

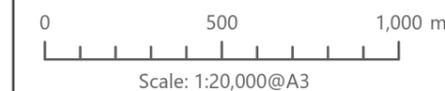
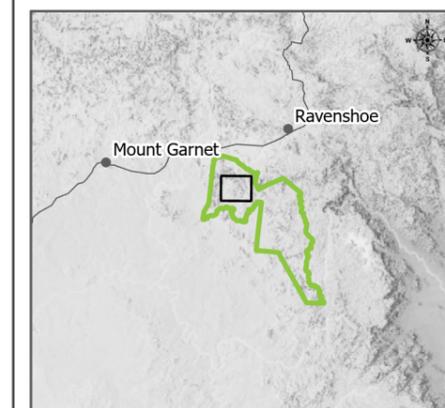
Chalumbin Wind Farm
Offset Management Area
Glen Gordon

Figure 7.5

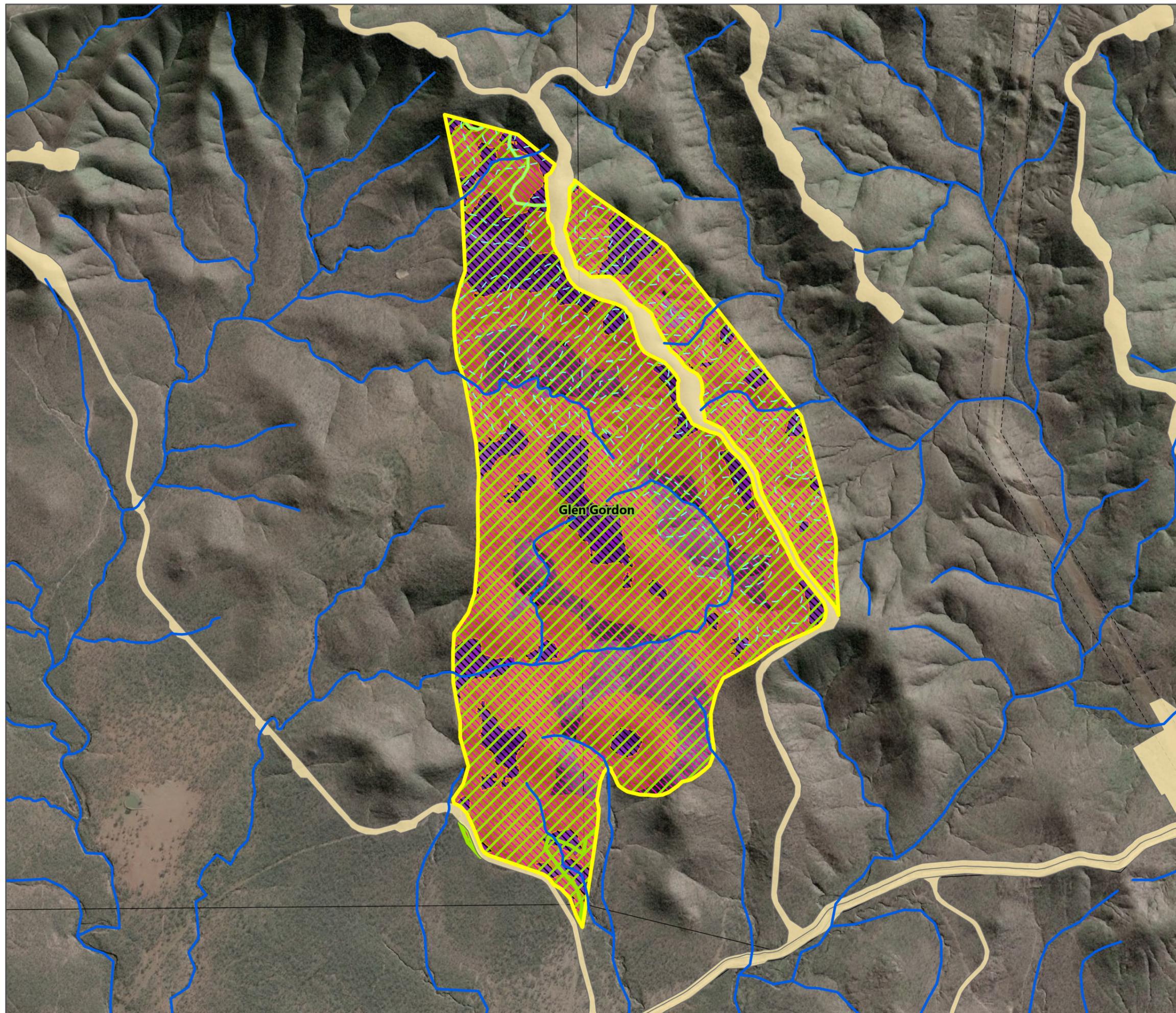
-  Project Area Boundary
-  Offset Management Area
- Koala Habitat**
-  Ancillary habitat trees
-  Locally important koala trees
- Magnificent Broodfrog Habitat**
-  MBF habitat (No Erosion Risk)
-  MBF habitat (Erosion Risk)
- Masked Owl Habitat**
-  Foraging Habitat
-  Nesting Habitat
- Greater Glider Habitat**
-  Denning Habitat
-  Foraging Habitat
- Clearance Envelope**
-  Stage 1
-  Stage 2
-  Watercourse
-  Protected Area Estate
-  Nature Refuge
-  WTQ Boundary
-  Lot Boundary
-  Easement

