient scope and duration to provide data on signalling when impacts occur.

A measurable trigger or threshold is required to identify when remedial action is necessary. Triggers/thresholds identify when an impact has occurred (leading to mitigating actions) or is likely to occur (leading to preventative actions). Where relevant, both preventative and mitigating triggers/thresholds should be used and clearly identified in the adaptive management plan. Include a framework of the adaptive management plan in the BAR. Where relevant, describe:

- the impact type (i.e. direct, indirect, prescribed, uncertain), detailing:
  - threatened entities likely to be impacted
  - likelihood of the impact
  - extent of the impact, spatially and temporally
- the monitoring program required to detect an uncertain impact, including:
  - baseline data required (collected pre-impact) to monitor any change against
  - monitoring methods, including sample size, stratification, timing and frequency
  - seasonal changes or relevant impacts to be measured
  - thresholds or triggers for management intervention (ecologically based and employing the SMART principles)
- adaptive management actions proposed to reduce or eliminate the impact, including:
  - reference to the relevant phase of the development
  - criteria to indicate when the action is complete (ecologically based and employing the SMART principles)
- reporting (type, timing, frequency)
- information that will be necessary to measure the impact over time and how these results could be used to inform ongoing (or future) operations
- which measures will be undertaken and how these have been committed to by the proponent. The decision-maker should consider this and any additional risk of measures that have not been committed to.

Include justification, with reference to published literature and data where relevant, for the selection of:

- thresholds and/or triggers
- proposed management actions, additional offsets or conservation measures, including documentation of the decision pathway
- ecologically-based indicators that demonstrate:
  - if the management action(s) are successful
  - when the management action(s) are complete
  - when further remedial actions are required.

Where an adaptive management plan is considered unnecessary for a proposal or some impacts of the proposal, include details on the:

- size and nature of the impacts
- reasons why the severity and consequence of direct and indirect impacts are easily predicted and well understood.

Where the risk of mitigation and management actions failing to address an impact remains high, consider alternatives. Alternatives include assuming total loss for direct impacts or proposing compensatory actions (including additional credit obligations and/or conservation measures) for indirect and prescribed impacts (Section 4.5 of this manual).

4.4.8 Adaptive management for uncertain impacts

(BAM Section 8.5)

Some impacts are difficult to assess or predict prior to commencement of the development – these impacts are considered uncertain impacts (see also Section 2.4 of this manual). Examples of uncertain impacts include damage related to karst, caves or other rocky ecosystems; subsidence and upsidence from longwall mining; or wind turbine strike. Management of uncertain impacts requires development of an adaptive management plan (as per Section 4.4.7 of this manual) to quantify and respond to these impacts.

Adaptive management plans must align with the recommendations of any relevant guides published by the department, including the *Addendum to NSW Biodiversity Offsets Policy for Major Projects: upland swamps impacted by longwall minimum subsidence* (Appendix A).

Box 4 outlines an example of an effective adaptive management plan to address an uncertain impact. The strategy includes a final step to generate and retire credits should earlier measures set out in the strategy fail to prevent the impact.

Some uncertain impacts cannot be adaptively managed (e.g. line strike and electrocution of threatened aerial species with high voltage powerlines). In these cases, or where the risk of management failure is high, options to compensate for loss in biodiversity values should be considered (see Section 4.5 of this manual). Any biodiversity credits proposed to offset these uncertain impacts are in addition to those required for offsetting direct impacts. They will not be part of the baseline credits generated by the BAM-C (Section 6.1 of this manual).

Additional biodiversity credits or conservation measures to offset the uncertain impacts of a development may also be required by the decision-maker (see Section 4.5 of this manual).

Box 4. Upland swamps impacted by longwall mining subsidence

Upland swamps are perched freshwater wetlands occurring in shallow basins of low hills or mountains. Examples include Coastal Upland Swamps, Newnes Plateau Shrub Swamps, Montane Peatland and Swamp, Blue Mountains Swamps and Temperate Highland Peat Swamps on Sandstone.

Subsidence impacts on upland swamps from longwall mining are more uncertain than impacts of clearing native vegetation. It takes time and monitoring to determine whether impacts have occurred.

The *Addendum to NSW Biodiversity Offsets Policy for Major Projects: upland swamps impacted by longwall minimum subsidence* provides the framework for addressing these uncertain impacts. This can be used as a model for developing an adaptive management plan for uncertain impacts from other types of development. In general, the framework includes:

- indicators to detect impacts on the target entities (e.g. hydrological monitoring, species monitoring)
- monitoring programs with timeframes (e.g. minimum 2-year pre-impact monitoring), and design requirements (e.g. control sites to ensure indicator changes are a result of the development activity and not natural variability)
- measurable thresholds at which impacts are likely to affect the target entities (e.g. quantifiable changes in hydrology within 12 months of the commencement of mining operations)
- steps to be undertaken once impact thresholds have been triggered (e.g. reporting results to the decision-maker, review of results by an independent panel, changes to future longwall panel layout to avoid further impacts)
- the process to calculate, and retire, an additional offset requirement if thresholds are exceeded and impacts occur.

4.5 Address residual impacts

(BAM Sections 8.1 and 8.6)

Residual impacts are those remaining after all reasonable measures have been taken to avoid, minimise and/or mitigate the impacts of development.

An offset requirement is determined by the BAM, and calculated by the BAM-C, for residual direct impacts only (refer to Subsection 4.5.9 and Section 6.1 of this manual). For residual indirect and prescribed impacts, the BAM does not provide a standard method for calculating offset requirements. These impacts are often difficult to quantify, highly variable, and specific to the development and site context. Subsections 4.5.10 and 4.5.11 of this manual provide examples of how residual indirect or prescribed impacts can be addressed.

Although the BAM does not determine a credit obligation for indirect or prescribed impacts, decision-makers have discretion to increase the number of biodiversity credits to be retired (or require other additional measures to be undertaken) to offset residual prescribed or indirect impacts. These biodiversity credits are then additional to the baseline biodiversity credits determined by the BAM-C.

For Part 4 EP&A Act proposals other than SSD/SSI and complying development, the increased credit obligation must be justified, having regard to the environment, social

and economic impacts of the proposed development (see s 7.13(4) of the BC Act). Justification for changes to the number of credits to be retired (as stated in the BAR) is not required for SSD/SSI proposals (s 7.14(3)). For Part 5 developments, reasoning is only required to be provided if the number of credits to be retired are less than that specified in the BAR.

4.5.9 Residual direct impacts

(BAM Subsection 8.1.1)

Calculations of the number and type of biodiversity credits required to offset direct impacts only are based on change in VI score, from current to estimated future value.

Ecosystem credits are based on the change or loss in VI score of the proposed development on native vegetation and threatened species habitat through partial or complete clearing. This change is automatically calculated for each vegetation zone in the BAM-C (see BAM Appendix H, Equations 16–27).

Species credits where the unit of measure is 'area' are based on the loss of habitat, taken as the change in VI score across all areas of suitable habitat for the species, represented by the species polygon. Where the species polygon encompasses multiple vegetation zones, the BAM-C automatically collates the change in VI score for each vegetation zone within the species polygon to score the impact on species habitat (see BAM Appendix H, Equations 16–27).

Species credits where the unit of measure is 'counts of individuals' are based on the number of individuals of the species that will be lost because of the proposed development. All individuals expected to be lost from the development must be captured within the species polygon and are used to calculate the offset requirement. The VI score is not used in this assessment. The BAM-C automatically calculates the number of species credits for flora assessed by count using Equation 3 in the BAM (see Section 6.1.2 of this manual).

For further information on calculating the offset requirement for direct impacts, see Section 6.1 of this manual. Additional information on the unit of measure for a threatened species is in the BAM Operational Manual – Stage 1 (Subsection 4.4.5 of that manual).

Impacts to threatened species habitat that is **not** native vegetation (e.g. caves, cliffs, human-made structures) are assessed as prescribed biodiversity impacts (see Section 4.3 of this manual).

4.5.10 Residual indirect impacts

(BAM Section 8.6)

Where indirect impacts on biodiversity cannot be avoided, minimised or adequately mitigated (Sections 3 and 4.4 of this manual), the proponent should consider retiring additional biodiversity credits to compensate for the proposed impact. Additional biodiversity credits to offset indirect impacts on retained or adjacent areas of native vegetation and threatened species or their habitat may be necessary.

The type of information provided in Table 2 can be used to inform the best approach for estimating an offset for the residual indirect impact. Provide evidence in the BAR (including published studies, monitoring report data) for the extent of each indirect impact; possible approaches include:

- mapping an area of vegetation adjacent to an existing vegetation zone as a management zone. The area of the management zone can be defined by a set distance (e.g. X m buffer) from the outer edge of the direct impact area. The management zone is then used to estimate the indirect impact in terms of partial

loss in the VI score. The partial loss (e.g. a percentage of the original condition), scored in future value of the vegetation in that management zone, is estimated by considering the impact of the changed land use on each of the condition attributes used to determine the VI score. Partial loss will depend on the type of development, the condition of retained vegetation and its proximity to the development

- some major road infrastructure projects have used a 50 m buffer along the edge of the direct impact footprint and, depending on the condition of the remaining vegetation, applied a percentage partial loss to the buffered area to generate a credit requirement (see Appendix C for an example)
- some indirect impacts may result in the 'sterilisation' of remaining vegetation. For example, large-scale subdivisions often retain small remnants of native vegetation within the subject land for recreation. If left unmanaged, they may not remain viable in the long term due to incremental degradation (e.g. human disturbance, weed infestation). Proponents may agree to treat these areas as 'cleared' and offset the loss in biodiversity values accordingly.

An example of compensating for residual indirect impacts is provided in Box 5.

Document the decision pathway and justification for additional biodiversity credits or other compensatory conservation measures in the BAR.

Box 5. Example – compensating for residual indirect impacts

Scenario

A development application is proposing construction of a new 120 MW solar farm with energy storage and associated infrastructure. The proposal consists of 2 solar array areas (east and west) connected by below-ground cabling.

The subject land is located predominantly on cleared cropping and grazing land, with some remnant areas of PCT 277 (Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion). This vegetation community occurs in scattered patches across the subject land, with a combined area of 60 ha (Figure 4). PCT 277 is also habitat for the squirrel glider (*Petaurus norfolcensis*), which was determined present on the site.

Efforts to avoid and minimise included:

- prioritising retention of the larger vegetation patches of PCT 277
- locating ancillary facilities in areas with less, or no biodiversity values
- maintaining connectivity between patches to support movement of the species
- amending the configuration of solar panels to avoid the removal of trees.

The length and size of solar panels limited the degree to which the vegetation could be avoided. Consequently, the final subject land resulted in loss of some vegetation. Direct impacts will occur to 16 ha of PCT 277, while 44 ha will be avoided. This includes a 20 ha area of retained vegetation in the centre of the development (Figure 5).

Despite efforts to retain vegetation, these areas are expected to undergo deterioration over time due to edge effects. This was identified as an indirect impact.