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Project: EPU-004

Author: TOD
Reviewed: NOD



Data Source(s):
Digital Cadastral Database - Department of Resources (2022)
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It is anticipated that approximately 561 ha will be set aside in this offset management area, including habitat split across each MNES value as illustrated in **Table 7-2**. It should be noted that the columns are not cumulative due to the co-location of offsets for each MNES value within the same offset management area.

Table 7-2 Colocation of MNES values in Glen Gordon Offset Management Area

MNES Value	Habitat Type	Proposed Offset Management Area (ha)
Koala	Locally important koala trees	555
	Ancillary habitat trees	6
Magnificent brood frog	Isolated from Project footprint	nil
	Downstream of Project footprint	144
Masked owl	Nesting habitat	98
	Foraging habitat	463
Northern greater glider	Denning habitat	98
	Foraging habitat	364
Spectacled flying-fox	Foraging habitat	561

This offset management area will also contribute to the acquittal of impacts to the following MSES values:

- Of Concern RE 9.3.15 (BVG:16a)
- Watercourse vegetation

7.4 Proposed Offset Acquittal Strategy

The proposed offset management areas on the two properties described above contain more than adequate vegetation to acquit 100% of the Project's residual impacts to all five MNES. The final areas to be used will be confirmed in the Offset Management Plans following negotiations with the landholders. The EPBC offset calculator will be re-run for each value using site-based habitat quality scores to demonstrate how offset liabilities have been acquitted.

In the case of the magnificent brood frog, it is proposed that a financial contribution of up to \$250,000 will also be made towards:

- Funding for research to better understand the following:
 - survey detection techniques, including the relative merits of bioacoustics, eDNA sampling and analysis and detector dogs;
 - habitat suitability modelling based on improved understanding of biophysical habitat requirements, such as geology, humidity, temperature, air pressure, groundwater, etc. Note the species entry published in SPRAT

states that all records have been from above 800 m asl however the majority of Project records were from below this elevation and Project information is therefore already contributing to improved species knowledge;

- detailed, ongoing ecological studies to determine the stability of known populations;
- trials to assess the impact of different management strategies on the species.
- Re-survey of historic sites (note the offset management area within Glen Gordon is the site of an historic record; the landowner has previously refused access to the Magnificent Brood Frog Working Group to re-survey this site but the Project team have been permitted to undertake surveys at this location and have already confirmed the continued presence of the species at this location);
- The design of simple and effective protective measures for populations which can be implemented by land managers; and
- The involvement of interested community groups in locating and monitoring populations and in their management (note that this engagement has commenced with the invitation to members of the Magnificent Brood Frog Working Group to join Project surveys in December 2021).