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Condition of consent

To address indirect impacts to PCT 277, the application applies one of the following 3 options:

1. To compensate for the loss of biodiversity values from residual indirect impacts, the proponent must quantify the decline of VI associated with the remnant patches of PCT 277 on the subject land. This will include a description of how the attributes of VI (composition, structure and function) for each vegetation zone is expected to decline over the life of the proposal.

The output of this option is a biodiversity credit obligation that compensates for the residual indirect impact on the retained vegetation. This is in addition to baseline credits generated for direct impacts by the BAM-C.

2. Alternatively, due to implementing a BMP, the proponent must demonstrate how the VI of retained patches will be improved to benchmark condition for PCT 277. This will involve describing how the actions of the BMP influence the attributes of VI that change over the life of the proposal, as well as associated monitoring and reporting.

The output of this option is a BMP that mitigates the indirect impacts on the retained vegetation.

3. The proponent may choose a combination of options 1 and 2, applied to different areas of retained vegetation.

Justification

Conditions of consent aim to either offset the decline in condition over time (1) or take action to maintain and improve the condition over time (2). In this instance, the proponent chose the Scheme credit requirement in lieu of the more arduous BMP, as a means of compensating for the loss of biodiversity values resulting from residual indirect impacts.

Note: The scenario described above (including Figures 4 and 5) is fictional, created to demonstrate correct use of the BAM and BAM-C.

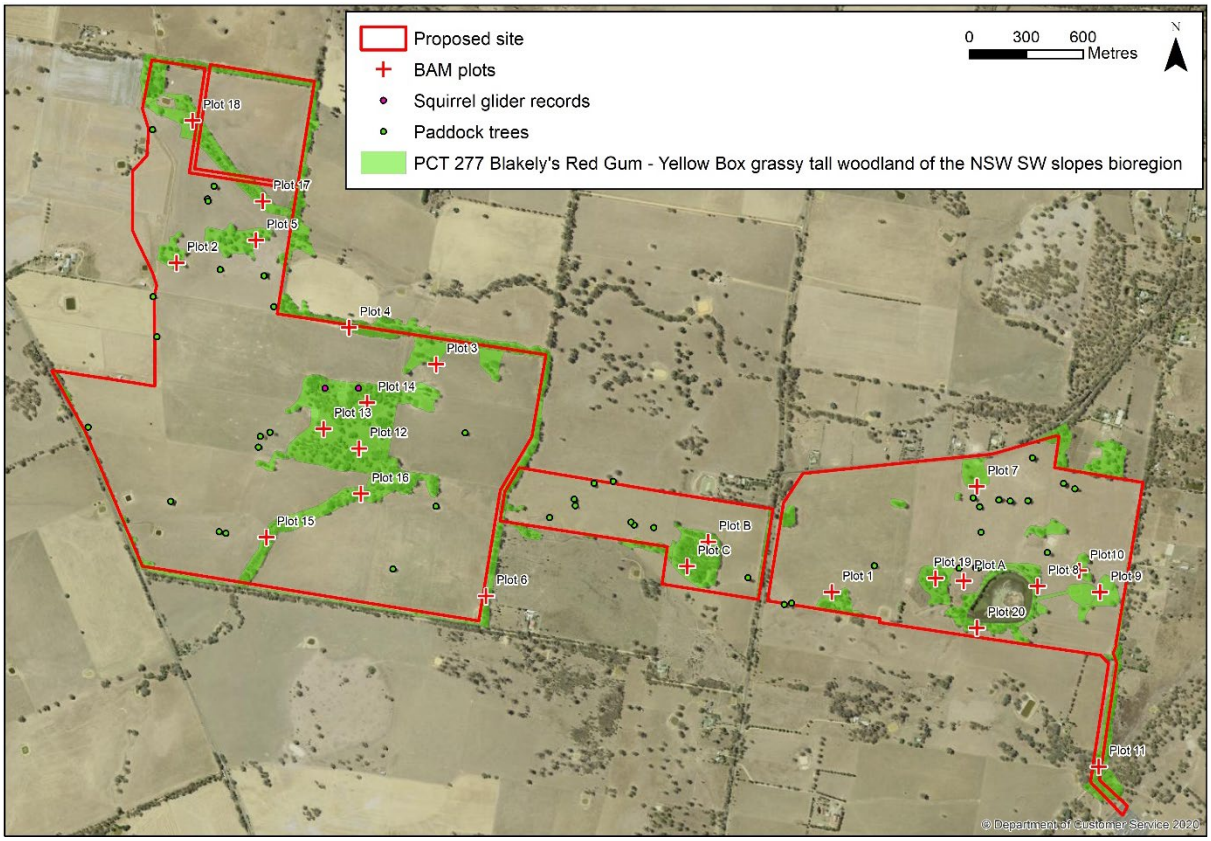

Figure 4 **Proposed location for solar farm (Box 5 example)**

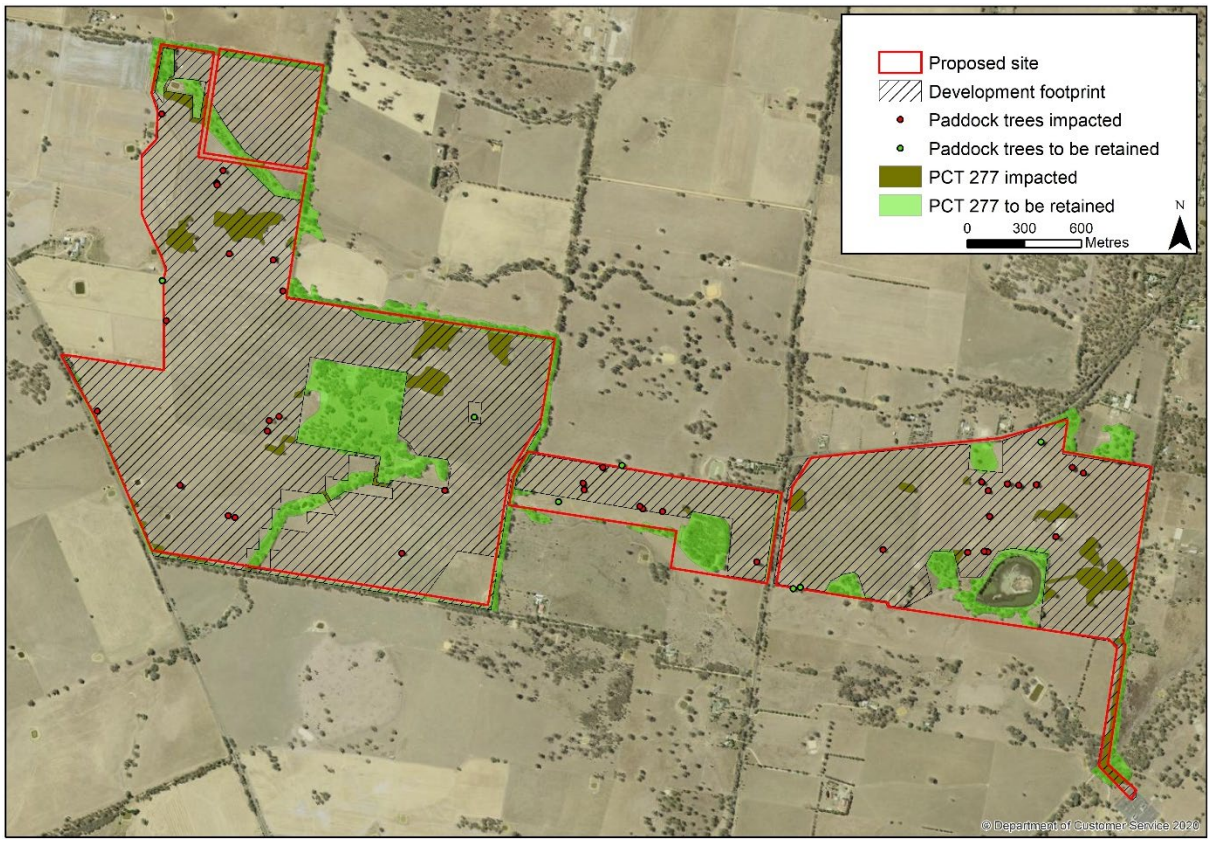

Figure 5 **Final layout of the proposed solar farm development (Box 5 example)**

4.5.11 Residual prescribed impacts

(BAM Section 8.6)

Prescribed impacts often affect biodiversity values that are irreplaceable – therefore, avoiding or minimising them is critical. These impacts are highly likely to be scrutinised by the decision-maker and carefully considered in approval decisions, including conditions of consent.

Prescribed impacts are particularly difficult to quantify, as they are often uncertain, related habitat features that generally cannot be readily replaced or offset, or occur beyond the subject land. Consequently, the BAM does not provide a method for calculating the biodiversity credits to offset a prescribed impact. This must be evaluated on a site-specific basis (see Section 4.5 of this manual).

Where mitigation measures or adaptive management cannot be employed, it is best practice for the assessor and proponent to propose compensatory measures such as additional biodiversity credits or conservation measures to compensate for any residual prescribed impacts. The biodiversity credits proposed to offset residual prescribed impacts are additional to the baseline credits required for offsetting direct impacts, and will not be part of the credit report generated by the BAM-C.

It is within the decision-maker's discretion to require additional biodiversity credits or additional measures to offset prescribed impacts of the development (see Section 4.5 of this manual).

Document the decision pathway and justification for compensatory measures to address residual prescribed impacts in the BAR. The decision-maker may decide to include these requirements in the conditions of development consent or approval.

Box 6 and Box 7 provide examples of calculating compensatory credits for residual prescribed impacts. Note that the scenarios described in Boxes 6 and 7 are fictional, created to demonstrate correct use of the BAM and BAM-C.

Box 6. Direct and prescribed impacts for species credit species

Impacts on the habitat for some species credit species will result in both direct and prescribed impacts. For example, impacts on habitat used by green and golden bell frogs (*Litoria aurea*) will generally result in baseline species credits generated from the loss of native vegetation in the area surrounding the waterbody on which they depend (see Section 6.1 of this manual). These credits will form part of the credit report produced by the BAM-C and submitted with the BAR to the decision-maker.

The loss of the waterbody feature will be assessed as a prescribed impact. Where the prescribed impact cannot be avoided or minimised, the proponent and assessor may consider options to compensate for this loss of habitat in the form of additional species credits or other actions that will directly benefit the species in the wild. These measures must be documented in the BAR. In this situation, the map of the species polygon should clearly indicate areas that will generate a baseline credit for direct impacts and areas that are a prescribed impact. For examples of polygon mapping, refer to the *NSW Survey Guide for Threatened Frogs*.

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Example: Gas terminal proposed development (critical SSI)

Impacts

- Removal of 0.23 ha planted native vegetation (direct impact)
- Removal of southern myotis (*Myotis macropus*) habitat (direct impact)
- Temporary disturbance of a potential movement corridor for green and golden bell frogs (prescribed impact)
- Removal of artificial detention ponds that provide non-breeding habitat for green and golden bell frogs (prescribed impact)
- Potential impacts on adjoining vegetation associated with edge effects, light spill, noise and introduction of weeds and pathogens (indirect impact)

Determining the credit obligation

Calculation of species credits is required for the direct impacts to:

- southern myotis – calculated based on the removal of 0.23 ha of PCT 1326

Calculation of additional species credits is required to compensate for the prescribed impacts to:

- green and golden bell frogs – calculated for the temporary disturbance of a potential movement corridor and removal of non-breeding habitat associated with 250 m^2 of artificial detention ponds based on the removal of 0.1 ha of PCT 1326.

Box 7. Example – compensatory measures for impacts to habitat connectivity

The BAM 2020 defines connectivity as the measure of the degree to which an area of native vegetation is linked with other areas of vegetation. The loss or degradation of habitat connectivity for threatened entities is assessed as a prescribed impact (BAM Subsection 8.3.3), for example:

- impacts to the vegetation corridors connecting the subject land with surrounding areas of habitat
- impacts to a movement corridor for threatened species of which the subject land forms part
- impacts to the movement of threatened species, particularly movement that is crucial to the species' life cycle.

These prescribed impacts may result in flow-on impacts and/or significantly impact biodiversity values that are irreplaceable. Consequently, avoiding such impacts is critical. Where the prescribed impact(s) above cannot be fully avoided, minimising the impact must be prioritised. For impacts to connectivity, this could be undertaken by retaining and managing vegetative corridors within the subject land. Actions to mitigate the prescribed impact may be possible; for example, artificial installations to facilitate the safe movement of threatened fauna. These measures must be justified in the BAR and supported by published literature.

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In the case of impacts to habitat connectivity, the BAR must explicitly define the residual prescribed impact expected to occur for both vegetative connection and the impacts to the ability of any candidate threatened species to maintain their life cycle via vegetative connection.

Where a residual prescribed impact cannot be avoided or minimised completely, the proponent and assessor may consider options to compensate for this loss of connectivity in the form of additional biodiversity credits or other conservation actions that will directly benefit the species in the wild. These measures must be documented in the BAR.

Quantifying residual prescribed impacts is often difficult. Where a residual prescribed impact has been identified as likely to occur, early consultation with the relevant decision-maker is recommended.

Example: Calculating credits – sand mine proposed development (SSD)

Impacts

- Removal of 15.6 ha native vegetation of PCT 1646 (direct impact)
- Removal of squirrel glider habitat (15.6 ha direct impact)
- Removal of Mahoney's toadlet habitat (4 ha direct impact)
- Removal of koala habitat (15.6 ha direct impact)
- Permanent disturbance of a movement corridor for all 3 candidate species (prescribed impact)

Determining the credit obligation

Ecosystem credits for the removal of 15.6 ha of PCT 1646 at a VI score of 63 were calculated via the standard formulas within the BAM-C. Credits for all 3 candidate species were calculated for the removal of potential habitat associated with the native vegetation, as per the areas defined above, according to a habitat condition of 63.

For residual prescribed impacts to connectivity the pre-construction vs post-construction state of connectivity was compared to explicitly determine the loss of connectivity.

The pre-construction connectivity was determined to be approximately 100% with no pre-existing connectivity gaps present on the site pre-construction. A gap of 20–60 m of cleared heavy industrial use and trafficked roads would be present post-construction. Due to the nature of the development no vegetation was proposed to be retained in situ to facilitate connectivity. As such, 15.6 ha of benchmark value PCT 1646 was entered into the calculator to compensate for the 100% loss to connectivity.

The pre-construction animal movement across the site was also determined to be 100%, with no significant impediments to animal movement present. The post-construction state and operational effects of the project were determined to result in significant impediments to fauna movement through the site.

As such, species polygons of 15.6 ha were determined for the squirrel glider and koala, and 4 ha for Mahoney's toadlet. These species polygons utilised the benchmark value PCT 1646 to determine credit generation to compensate for the 100% loss to animal movement that would occur post-construction.

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In a later stage of the project, 2 canopy bridges were proposed to be installed to mitigate for impacts to animal movement across the site, one at the north of the site and one at the south of the site. These canopy bridges were determined to only facilitate the movement of the squirrel glider across portions of the site. As such, it was proposed that the residual prescribed impacts to squirrel gliders could be reduced spatially within a 500 m buffer from these canopy bridges, reducing the total residual impacts to the squirrel glider by 8.15 ha.

It was proposed that the potential vehicle strike impacts to fauna would be monitored in an adaptive management plan. The adaptive management plan included SMART principles and a Trigger Action Response Plan (TARP), which incorporated offsetting for any future vehicle strikes to threatened fauna and was included as a condition of consent by the consent authority.

5. Thresholds for assessing and offsetting the impacts of development

(BAM Chapter 9)

Once the location and extent of the subject land are finalised (Section 3), impacts assessed and mitigation/management measures identified (Section 4), apply the impact thresholds. These thresholds determine the risk of SAII and where offsets are required for direct impacts.

5.1 Assess serious and irreversible impacts

(BAM Section 9.1)

The concept of an SAII is fundamentally about protecting threatened species and TECs most at risk of extinction from development or clearing. The principles defining an SAII are outlined in clause 6.7 of the BC Regulation.

The BC Act and LLS Act impose obligations on decision-makers for impacts on biodiversity values that are likely to cause serious and irreversible harm. Generally, this requires the decision-maker to determine if any residual impacts on biodiversity values, from a development proposal, are serious and irreversible. If the decision-maker is of the opinion that the proposed development is likely to have SAII on biodiversity values, the BC Act and LLS Act set out requirements in relation to any approval or consent of the proposal. The requirements of the decision-maker for different types of planning proposals are detailed in s 7.16 of the BC Act. Where the decision-maker determines that a proposed development under Part 4 of the EP&A act (except SSD/SSI) is likely to have serious and irreversible impacts on biodiversity values, development consent must be refused; whereas, if the Minister for Planning or determining authority considers an SSD/SSI project, or Part 5 development respectively, is likely to have serious and irreversible biodiversity impacts, the impacts must be taken into consideration and the decision-maker is required to determine if there are any additional and appropriate measures that will minimise those impacts if consent or approval is to be granted.

The department has published resources to support assessors and decision-makers in their various roles for SAII assessments (see Box 8) and is currently preparing additional guidance to update the current *Guidance to assist a decision-maker to determine a serious and irreversible impact*.

The BAR must:

- identify the entities at risk of SAII from the proposal
- for each entity at risk of SAII, address all assessment criteria detailed in BAM Subsections 9.1.1 and 9.1.2.

Provide relevant data and information required for the decision-maker to determine whether the proposed impact will be serious and irreversible.

Consult the decision-maker early to identify entities, appropriate data sources, and information to include in the BAR.

Relevant information to support the decision-maker's determination will include:

- clear documentation of the information sources used, such as scientific literature, published and unpublished technical reports, databases, documented field observations or expert opinion (referred to as a 'pers. comm.' with the date of communication, qualifications, advice provided and contact details of the expert)
- maps illustrating the derivation of data to address assessment criteria relating to the extent, fragmentation or isolation of the TEC or species population within the subject land and more broadly (e.g. in relation to Subsection 9.1.1(4.)

- an indication of the confidence in the information provided (e.g. low confidence if information is inferred from other similar taxa or communities), or if it is of questionable reliability (e.g. from an unknown source, historical data, an adjoining IBRA subregion)
- an explanation if information is not available; for example, where the TBDC indicates data is 'unknown' or 'data deficient'
- documentation of any additional conservation measures (i.e. above the credit requirement generated by the BAM-C) proposed and how these will contribute to the recovery of the entity
- references to sections of the BAR where the information has been documented and therefore does not need to be repeated (e.g. references to avoid and minimise actions that relate to SAII entities).

The assessor does not provide conclusions or recommendations on whether the impact is serious and irreversible in the BAR (or elsewhere) – this is determined by the decision-maker. Only information in accordance with the assessment criteria is required in the BAR. Relevant legislation, policies and other documents do not require replication in the BAR, they may instead be referenced.

Box 8. Resources to support SAII assessments

Serious and irreversible impacts: Biodiversity Offsets Scheme guide

The *Guidance to assist a decision-maker to determine a serious and irreversible impact* (Appendix A) supports assessors and decision-makers to understand:

- the regulatory context of SAII
- how the SAII principles are used to identify entities at risk of an SAII
- the required documentation to be provided by an assessor for impacts on entities at risk of SAII, including examples using the department's BDAR template
- how the decision-maker must apply the SAII principles to determine if an impact is serious and irreversible.

The department is currently updating this guide.

List of species at risk of SAII

The department has identified some entities considered to be at risk of an SAII to assist assessors and decision-makers to identify entities for SAII assessment. The list is not exhaustive. Decision-makers may consider other entities to be at risk of SAII where they meet the SAII principles in clause 6.7 of the BC Regulation. They may seek data and information on these entities to be supplied in the BAR.

The department's list of entities at risk of SAII is available on the department's website and is reflected in the TBDC profiles and the BAM-C (Appendix A). It is important to review each of these sources, as misalignments may occasionally occur (e.g. a species is listed as at risk of an SAII in the TBDC, but not in the BAM-C). These result from periodic updates to threatened species schedules and/or new information on a species, and different timing of updates to the different sources. Assessors and subscribing local government officers are notified of changes to the list of species at risk of SAII via the *Biodiversity Offsets Scheme Update* newsletter.

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Data to support assessments

Data to support SAII assessments for threatened entities, where available, can also be provided by the department. At the time of publication this information is best requested from the BOS Help Desk mailbox (BOS.helpdesk@environment.nsw.gov.au). The data may be added to the SAII and 'Risk Weighting' tab in the TBDC in the future.

5.2 Determine where offsets are required

(BAM Sections 9.2 and 9.3)

The BAM includes thresholds to identify where no further assessment or offset is required. These thresholds are described in BAM Sections 9.2 and 9.3 and are summarised here:

- **An assessment of ecosystem credits is not required** for areas on the subject land without native vegetation (as per BAM Subsection 4.1.2)
- **An ecosystem credit obligation is not required** for a vegetation zone with a VI score of either:
  - <15 where the PCT is representative of an endangered ecological community (EEC) or critically endangered ecological community (CEEC)
  - <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community
  - <20 where the PCT does not represent a TEC and is not associated with threatened species habitat (as represented by ecosystem credits).

Areas of the subject land without native vegetation, or with native vegetation below the condition thresholds listed above, must still be assessed for **species credit species** (as per BAM Chapter 5). Similarly, if the vegetation is a TEC at risk of SAII, the criteria in BAM Subsection 9.1.1 must be addressed, even if no offset is required.

The required ecosystem credits and species credits are calculated in accordance with BAM Chapter 10 (see Section 6 of this manual).

6. Applying the no net loss standard

(BAM Chapter 10)

The net ecological outcome, or standard, of the BAM is no net loss of biodiversity values in New South Wales (BAM Section 10.3). Notwithstanding specific exemptions, this standard is achieved by ensuring the number of credits to offset an impact is equivalent, at least, to the number of credits generated from improvements in biodiversity values at a biodiversity stewardship site.