The above are listed as specific objectives of the Recovery Plan for the magnificent brood frog (McDonald et al. 2000) and/or were identified by the Magnificent Brood Frog Working Group (during a meeting held in September 2021) as current priorities for species research.

8.0 Desired Conservation Outcomes

8.1 Final Outcomes

The majority of the proposed offset areas are remnant vegetation in generally good condition. There are some existing threatening processes that have reduced the habitat quality for the MNES in question, including cattle grazing, weeds and pests, and inappropriate fire regimes. It is the intention of the offset program to manage the offset areas in a way that improves their suitability as habitat for these MNES. These habitat improvements will be achieved within 20 years.

The overall habitat quality across each offset management area will be improved through enhancing site condition attributes such as reducing weed cover, and increasing shrub and native grass cover. The offset site field assessments will enable the improvements in each of these characteristics for each MNES to be estimated.

The offsets will result in the following threats being reduced for each MNES:

- Koala – habitat loss, fragmentation, predation by dogs, inappropriate fire regimes, habitat degradation due to weeds;
- Magnificent brood frog – erosion and sedimentation, grazing and trampling by cattle, control of amphibian chytrid fungus;
- Masked owl – habitat loss, grazing by cattle, habitat degradation due to weeds, inappropriate fire regimes, control of feral cats which may compete for prey;
- Northern greater glider – habitat loss, fragmentation, inappropriate fire regimes, entanglement on barbed wire fencing, predation by feral cats and dogs; and
- Spectacled flying-fox – habitat loss, fragmentation, inappropriate fire regime and entanglement on barbed wire fencing.

Koala has not been detected in the impact area during any of the Project's ecological surveys to date, nor historically through desktop searches or landowner advice. It has been conservatively estimated that the koala may occupy the Project area at low density and/or on a very sporadic basis. It is not currently proposed that the offset areas will aim to provide an increase in stocking rate for koala but rather provide suitable habitat that could be used by the species in the future, for example as climate change refugia. Similarly, spectacled flying-fox has not been recorded within the Project area and it is not intended to provide an increase in stocking rate for this species whose presence is likely to be strongly seasonal, in response to availability of food resources.

8.2 Interim Milestones

In order to track progress towards the desired final conservation outcomes, interim milestones have been defined. These provisional milestones are currently presented in relation to the baseline condition and will be refined once the detailed habitat quality field assessments have been completed.

- Pest and weed management
 - Demonstrate the extent of weed cover across the offset management areas is < 25% by the end of year 5 and < 5% by the end of year 10, and then maintained at or below this level
- Stock management

-
- Install fauna friendly stock exclusion fencing around the offset management areas as required, by the end of year 1
 - Only permit grazing for the purposes of bushfire hazard reduction, to extent required to meet the habitat quality improvement milestones listed below, by the end of year 1
 - Ensure all livestock are excluded from the offset management area for a minimum of 5 years, or until a suitably qualified independent expert has determined that any significant cohorts of koala and grey-headed flying-fox feed trees are a sufficient size to withstand grazing by sheep and cattle. Cattle will be permanently excluded from the portion of the offset management areas intended for the magnificent brood frog.
 - Ensure any grazing is managed so as to prevent the risk of injury or mortality of koalas, by the end of year 1
 - Habitat quality improvement
 - Undertake ecology work which contributes to improvement of the condition of REs and facilitates natural regeneration within the offset management area, such that the following outcomes are achieved:
 - Average recruitment of woody perennial species in the ecologically dominant layer (EDL) is > 75% of the benchmark for the relevant RE by the end of year 5 and maintain that level or greater
 - Maintain average tree canopy height at > 50% of the benchmark for the relevant RE by the end of year 10
 - Maintain average tree canopy cover at > 25% of the relevant benchmark for the relevant RE by the end of year 10

9.0 Future Steps

The following sections outline the necessary steps for future offset commitments.

9.1 Offset Management Plans

Following field surveys to assess vegetation type, habitat attributes and condition, management plans will be prepared for each offset site. The management plans will provide details on the performance outcomes to be achieved, specific management actions required on each offset site, an estimate of the costs of management and details regarding the reporting and monitoring of offset actions and outcomes. Offsets include a mix of remnant vegetation and non-remnant areas. The management plans will therefore include details on where active management is required to restore ecosystem function whilst identifying appropriate management actions for remnant areas that require a different mix of management actions. The final management actions recommended will be dependent on the condition of vegetation and habitat, and the nature and type of threatening processes.

Detailed offset management plans will be developed that provide specific information on the following:

- Specific weed mapping across the offset sites;
- Pest animal mapping;
- Detailed assessment / mapping of species composition across all planted and regrowth areas to guide supplementary and enrichment planting;
- Fully quantify tree planting and maintenance requirements;
- Inspect and quantify changes to livestock grazing and pest exclusion fencing;
- Mosaic fire regimes (based on fuel load assessment and time since previous fire events).

Management plans will include cost estimates for all proposed management actions, monitoring and reporting, and detailed logistical program of works to guide implementation of conservation measures. Timing of works to maximise the return from resource and financial investment is considered critical for achieving conservation outcomes.

Management plans will set out an active management period of 20 years; however, all management actions will be guided through monitoring and subsequent reporting. It is anticipated that management efforts will be greatest in the first five years, particularly to establish revegetation areas, new fencing and getting weed populations under control.

9.2 Legal Mechanisms for Securing Offsets

Once the final offset package has been agreed, offset sites would be legally secured for offset purposes following Section 29 of the Offsets Act, through either of:

- An environmental offset protection area under Section 30 of the *Environmental Offsets Act 2014*; or
- An area declared as an area of high nature conservation value under Section 19F of the *Vegetation Management Act 1999* where it is secured for the purposes of an environmental offset

The mechanisms adopted to secure offsets will ultimately depend on the approval of relevant government departments, and landholders or parties with interests over the offset property.

The legal mechanism would remain on title for the offset area in perpetuity, ensuring that conservation gains are protected for the long term.

9.3 Offset Monitoring and Reporting

Offset management plans will include a monitoring program. It is proposed that monitoring be conducted annually for the first five years, with subsequent monitoring events being conducted bi-annually for a maximum of 20 years or until it can be demonstrated that the objectives of the management plans have been met. Monitoring plans will be developed in conjunction with the detailed management plans and will reflect the management actions at the site.

Vegetation / habitat condition monitoring will be based around the Queensland Government Guide to Determine Terrestrial Habitat Quality, following the baseline assessment used in determining the area of offset required at each of the sites. Other monitoring would include:

- Weed population and extent;
- Pest animal occurrence / abundance;
- Fire fuel load monitoring, fire impact monitoring and associated habitat change;
- Supplementary / enrichment planting monitoring for growth and survival rates; and
- Targeted fauna surveys and fauna utilisation monitoring (against the target species for the sites).

Monitoring reports will be used to inform ongoing management actions and be supplied to regulators as they are completed, to demonstrate progress towards the target conservation gains. Active management and associated monitoring would continue until all conservation gains at the offset sites have been achieved.

10.0 Compliance

10.1 Compliance with the EPBC Act Environmental Offsets Policy

Table 10-1 lists the principles of the EPBC Act Environmental Offsets Policy and describes how this Preliminary Offset Strategy has been developed to adhere to these principles.