6.1 Calculate the offset requirement for direct impacts

(BAM Section 10.1 and Subsection 10.1.1)

The BAM only generates a biodiversity credit requirement to offset residual direct impacts from the proposed development. These are the baseline credits calculated by the BAM-C and must be retired by the proponent.

A **residual impact** is the direct impact remaining to native vegetation and/or threatened entities and their habitat, after all reasonable measures to:

- avoid and/or minimise the impacts of the development proposal (Section 3 of this manual)
- mitigate the impacts (Section 4 of this manual).

The decision-maker must be satisfied that reasonable measures have been made to avoid, minimise and mitigate impacts on biodiversity. **Therefore, the assessor must clearly document in the BAR outcomes from applying BAM Chapters 7 and 8. Few to no offsets may be required if impacts are avoided or minimised.**

BAM Section 10.1 outlines the calculations to determine the offset requirement for direct impacts in the form of biodiversity credits. There are 2 broad biodiversity credit classes – ecosystem and species credits. These 2 credit classes are further described in the BAM Operational Manual – Stage 1, Section 4.3. The BAM-C automatically applies the BAM equations to generate the credit requirement for offsetting direct impacts. The number and class of biodiversity credits that must be retired are set out in the credit report.

Presence of hollow bearing trees must be recorded in the BAM Stage 1 vegetation condition assessment (BAM Subsection 4.3.4(8.–12.)). The presence or absence of hollows does not influence the number of biodiversity credits required as part of the offset obligation. Instead, hollow bearing trees are assessed under habitat suitability (e.g. the presence of suitable breeding habitat for hollow nesting species) and form part of the credit profile for ecosystem credits (see BAM Operational Manual – Stage 1). It is important the assessor ensures that the location of their VI survey plots in the vegetation zone are representative of the condition state of the vegetation. The location of plots should also seek to include hollow bearing trees where they are present.

6.1.1 Ecosystem credits

(BAM Subsection 10.1.2)

The BAM-C applies BAM Equation 1 to calculate ecosystem credits for a vegetation zone. Calculations are based on the:

- change in VI score (as determined by BAM Equation 27)
- biodiversity risk weighting (BRW) for the PCT (or TEC) (see Box 9)

- area in hectares.

Equation 1 also includes a standard multiplier of 0.25, which is used to bring the quantum of credits to a manageable number. The multiplier is applied equally to loss and gain equations for ecosystem credits (see BAM Equation 4). Consequently, it has no effect on offset ratios.

Credits calculated per vegetation zone using Equation 1, are then added together to determine the number of ecosystem credits required per PCT (or TEC).

For ecosystem credits, the sensitivity to loss component of the BRW is determined by the highest threat ranking for any listed TEC. Where there is no TEC, the per cent cleared status of the PCT identified at the site is used. The sensitivity to gain component is derived from the ecosystem credit species associated with the PCT that has the highest sensitivity to gain ranking. A PCT (or TEC) that is not associated with, or does not provide habitat for, an ecosystem credit species will automatically be allocated a sensitivity to gain score of one (see BAM Table 19).

Box 9. Biodiversity risk weighting

It is common practice to adjust metrics used in offset calculations by multipliers. Generally, multipliers are employed to address issues that are difficult to account for within the offset metric, such as:

- social equity and distributional issues (e.g. where offsets are located)
- a desire to ensure a particular long-term outcome (e.g. consideration of existing conservation targets, 'endgame' protection levels)
- temporary loss (i.e. loss of biodiversity/ecosystem services' benefits for stakeholders)
- sources of risk/uncertainty that the intended goal (such as no net loss, net gain) will not be achieved (e.g. uncertainty that impacts on entities can be adequately offset)
- to compensate for dissimilar biodiversity values between the impact and offset site or uncertainty in assessment processes/implementation/data (Rayment et al. 2014).

These are often referred to as 'risk multipliers' and are based on the precautionary principle. Risk multipliers serve to increase the basic size of an offset requirement (as set by the underlying biodiversity currency and associated accounting model). This addresses concerns that the offset may be insufficient to deliver the desired outcome (BBOP 2012).

The BRW is used as a basic risk multiplier in BAM credit calculations. It has 2 components:

- **sensitivity to loss** estimates the increased threat posed to an entity from offsetting the loss of habitat or population
- **sensitivity to gain** estimates the ability of a species to respond to improvements in habitat condition at an offset site.

For information on the factors that determine sensitivity to loss or gain for an entity see BAM Appendix I. The BRW and supporting data is documented in the TBDC for threatened species.

For all ecosystem credits, document in the BAR the:

- number of ecosystem credits calculated for each PCT (or TEC)
- biodiversity credit report from the BAM-C, which identifies the number and class of ecosystem credits required to offset direct impacts.

Where the total number of credits for a vegetation zone is less than one, the BAM-C will round up to one credit.

6.1.2 Species credits

(BAM Subsection 10.1.3)

Species assessed by area of suitable habitat

The calculation used to determine species credits is dependent on the unit of measure used to assess the proposed impact. Species are assessed by either:

- area of suitable habitat (all threatened fauna and some threatened flora)
- counts of individuals (remaining threatened flora).

The unit of measure for a species is identified in the TBDC and the BAM-C.

The BAM-C applies BAM Equation 2 to calculate species credits (for species assessed by area of suitable habitat) for a vegetation zone. Calculations are based on the:

- condition of the habitat in the species polygon, taken as the change in VI score per vegetation zone
- BRW for the species (see Box 9)
- area of habitat in hectares, per vegetation zone.

The standard multiplier of 0.25 is also applied (see Section 6.1.1 of this manual).

Credits are calculated per vegetation zone within a species polygon using Equation 2, then added together to determine the number of species credits required for that species. The area of habitat for a vegetation zone may be less than the total size of the vegetation zone. For example, a species polygon may be based on a 50 m buffer from the creek line, but the vegetation zone continues beyond that distance. Only the area of that vegetation zone within the species polygon is used in the calculations.

Species assessed by counts of individuals

The BAM-C applies BAM Equation 3 to calculate species credits (for species assessed by counts of individuals). Calculations are based on the:

- change in the number of individuals from impacts of the proposal
- BRW for the species (see Box 9).

No standard multiplier is required because species assessed by count are generally long-lived trees and shrubs with naturally low abundance.

For all species credits, document in the BAR the:

- BRW for each species credit requirement
- number of species credits calculated for each species credit species impacted by the proposal
- biodiversity credit report from the BAM-C, which identifies the number and class of species credits required to offset the proposed impact.

Where the total number of credits is less than one, the BAM-C will round up to one credit.

6.2 Biodiversity credit classes and offset rules

(BAM Sections 10.2 and 10.3)

Once Stage 2 of the BAM is complete, the proponent must consider how to meet any offset obligations. The biodiversity credit class assigned to ecosystem credits determines the type of credits that can be used to offset the impacts of developments via application of the offset rules. The offset rules are established through the BC Regulation; these include:

- retiring credits based on the like-for-like rules
- funding a biodiversity conservation action that benefits the threatened entity impacted by the development. The action must be listed in the 'Ancillary rules – Biodiversity conservation actions' (see Appendix A) and meet the other requirements set out by the rules
- committing to deliver mine site ecological rehabilitation that creates the same ecological community or threatened species habitat (restricted to major mining projects, for which ancillary rules are in development)
- making a payment to the Biodiversity Conservation Fund managed by the Biodiversity Conservation Trust (BCT). The responsibility for delivering credit requirements is then transferred to the BCT.

The *Offset rules and ecosystem credits – Guidance on credit retirement options for ecosystem credits under the offset rules* (Appendix A) assists assessors and decision-makers.

References

BBOP (Business and Biodiversity Offsets Programme) (2012) *Resource paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets*, Business and Biodiversity Offsets Programme, Washington DC.

Rayment M, Haines R, McNeil D, Conway M, Tucker G and Underwood E (2014) *Study on specific design elements of biodiversity offsets: Biodiversity metrics and mechanisms for securing long-term conservation benefits*, Institute for European Environmental Policy and ICF International.

Appendix A. Websites and online resources

- Acid sulfate soils risk
- Addendum to NSW Biodiversity Offsets Policy for Major Projects: upland swamps impacted by longwall minimum subsidence
- Aligning Biodiversity Assessments fact sheet
- Ancillary rules – Biodiversity conservation actions
- Ancillary rules – Impacts on threatened species and ecological communities
- Ancillary rules – Reasonable steps to seek like-for-like biodiversity credits for the purpose of applying the variation rules
- Areas of Outstanding Biodiversity Value (AOBV)
- Areas of Outstanding Biodiversity Value (AOBV) register
- Assessor resources
- BioBanking
- BioBanking Public Registers
- Biodiversity Assessment Method (BAM) – About
- Biodiversity Assessment Method (BAM) Calculator
- Biodiversity Conservation Act – Public registers
- Biodiversity Offsets and Agreement Management System (BOAMS)
- Biodiversity Offsets Scheme – About
- Biodiversity Offsets Scheme – Biodiversity experts
- Biodiversity Offsets Scheme – Help desk and support
- Biodiversity Offsets Scheme – Offset rules
- Biodiversity Offsets Scheme – Public registers
- Biodiversity Values Map and Threshold Tool
- BioNet – About
- BioNet – Atlas
- BioNet – Application for login access to BioNet
- BioNet – Species sightings
- BioNet – How to access the BioNet Web Service using Excel and Power Query: A BioNet Quick Guide
- BioNet – Resources
- BioNet – Systematic Flora Survey data
- BioNet – Threatened Biodiversity Data Collection (TBDC)
- BioNet – Vegetation Classification
- BioNet – Vegetation Classification user manual
- BioNet – Vegetation maps
- BioNet – Web services
- Coastal management
- Coastal wetlands – State Environmental Planning Policy no. 14
- Directory of Important Wetlands in Australia (DIWA) (Australian Government)
- EPBC Act – Listed threatened species and ecological communities

- Geological sites of NSW
- High Threat Weeds list (under 'Data, information, tools and forms')
- Hydrogeological landscapes
- Interim Biogeographic Regions of Australia (IBRA) (Australian Government)
- Local government and other decision maker support
- Native Species by Growth Form list [XLS 2.9 MB]
- Native Vegetation Integrity Benchmarks: An information sheet
- Native Vegetation Interim Type Standard
- Native Vegetation Regulatory Map
- NSW Cadastre Web Service
- NSW Estuaries
- NSW (Mitchell) Landscapes – Descriptions [PDF 1.3 MB]
- NSW (Mitchell) Landscapes – Map
- NSW Planning Portal – Major Projects
- NSW Soil Profiles
- PlantNET NSW
- Plot to PCT Assignment Tool – About
- Plot to PCT Assignment Tool User Guide – Eastern NSW PCT Classification
- Policy and guidelines for fish habitat conservation and management
- Serious and irreversible impacts – About
- Serious and irreversible impacts – Threatened ecological communities nomination form
- Serious and irreversible impacts – Threatened species nomination form
- Sharing and Enabling Environmental Data (SEED)
- Spatial Collaboration Portal – NSW spatial datasets
- Species Profile and Threats Database (Australian Government)
- State Environmental Planning Policy (Biodiversity and Conservation) 2021
- State Vegetation Type Map
- Threatened biodiversity profile search
- Threatened species test of significance
- Threatened Species Test of Significance Guidelines
- Vegetation Condition Benchmarks

Legislation and regulation

- Biodiversity Conservation Act 2016
- Biodiversity Conservation Regulation 2017
- Environmental Planning and Assessment Act 1979
- Environment Protection and Biodiversity Conservation Act 1999
- Local Land Services Act 2013
- NSW Biodiversity Assessment Method (BAM) Order 2017 [PDF 1.8 MB]
- NSW Biodiversity Assessment Method (BAM) Order 2020 [PDF 2.4 MB]
- State Environmental Planning Policy (Biodiversity and Conservation) 2021

BAM guidance and publications

- Biodiversity Assessment Method (BAM) Calculator – User Guide
- Biodiversity Assessment Method 2020 Operational Manual – Stage 1
- Biodiversity Assessment Method 2020 Operational Manual – Stage 3
- Biodiversity Development Assessment Report Template [DOCX 772 KB]
- Biodiversity Offsets and Agreement Management System (BOAMS) – User Guide [2.35 MB]
- Guidance for assessors and decision makers in applying modified benchmarks to assessments of vegetation integrity: Biodiversity Assessment Method
- Guideline for applying Biodiversity Assessment Method at severely burnt sites: Biodiversity Development Assessment Report/Biodiversity Certification Assessment Report
- Guide for mapping threatened species for inclusion in the NSW regulatory framework
- Guidance for the Biodiversity Development Assessment Report Template
- Guidance to assist a decisionmaker to determine a serious and irreversible impact
- Manageable high threat weeds – improving gain on offset sites: Biodiversity Assessment Method Practice Note
- Offset rules and ecosystem credits: Guidance on credit retirement options for ecosystem credits under the offset rules
- Streamlined assessment module – planted native vegetation: Biodiversity Assessment Method operational manual

Threatened species survey guides

- Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide
- NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment
- 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method
- Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft 2004)
- Threatened reptiles – Biodiversity Assessment Method survey guide

Appendix B. Avoid and minimise – case studies

The following case studies illustrate various approaches to avoiding and minimising impacts of development. Examples 1 and 2 are fictional (including Figures 6–11); Example 3 (including Figures 12–14) is drawn from an actual BDAR.

Example 1. Solar farm

Note the largely cleared surrounding landscape (Figure 6). Vegetation on site has low VI scores; however, the PCTs on site represent Box Gum Grassy Woodland CEEC and threatened species habitat.

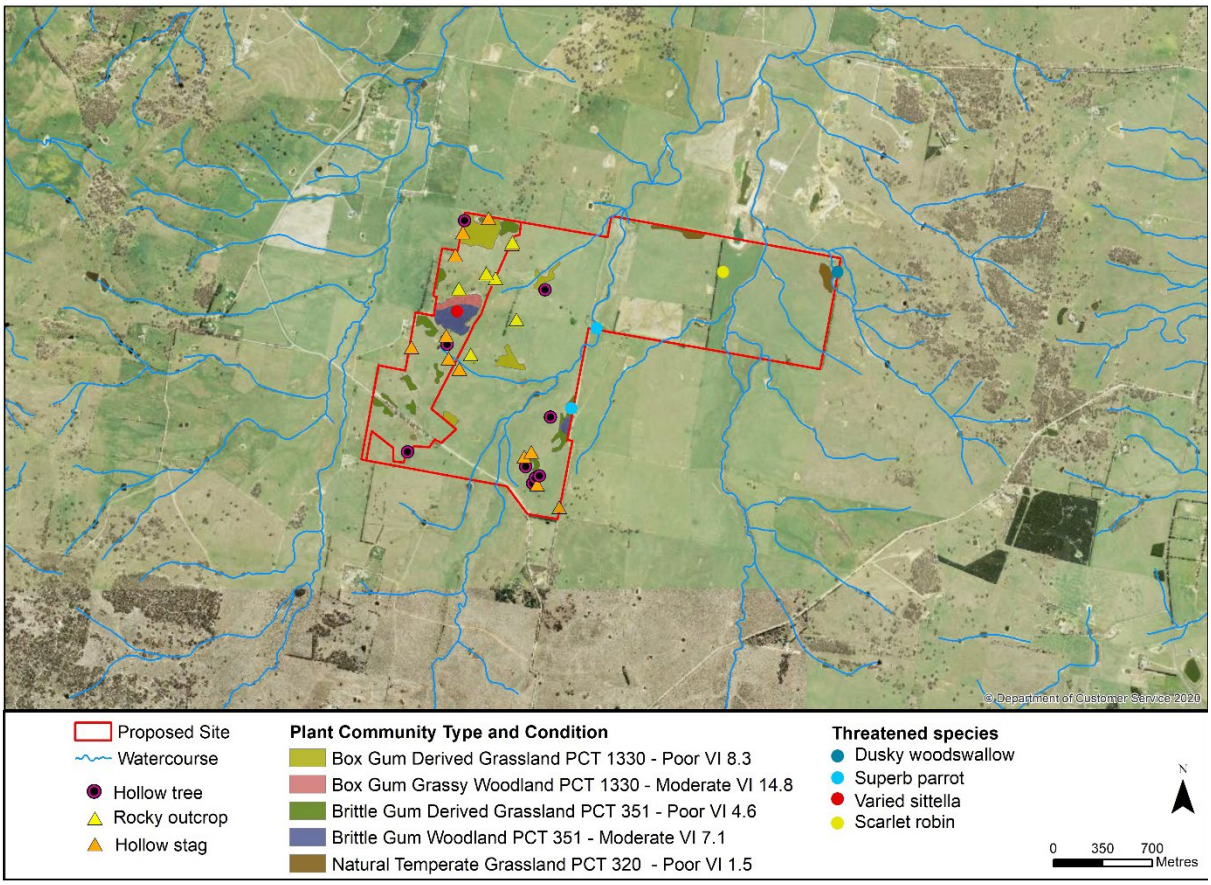

Figure 6 Biodiversity values on site

The proposed design (Figure 7):

- uses advanced high output solar panels to maintain capacity for electricity generation while minimising the size of the subject land
- avoids vegetation zones with highest VI scores including Box Gum Woodland CEEC, Brittle Gum Woodland, striped legless lizard habitat, varied sitella habitat
- minimises impact to Box Gum derived grassland TEC, golden sun moth habitat and superb parrot breeding and foraging habitat, hollow bearing trees, stag trees, and riparian areas.

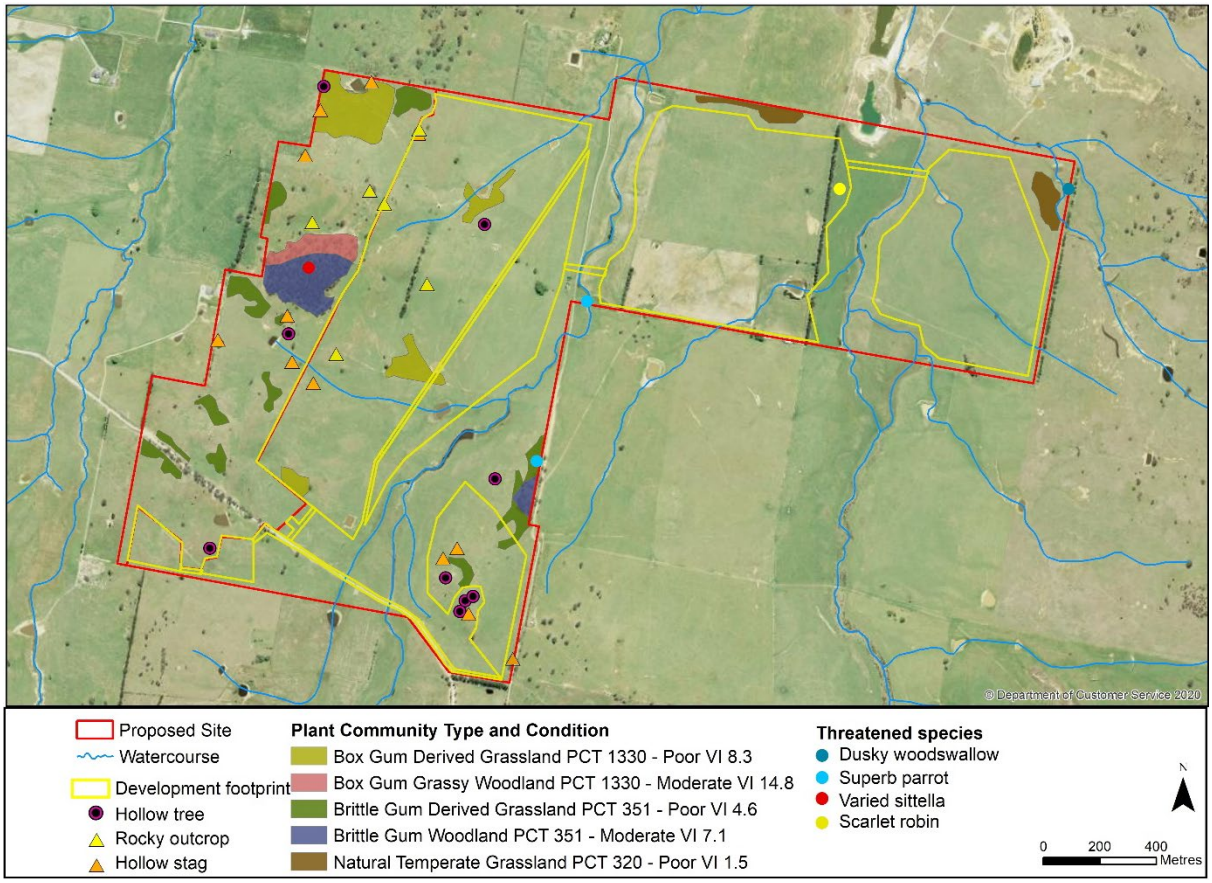

Figure 7 Proposed design for the development

Other measures proposed to avoid and minimise impacts (Figure 8):

- retain and rehabilitate native vegetation (includes threatened species habitat plus 50 m buffer)
- signpost and fence retained areas using fencing materials that enable passage of adult golden sun moths
- maintain buffer between landscaping in the subject land and the retained vegetation. Landscape with local endemic shrubs (foraging habitat for threatened birds)
- manage timing and conduct of works (vehicles use formed roads, avoid breeding periods, hollow inspections, wildlife care provisions)
- manage practices (waste, sediment and erosion, fertiliser, stocking, pasture sowing) including during construction and until planted vegetation is established.

The buffer between landscaping and retained vegetation serves to avoid shading native ground cover and habitat for the golden sun moth. Shading causing change in community composition; that is, death of plants, is considered clearing, which is a direct impact – if not avoided the area affected must be included in the impact assessment.