Table 10-1 EPBC Act Environmental Offsets Policy Principles

Principle	Offset Management Strategy Compliance
<p>Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the proposed action</p>	<p>Based on the outcomes of a desktop offset availability analysis, a number of potential offset sites have been identified for the Project as described in Section 6.3. The offset site selection and preliminary site inspections have assessed the suitability of each potential offset site to deliver conservation gains for each matter being offset. The next stage of the Project's offset program will involve undertaking habitat quality assessments for the offset areas and uses of the EPBC Calculator to more fully demonstrate that the offset will improve or maintain the viability of relevant MNES.</p>
<p>Suitable offsets must be built around direct offsets but may include other compensatory measures</p>	<p>Direct offsets will provide 100% of the Project's offset requirements for all five MNES. The offset availability analysis presented in Section 6.0 demonstrates that there are a large number of properties within the sub-bioregion that provide potentially suitable vegetation to meet the Project's offset requirements.</p>
<p>Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter</p>	<p>In the absence of habitat quality measurements for the offset areas, it is not yet possible to fully assess the suitability of the proposed offset sites using the EPBC Calculator, although indicative calculator sheets are included in Appendix A. These will be updated during the next stage of the offsets program after habitat quality assessments have been undertaken in the field.</p>
<p>Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter</p>	<p>Offset availability assessment has incorporated consideration for how the proposed offset will be proportionate to the residual impacts on each of the MNES.</p>
<p>Suitable offsets must effectively account for and manage the risks of the offset not succeeding</p>	<p>It is not yet possible to estimate the risk of the offset not succeeding based on current information; this will be assessed during the next stage of the offset program and presented in the Offset Management Plan, which will also provide further detail on proposed monitoring, reporting and adaptive management.</p>
<p>Suitable offsets must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)</p>	<p>As described in Section 2.3 the EPBC Act Environmental Offsets Policy takes precedence in relation to MNES and the State cannot impose an offset condition in relation to the same or substantially the same impact, if DAWE has assessed an activity as a controlled action and decided that an offset is, or is not, required.</p> <p>The Project has the potential to result in significant residual impacts to MSES that are not also MNES and it is intended that the proposed</p>

Principle	Offset Management Strategy Compliance
	offset sites will also fully acquit the State offset requirements for these MSES.
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	It is the proponent's intention to have the offset in place prior to commencement of construction. As part of that process, an Offset Management Plan will be developed in early 2023 which will present the outcomes of the habitat quality assessments and the proposed offset management approach.
Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	The proposed governance arrangements for the offset property will be described in detail in the Offset Management Plan.
In assessing the suitability of an offset, government decision-making will be informed by scientifically robust information and incorporate the precautionary principle in the absence of scientific uncertainty	Noted.
In assessing the suitability of an offset, government decision-making will be conducted in a consistent and transparent manner	Noted.

10.2 Compliance with the Queensland Environmental Offset Policy

Table 10-2 lists the principles of the Queensland Environmental Offsets Policy and describes how this Preliminary Offset Management Strategy has been developed to adhere to these principles.

Table 10-2 Queensland Environmental Offsets Policy Principles

Principle	Offset Management Strategy Compliance
Offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy.	Section 2 outlines the approvals and regulatory framework applicable to this Project.
Impacts must first be avoided, then mitigated, before considering the use of offsets for any remaining impact.	Section 6 of the PER outlines how the mitigation hierarchy (avoid – minimise – mitigate – rehabilitate then offset) has been applied in full to the Project.
Offsets must achieve a conservation outcome that counterbalances the significant residual impact for which the offset was required.	Project impacts on MSES relate primarily to clearing of vegetation and habitat degradation. Notwithstanding that a comprehensive range of mitigation measures will be implemented in the construction and rehabilitation phases, specific management measures will be developed for each proposed offset management

Principle	Offset Management Strategy Compliance
	area that will achieve a conservation gain for each of the MSES over the life of the offset.
Offsets must provide environmental values as similar as possible to those being lost.	The requirements of the Queensland Environmental Offsets Policy have been considered in the identification of proposed offset management areas, for example selecting areas that support vegetation communities that are the same RE or same BVG as the vegetation being cleared, and identifying offset management areas in the same bioregion as the impact sites.
Offset provision must minimise the time-lag between the impact and delivery of the offset.	The proposed offset management areas will be subject to additional assessment as part of the Project approvals process under the EPBC Act. Once the offset program has received approval, CWF will undertake to legally secure the sites and commence offset management actions in tandem with construction of the Project.
Offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values.	Additional field assessments will be undertaken to assess current habitat quality at the proposed offset management areas and to subsequently determine the management actions that will be required for each MSES. These management actions will be described in detail in a future Offset Area Management Plan.
Where legal security is required, offsets must be legally secured for the duration of the impact on the prescribed environmental matter.	Offset management areas will be legally secured for the duration of the impact on the relevant MSES.