Retention and rehabilitation of native vegetation will include ongoing weed management, supplementary planting of native grasses, stock exclusion for 5 years then seasonally responsive decreased stocking rates and stock rotation, monitoring of ground cover in retained areas to maintain golden sun moth microhabitat requirements.

Discontinue fertiliser use and pasture sowing across the subject land.

The BDAR/BCAR may refer to preparation of management plans but should indicate the actions to be included in those plans to provide sufficient information for the decision-maker to be satisfied of impact avoidance and minimisation at this stage of planning.

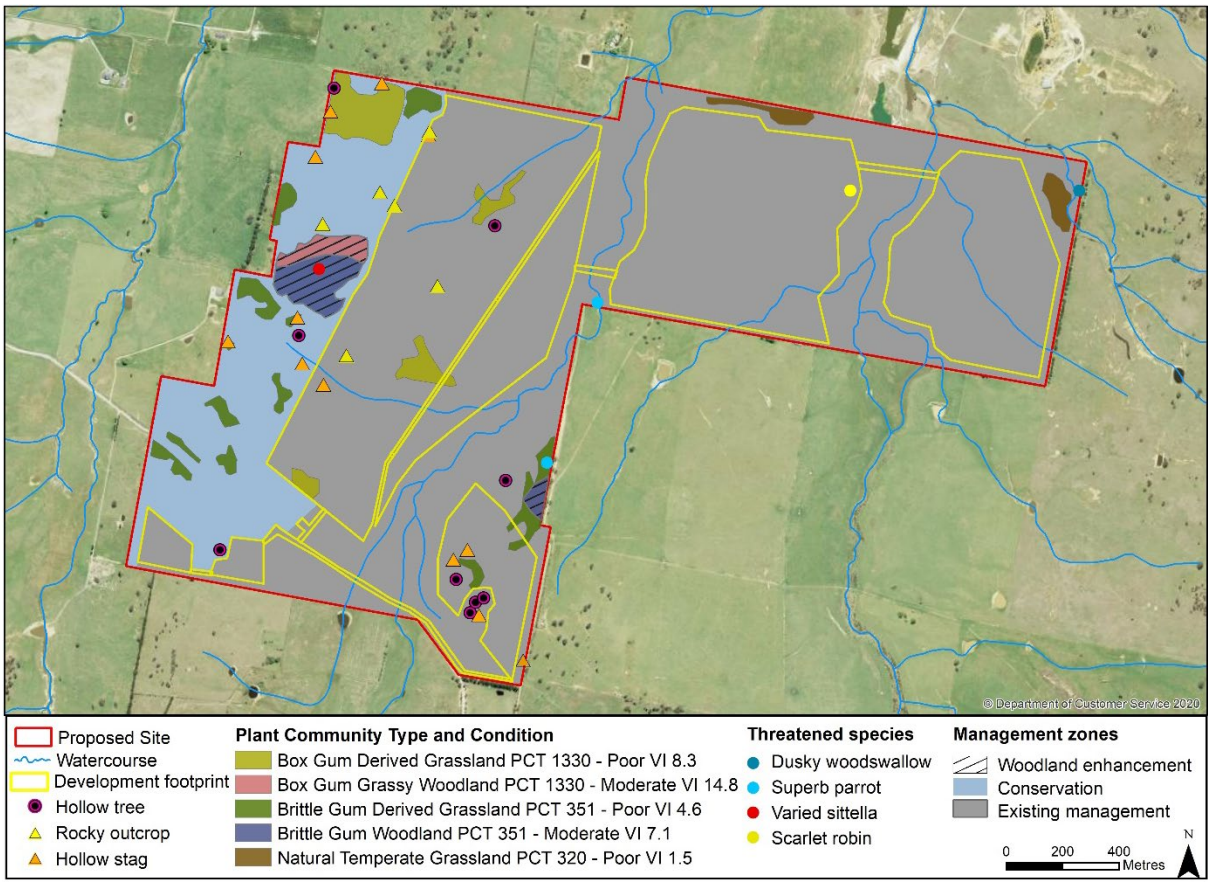

Figure 8 **Other measures proposed to avoid and minimise impacts**

Example 2. Small residential subdivision

Avoiding and minimising impacts can be challenging where development involves a small, or otherwise constrained site (e.g. sloped, rocky, limited access or infrastructure). Balancing financial/economic feasibility with avoiding and minimising biodiversity values on small developments can also require significant thought and iterative design processes as in this example.

The initial proposal was for clearing of all vegetation to cater for a 20 lot subdivision and associated infrastructure (Figure 9). The initial design did not demonstrate avoidance or minimisation of impact to quality vegetation (VI scores: 51, 58 and 82) potentially representing an EEC, threatened species habitat (grey-headed flying-fox (GHFF) and eastern bent wing bat) and hollow bearing trees.

In addition, as shown in the Figure 10, the site has connectivity values to vegetation immediately to its south, and potentially also for some species to the east and north-west (fragmented urban landscape gaps between approx. 50–400 m).

Figure 9 **Proposed 20 lot subdivision and associated infrastructure. No demonstration of avoid and minimise**

Figure 10 **Proposed location of residential subdivision. Site has connectivity values**

The revised proposed development (Figure 11):

- utilised existing roadway access and single APZ for all proposed dwellings, contributing to reducing the subject land
- conserved threatened species habitat, hollow bearing trees and all PCTs on site to some extent, which were all in moderate–good condition and included a large proportion of the highest VI vegetation type and potential Swamp Sclerophyll Forest on Coastal Floodplain EEC in a retained habitat corridor
- fenced the retained habitat corridor to avoid incidental damage during construction and degradation in the operational phase of the development
- retained canopy foraging resources for GHFF and bats plus a 1 ha buffer area by partial clearing of APZ
- maintained connectivity to the south and gaps of <500 m to other remnant vegetation (coastal strip and north-west)
- restricted use and management of the retained habitat corridor to maintain condition long term, e.g. preventing lot boundary fencing from being constructed in the retained habitat corridor, and weed management
- involved supplementary planting of previously cleared area in the south-east of the subject land with native shrub and overstorey species to compensate for lost bat and GHFF foraging habitat
- relocated potential habitat features to the retained area (large woody debris, etc.)

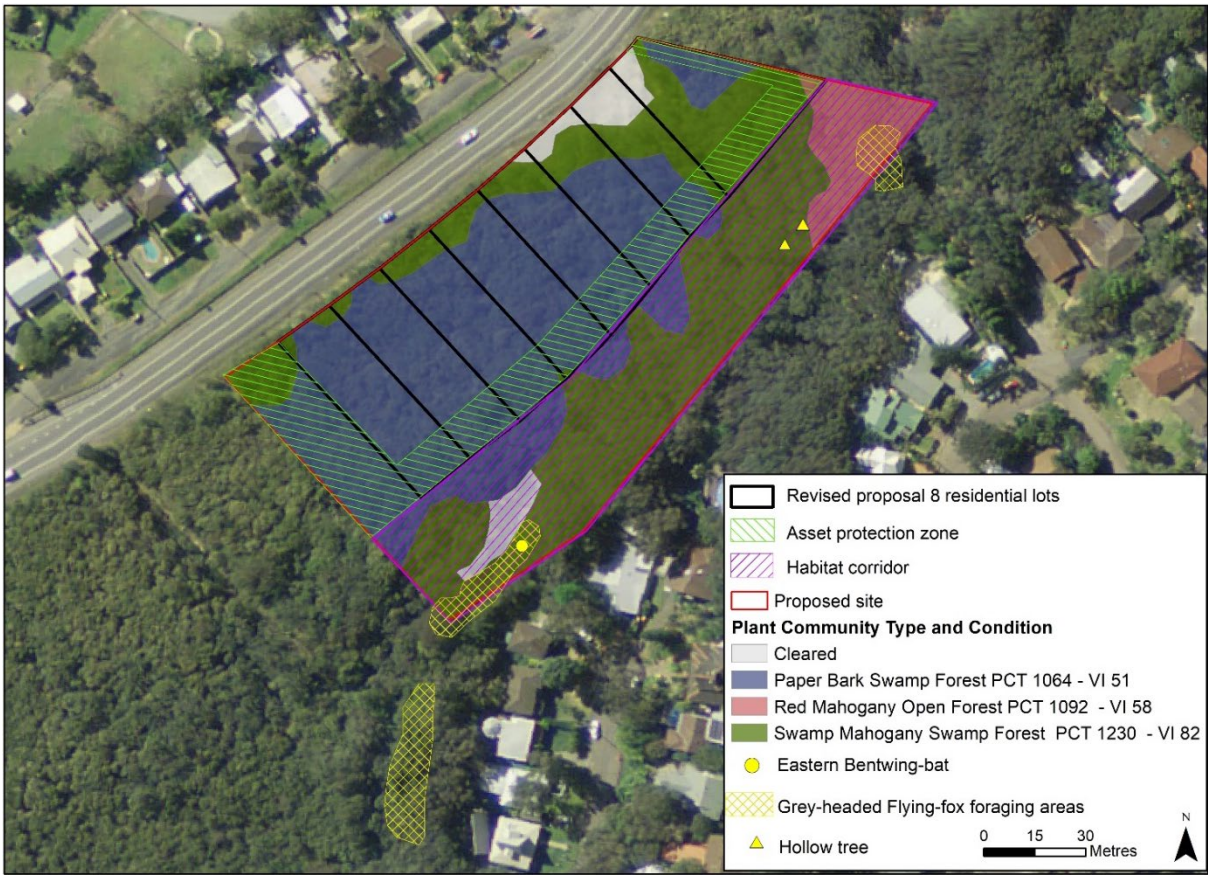

Figure 11 Revised proposal

The revised proposal yielded 8 lots rather than the 20 initially proposed. Comparing the 2 proposals, the decision-maker required further information about the original proposal to ensure it complied with the BAM, thereby adding time and assessment costs. Substantial offsets would have been generated from the initial design for complete removal of all vegetation types associated with a TEC and impacts on GHFF and eastern bent wing bat. The developer would then have been obliged to obtain these credits or make an equivalent payment to the BCT to offset the credits generated. By reducing the lot yield, the developer received less return from the development, but did not generate such a substantial credit obligation and offset costs.

Example 3. Rural residential subdivision

Proposed development

A rural residential subdivision of 40 lots, most approximately 1 ha, and roads (Figure 12). The property is mostly covered in Box Gum Woodland EEC (Figure 13). Five hectares of 'retained woodland area' were excluded from the development (unshaded portion of property in Figure 13) and will be subject to management under a VMP to protect the regenerating native vegetation there and manage it for conservation in perpetuity. The landholder will be responsible for implementing the VMP, which will be reviewed annually by council. Existing dwelling excluded from proposed development. The proponent indicated that all vegetation outside building envelopes and roads was avoided and by default, protected.

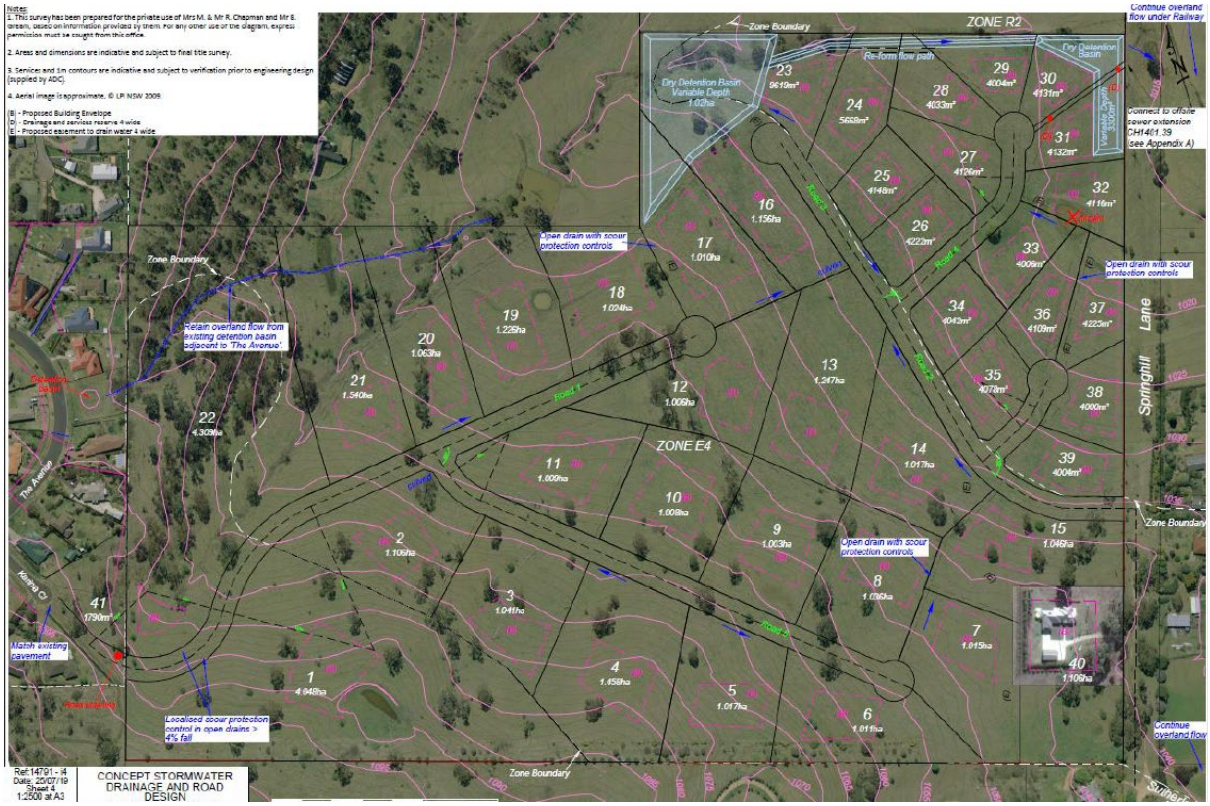

Figure 12 Proposed subdivision and lot layout

Figure 13 **Extent of Box Gum Woodland EEC on the subject land**

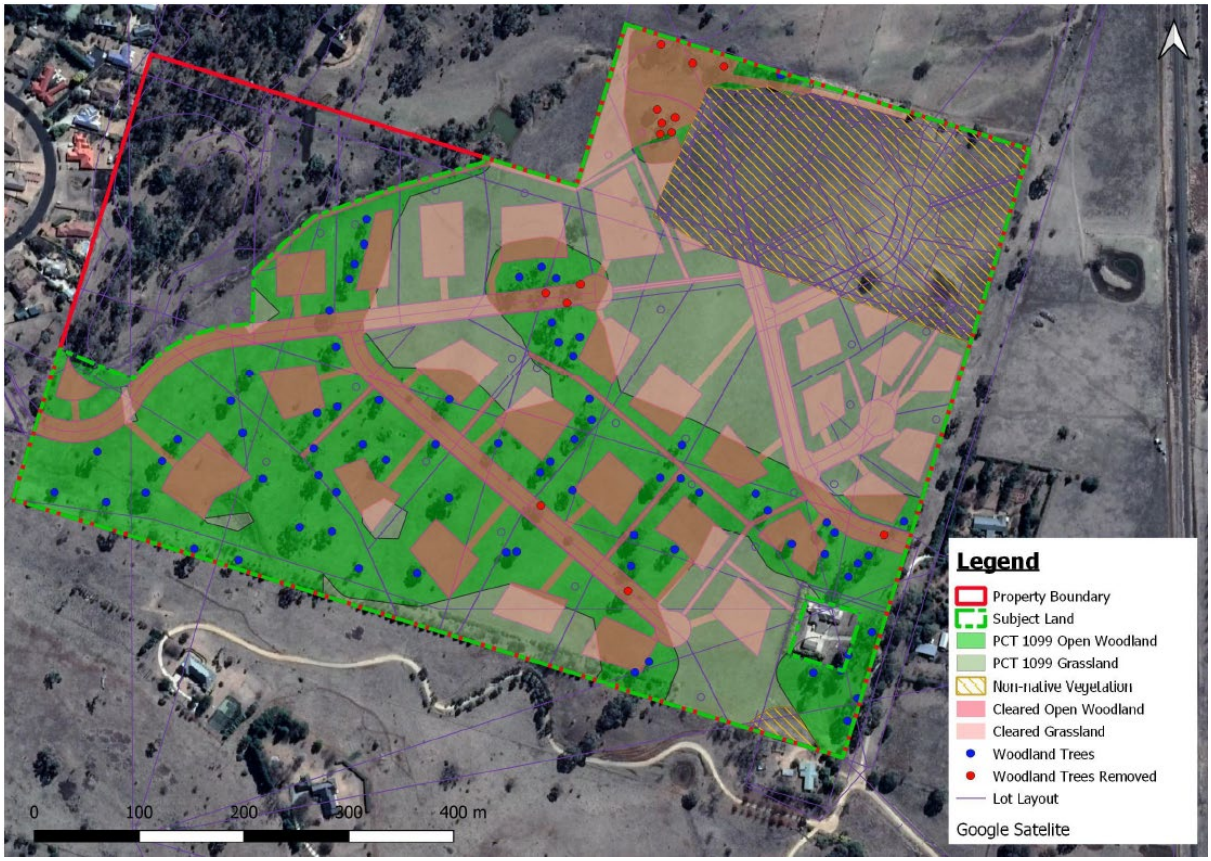

Figure 14 **Impacts of the proposed development**

The department's response

Council asked the department's regional planning branch to review the BDAR. The department's response included the following feedback:

1. Other infrastructure and rural residential uses, e.g. fences, effluent disposal, sheds, gazebos, stock, etc., would result in further unregulated clearing and degradation of the vegetation, so it should be treated as 100% loss on such small lots unless a mechanism could be established by conditions of consent to protect that vegetation from such uses (BAM 2020 Subsection 7.1.2(1.e.)).
2. In accordance with BAM requirements to demonstrate that biodiversity impacts have been avoided to the greatest extent possible, the subdivision layout should be configured so that the land within the VMP area on proposed lots 19, 20, 21 and 22 is associated with only one lot.
3. If the subdivision is approved, a condition of consent must be included to ensure the area of vegetation subject to the VMP is managed in perpetuity, such as a conservation agreement or BSA.

Outcomes

- Recognising that the required protection mechanism (1. above) would be difficult to establish, monitor and achieve in a rural residential environment, the proponent adopted the approach of 100% loss. The BDAR and BAM-C calculations were updated accordingly.
- The proponent revised the proposed layout to enlarge lot 22 to incorporate the entire retained woodland area including the rear of lots 19, 20 and 21.
- The BDAR was revised to address the department's recommendation 1. and council then approved the development subject to conditions of consent that included recommendations 2. and 3. from the department.
- Credits were in the order of $5 million.

Appendix C. Indirect impacts – case study

The following 6 steps outline a method to calculate indirect offsets for linear infrastructure that cannot be avoided or adequately minimised through mitigation and management measures.

Step 1: Assess the existing condition of vegetation within an indirect impact assessment buffer of 50 m from the boundary of the subject land:

- establish an indirect impact investigation area by applying a 50 m buffer to the boundary of the subject land
- classify the native vegetation within the 50 m buffer into the following categories, based on vegetation mapping undertaken for the assessment or regional vegetation mapping where required.

Category	Description	Next step
Isolated patches	Small fragments of vegetation (<0.25 ha patch size after project clearing) within the buffer that will remain following the completion of the project. These vegetation fragments are considered no longer likely to be viable in the long term	Assess and offset as if directly impacted (i.e. future VI score reduced to zero)
Existing edge	An existing vegetation edge either adjoins, only slightly overlaps (i.e. 1–2 m of overlap) or is set back from the subject land. These areas are already subject to existing edge effects, which are unlikely to increase due to the project	No further assessment or offsetting required
New edge in fragmented and/or disturbed vegetation	Vegetation in any condition that is less than 50 m wide and/or is currently fragmented and disturbed with modified structure and high exotic cover. Therefore, the creation of new edges is unlikely to result in substantial alteration to remaining areas of this vegetation	No further assessment or offsetting required
New edge in unfragmented and undisturbed vegetation	Vegetation patch that meets the VI score offset thresholds detailed in BAM Subsection 9.2.1 that will be fragmented by the construction footprint to form one or more new edges within previously unfragmented vegetation that extends over 50 m from the edge of the subject land	Further assessment required – proceed to Step 2

Step 2: Determine an appropriate buffer width for calculating the indirect impact of edge effects. Using desktop information, review aerial photographs, any data collected during site inspections and the current extent of edge effects:

- for road widening, the future edge effects are likely to be similar in extent to the edge effects of the existing road, provided the vegetation has the same/similar PCT and landscape values, and that road alignment and general design will also be similar
- for new road routes, use a nearby reference site to measure the distance of edge effects from the roadside
- the extent of edge effects would be measured primarily by assessing the difference in cover of exotic species, modified structure and other disturbance at 10 m increments in a transect extending perpendicularly away from the existing edge
- parts of BAM Appendix A can be used for guidance in collecting benchmark data from local reference sites.

Once the extent of existing edge effects has been determined, adjust the buffer around the subject land to the appropriate width.

Step 3: Determine the length of sections of road likely to have indirect impacts on new edges within native vegetation that meets the VI score offset thresholds detailed in BAM Subsection 9.2.1, based on review of road design and the table below.