11.0 References

Department of Environment and Heritage Protection (EHP) (2014). *Queensland Environmental Offsets Policy Significant Residual Impact Guideline*. State of Queensland

Department of Environment and Science (DES) (2021). *Queensland Environmental Offsets Policy 1.10*. State of Queensland.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). (2012). *Environment Protection and Biodiversity Conservation Act 1999 EPBC Act Environmental Offsets Policy*.

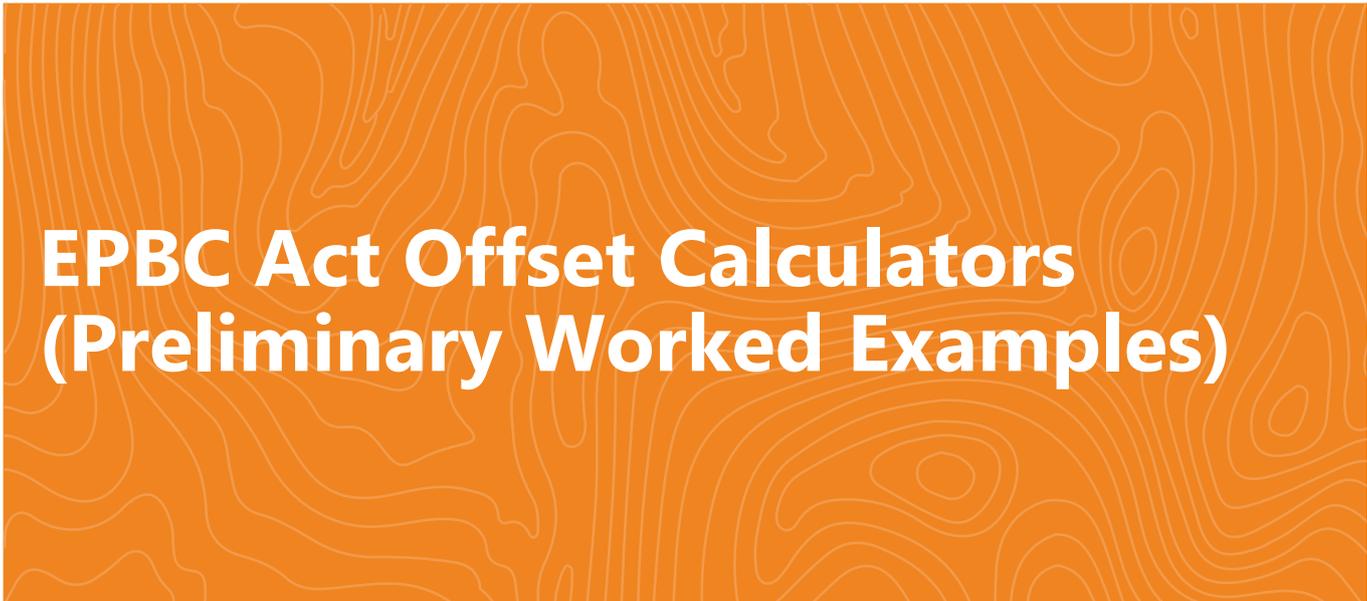
Department of the Environment (DoE) (2013) *Matters of National Environmental Significance Significant Impact Guidelines 1.1*. Australian Government.

Eyre T.J., Ferguson D.J., Hourigan C.L., Smith G.C., Mathieson M.T., Kelly A.L., Venz M.F., Hogan L.D. & Rowland J. (2018) *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland*. Department of Environment and Science, Queensland Government.

MacHunter, J., Brown, G., Loyn, r. and Lumsden, L. (2011) *Approved Survey Standards: Greater Glider Petauroides Volans*. Victorian Department of Sustainability and Environment

McLean, M., Kavanagh, R. P., Penman, T., Bradstock, R. (2018) The threatened status of the hollow dependent arboreal marsupial, the Greater Glider (*Petauroides Volans*), can be explained by impacts from wildfire and selective logging. *Forest Ecology and Management*. Volume 415-416, Pages 19-25.

Appendix A



EPBC Act Offset Calculators (Preliminary Worked Examples)

EPBC offset assessment guide input justification: – Northern Greater Glider Habitat Impact (remnant vegetation) and Offset area (remnant vegetation)

Aspect	Score	Justification
Impact site inputs		
Area of habitat (ha)	887.9	The total area of known greater glider habitat in the impact area is 887.9 ha .
Quality	7	Greater glider denning habitat was mapped as vegetation communities containing tree species characterising greater glider habitat within the relevant bioregions (as listed in DES 2022), containing “large trees” at a density of >25 trees per ha for the Wet Tropics bioregion (lower quartile of 46.5 cm DBH based on LQ = Mean – (0.65 x SD)) and >20 trees per ha for the Einasleigh Uplands bioregion. Greater glider foraging habitat was mapped as vegetation communities containing habitat trees species listed in DES 2022 within a buffer area around denning habitat based on a conservative home range size of 12 ha. The quality of greater glider habitat in the impact site is assessed as follows using <i>the Offsets Assessment Guide</i> :
Site Condition (score out of 4)	2	Site Condition - While the diversity and total number of eucalyptus food trees exceed the minimum requirement of six foraging trees per hectare across all sites, there is greater diversity of eucalyptus species in the lower slopes including preferred foraging habitat trees of <i>E. tereticornis</i> (forest red gum) and <i>C. intermedia</i> (pink bloodwood). The ecologically dominant canopy and sub-canopy layers of the upper and mid-slope sites were of relatively small stature and diameter at breast height (DBH) with little opportunity for large hollows to form. Live and dead hollow-bearing myrtaceous trees inclusive of large hollows with diameters greater than 10 cm at least 8 m from the ground were more prevalent in the lower slopes with a considerably larger and taller stature, and more diverse ecologically dominant layer, therefore representing higher quality of required denning habitat features. The habitat scores a 2 out of 4 for site condition.
Site Context (score out of 3)	3	Site Context - Contiguous forest patches of preferred greater glider habitat are well connected throughout much of the project area and the adjacent National Parks. Limited fragmentation of remnant habitat within the study area allows for good dispersal ability (modelling suggests that greater glider require native forest patches of at least 160 km ² to maintain genetic diversity and population viability (Eyre 2002)). Barbed wire fencing and powerlines are known minor threats to the species and are both present within the Project