Alignment	Vegetation/landscape attributes	Next step
New route or road widening in fill	Native vegetation that meets the offset thresholds detailed in BAM Subsection 9.2.1	Further assessment will be required – proceed to Step 4
New route or road widening at grade	Vegetation adjoining existing road at grade is not currently subject to edge effects Vegetation in 50 m buffer downslope of construction footprint Vegetation forming a PCT that is susceptible to edge effects from increased light penetration (e.g. rainforest) Vegetation adjoining existing road at grade is currently subject to edge effects	Further assessment will be required – proceed to Step 4
New route or road widening in cut	Terrestrial groundwater dependent ecosystems corresponding to a vegetation zone that meets the offset thresholds detailed in BAM Subsection 9.2.1	Further assessment will be required – proceed to Step 4
	All other native vegetation that meets the offset thresholds detailed in BAM Subsection 9.2.1	No further assessment or offsetting required

Step 4: Using results from Steps 1, 2 and 3, map the areas of vegetation considered likely to be subject to indirect impacts as separate vegetation zones. If required, different vegetation zones can be delineated based on the type of indirect impacts expected as a result of the proposal. The most likely indirect impacts are:

- weed incursion – increase in the cover and abundance of weeds
- increased light penetration, which may affect the structure and composition of PCTs
- altered hydrology regimes, which may affect the structure and composition of groundwater dependent ecosystems and riparian vegetation
- increased human activity, which may result in an increase in the cover and abundance of weeds, changes to the structure and composition of PCTs, and removal of fallen logs and litter.

Step 5: Determine the likely reduction in VI due to indirect impacts by adjusting the condition scores for the zone in the 'Future vegetation integrity score' section of the BAM-C under the 'Vegetation' tab.

Predicted changes are calculated by assuming that VI will decline to be similar to existing edge-affected vegetation relevant to the project (e.g. reference site). This can be assessed using the following methods:

- VI plot data will need to be entered into the BAM-C for the new edge-affected zones.

  Assuming the vegetation that will be edge-affected is contiguous with vegetation zones that will be directly impacted, the plot data for these zones will be relevant to this exercise. In some cases, additional VI plot data undertaken within the indirect impact areas may be required.
- Assume a 20% reduction in the VI score for the zone. Adjust the condition scores for the zone in the 'Future vegetation integrity score' section of the BAM-C until a 20% reduction is achieved. When adjusting condition scores to obtain the future VI, consider which attributes will likely be modified by the edge effects; for example, a new edge is likely to increase exotic species cover, however, the cover of the canopy is unlikely to reduce.

  An expected increase in exotic species cover in the new edge (as may have been observed at the reference site) is likely to result in a decrease in the cover of native ground layer species over time, therefore an appropriate method of calculating the future VI score would be to manually adjust the management zone structure (cover) scores for 'grass', 'forbs', 'ferns' and 'other' growth forms by a chosen percentage.

  An increase in exotic cover may also lead to a decrease in leaf litter cover. Note that the cover of high threat exotic species cannot be adjusted in the BAM-C.

Step 6: Estimate the credit requirement by calculating credit value for each vegetation zone based on Step 5. Isolated patches should be offset assuming total loss of VI for these patches.

Appendix D. BAR requirements – data submission

Stage 1: Biodiversity assessment and Stage 2: Impact assessment (biodiversity values)

1. Data format

- Digital data are to be supplied in a single zip file
- All GIS datasets are to have a projection and be in ESRI-compatible vector files, e.g. shapefile or feature datasets in a geodatabase
- The BAR is to include details of GPS datum and projection

2. BOAMS and BAM-C case submission

The BOAMS case must be finalised and submitted as per s 6.15 of the BC Act (see Section 1.2 of this manual).

Step 1:

- In the BAM-C, change the status of the development assessment case from 'in-progress' to 'finalised'.

Step 2:

- The BOAMS parent case must then be submitted by clicking on the 'Submit to Consent Authority' button. This will allow allocation to council or officers of the department's Biodiversity Conservation Division (BCD) by a BOAMS administrator.

For major projects where BCD reviews the BAR, the following action removes the need for manual allocation by the BOAMS administrator.

- The assessor adds the relevant BCD branch listed in Table 6 below as a 'Case Party' to the parent case in BOAMS.

Table 6 BCD Branches – case party and data submission details

Branch	Case party name	Account number	Email (for data submission)
Greater Sydney	Greater Sydney – Compliance & Regulation	C-012052	rog.gsrplanning@environment.nsw.gov.au
Hunter Central Coast	Hunter Central Coast Regional Planning Team	C-011729	huntercentralcoast@environment.nsw.gov.au
North East	NE Regional Planning Team – DPE	C-011928	planning.northeast@environment.nsw.gov.au
North West	North West Planning	C-012002	northwest@environment.nsw.gov.au
South East	Southeast Planning	C-011943	southeast@environment.nsw.gov.au
South East (Illawarra)	ROG Illawarra Planning	C-014618	rog.illawarra@environment.nsw.gov.au
South West	South West Branch – BCD	C-011860	rog.southwest@environment.nsw.gov.au

3. Digital data specification

Table 7 Minimum digital data requirements

BAR section	Data to be supplied	Notes	Format
Introduction	Subject land boundary		Polygon ESRI-compatible
	Cadastre of the subject land		Polygon ESRI-compatible
	Construction/development footprint (including all ancillary infrastructure/roads)		Polygon ESRI-compatible
	Operational footprint		Polygon ESRI-compatible
Landscape context	Assessment area – 1,500 m buffer surrounding the edge of the boundary of the subject land and/or 500 m from each edge of a linear development	Separate assessment areas for linear development with site-based aspects, e.g. new transmission line with large construction compound	Polygon ESRI-compatible
	IBRA sub-regions within assessment area		Polygon ESRI-compatible
	NSW (Mitchell) landscapes within assessment area		Polygon ESRI-compatible
	Native vegetation cover in assessment area including non-woody and planted native vegetation		Polygon ESRI-compatible
	Landscape features identified in BAM Subsection 3.1.3 and any other landscape features referred to in the prescribed impacts assessment of the BDAR		Polygon ESRI-compatible
	Connectivity, e.g. local and regional corridors		Polygon ESRI-compatible
	Rivers, streams, estuaries and wetlands		Polyline and/or polygon ESRI-compatible
	BAM important habitat map		Polygon ESRI-compatible

BAR section	Data to be supplied	Notes	Format
Native vegetation	Native and non-native vegetation on the subject land *Minimum attributes*: • PCT ID • PCT name • Vegetation class • Subregion • PCT attribution source (e.g. field survey verified, State Vegetation Type Map) • PCT justification (including justification for assigned PCT for each polygon where no access granted for verification)		Polygon ESRI-compatible
	Vegetation zones – labelled according to each BAM-C record and consistent with the BDAR *Minimum attributes*: • Bioregion • IBRA subregion • Vegetation zone # (e.g. 1, 2, 3 per each BAM-C) • Vegetation zone name (per each BAM-C) • Vegetation condition • PCT ID • Area (ha)	If the vegetation zones include partial impacts, these must be separated with a unique identifying field and all of the vegetation zone polygon fields recorded for each partial impact zone	Polygon ESRI-compatible
	Threatened ecological community (NSW and C'th) *Minimum attributes*: • Subregion (if more than one BAM-C case) • Vegetation zone ID • PCT ID • SAII • BC Act TEC name • Area BC Act (ha) • EPBC Act TEC name • Area EPBC Act (ha)		Polygon ESRI-compatible

BAR section	Data to be supplied	Notes	Format
Native vegetation, continued	Vegetation plots – labelled according to BDAR and field datasheets *Minimum attributes:* • Plot ID • Survey date • PCT ID • PCT name • Condition • Vegetation zone ID	Plot ID must match field datasheets and BAR	Point ESRI-compatible
	Vegetation plot field datasheets	ID must match spatial data and BAR Must be all field data as collected, not a summary	Scanned datasheets or relevant files if data captured digitally in the field
	Scattered tree module (where applicable) *Minimum attributes:* • Subregion • Tree ID • Tree species (scientific name) • Diameter at breast height over bark (cm) • PCT ID • PCT name • Tree class • Hollows present • Threatened species (sighting or evidence) • SAII (Y or N)	Streamlined module only	Point ESRI-compatible

BAR section	Data to be supplied	Notes	Format
Threatened species	Candidate flora and fauna species and associated PCTs for survey *Minimum attributes:* • Bioregion • Subregion • Common name • Scientific name • Associated PCT ID • Associated PCT name • Habitat constraint (where applicable)	This layer should then be used to identify survey locations and effort in association with the vegetation zones layer	Polygon ESRI-compatible
	Threatened flora surveys *Minimum attributes:* • Target species (scientific name) – can be multiple species • Date of survey • Survey type (e.g. transect, 2-phase grid, incidental) • Survey tracks	If using 2-phase grid approach for large projects with over 50 ha of an associated PCT, the 100 m grid and 40 m survey circles must also be provided with target species listed for each survey circle	Point and/or polyline ESRI-compatible
	Fauna surveys *Minimum attributes:* • Target species (scientific name) – can be multiple species • Date of survey • Survey duration • Survey type, e.g. spotlighting, call playback, diurnal bird survey		Point and/or polyline ESRI-compatible
	Threatened flora and fauna recorded *Minimum attributes:* • Group (flora or fauna) • Scientific name • Common name • Survey site identifier • Date of observation • Survey method • Source of record	Including existing records from BioNet, Atlas of Living Australia (ALA) & Australasian Virtual Herbarium (AVH)	Point ESRI-compatible

BAR section	Data to be supplied	Notes	Format
Threatened species, continued	Threatened species – previous records *Minimum attributes:* • Scientific name • Common name • Source of record • Easting • Northing	Including existing records from BioNet, ALA & AVH	MS Excel
	Species polygons for species credit species *Minimum attributes:* • Scientific name • Common name • PCT ID • PCT name • Vegetation zone ID • Presence (recorded, assumed, expert report) • Rationale /justification (surveyed - xx month **or** associated PCT with no access **or** associated PCT not surveyed during survey month **or** other (e.g. drought/flood conditions)) • Important habitat map for species credit component, if applicable • Area (ha)	This layer should be the outcome of the candidate flora and fauna and associated PCTs layer and the survey outcomes	Polygon ESRI-compatible
	Expert reports and supporting data, in accordance with fields outlined for species polygons, if applicable		PDF or MS Word Polygon ESRI-compatible
Prescribed impacts	Location of prescribed impact features • Karst, caves, crevices, cliffs, rocks, etc. • Human-made structures • Connectivity locations • Waterbodies and hydrology • Flyways/migration routes • High collision risk areas	Where appropriate include landscape context features identified in that section	Point and/or polyline and/or polygon ESRI-compatible

BAR section	Data to be supplied	Notes	Format
Avoid and minimise impacts	• Alternative location boundary (e.g. options assessment) • Locations of any specific mitigation measures (e.g. wildlife crossing structures, specific protection zones)		Point and/or polygon ESRI-compatible
Impact summary	Direct impact zone boundary		Polyline ESRI-compatible
	Indirect impact zone boundary		Polyline ESRI-compatible
	SAII entities *Minimum attributes:* • SAII identification (e.g. TEC or species) • Associated vegetation zone ID		Point and/or polygon ESRI-compatible
	Impacts requiring offset	This layer should be generated from the fields in the vegetation zones layer and species polygon layer	Polygon ESRI-compatible
	Impacts not requiring offset	This layer should be generated from the fields in the vegetation zones layer	Polygon ESRI-compatible
	Areas not requiring assessment		Polygon ESRI-compatible