Aspect	Score	Justification
		area. Therefore, the habitat scores a 3 out of 3 for site context.
Stocking Rate (score out of 3)	2	Species stocking rate – Greater gliders were observed at multiple locations across the Project area, but observation frequency was below that of a 'large' population (MacHunter et al., 2011). Therefore, the habitat scores 2 out of 3 for stocking rate.
		The overall quality of greater glider habitat in remnant vegetation areas of the impact site is assessed as being a 7 out of 10 .
Offset site inputs		
Time over which loss is averted (max 20 years)	20 years	A timeframe of 20 years has been applied corresponding to the length of the active management period and consistent with the <i>Offsets Assessment Guide</i> .
Start quality (1-10)	7	<p>The offset sites are located within the Project area and achieve a similar habitat quality score. A diversity of eucalyptus food trees of sufficient density is present across the site including <i>E. tereticornis</i> (forest red gum), <i>E. portuensis</i> (white mahogany) and <i>C. intermedia</i> (pink bloodwood). Habitat quality declines with tree size and density towards the ridgelines. greater gliders were observed at sites within and adjacent to the preliminary offset areas.</p> <p>The quality of greater glider habitat in the impact site is assessed as follows using <i>the Offsets Assessment Guide</i>:</p> <p>Site Condition – The ecologically dominant canopy and sub-canopy layers of the upper and mid-slope sites were of relatively small stature (<30 DBH) with little opportunity for large hollows to form. Hollow-bearing trees (>50 DBH) inclusive of large hollows with diameters greater than 10 cm at least 8 m from the ground were more prevalent in the lower slopes with a considerably taller and more diverse ecological dominant layer, therefore representing higher quality of required denning and foraging habitat features. Preliminary offset areas in the riparian zones and close to the overhead transmission line (OHTL) are severely impacted by invasive weeds including lantana (<i>Lantana camara</i>) and Siam weed (<i>Chromolaena odorata</i>). These areas have been disturbed by previous clearing and contain fewer large, hollow-bearing trees. Disturbed sites are estimated to achieve lower scores for species richness, species diversity and ground cover diversity. Barbed-wire fencing and powerlines are known threats and are both present within the Project area. This poses a high risk of collision and entanglement leading to an increased mortality rate. Therefore, the habitat scores a 2 out of 4 for site condition.</p>

Aspect	Score	Justification
		<p>Site Context – Contiguous patches of preferred greater glider habitat are well connected throughout much of the project area and the adjacent National Parks. Limited fragmentation of remnant habitat within the study area allows for good dispersal ability (modelling suggests that greater glider require native forest patches of at least 160 km² to maintain genetic diversity and population viability (Eyre 2002)). Therefore, the habitat scores a 3 out of 3 for site context.</p> <p>Species Stocking Rate - Greater gliders were observed at multiple locations across the Project area observation frequency was below that of a 'large' population (MacHunter et al., 2011). Therefore, the habitat scores 2 out of 3 for stocking rate.</p>
Time until ecological benefit	20 years	Management actions described in the Preliminary Offsets Strategy aim to increase the habitat quality at the offset site by one point over 20 years .
Risk of loss (%) without offset	1%	<p>Background risk of loss for the Atherton Tablelands Area is set at 0.44% according to the Assessment Guide. Risk of development on the site is low and would trigger an offset requirement under Queensland vegetation clearing laws. Risk of loss of site value for greater glider is driven by:</p> <p>Inappropriate fire regimes – direct mortality and indirect habitat damage from bushfire have been shown to significantly reduce greater glider populations.</p> <p>Selective clearing – selected clearing may be permitted under current exemptions.</p> <p>Predation by feral cats – an established population of feral cats currently inhabits the site, which is a known threat to the greater glider.</p> <p>Barbed wire fencing and powerlines – Direct mortality associated with collision and/or entanglement</p> <p>The risk of loss without offset has been assessed as 1%.</p>
Future quality without offset (1-10)	6	Expected decline in habitat quality is driven by threatening processes continuing in the absence of offset management. Greater glider is impacted by habitat loss and fragmentation by selective clearing. Intense and frequent fires are thought to impact greater glider directly and reduce the availability of suitable habitat trees. The site supports an established population of feral cats, which are known to predate on greater gliders. Habitat degradation due to invasive weed impacts is also expected to degrade site quality over time. Collision and/or entanglement from barbed wire fencing will have minor consequence on greater glider populations.

Aspect	Score	Justification
		In the absence of offset establishment and management activities, these threats have been assessed as reducing the future habitat quality of the site to 6 out of 10 .
Risk of loss (%) with offset	0%	Establishment of a legally secured offset title in perpetuity will significantly reduce the impact of threatening processes on the habitat quality for greater glider. Implementation of offset management activities will prevent the selective clearing of native vegetation and reduce the risk of bushfires. All offset areas will improve site condition through alternative fencing methods (animal friendly fencing or replacing the top wire with plain wire instead of barbed wire). Offset site protection will persist should the land be sold in the future. Therefore, the risk of loss with the offset has been assessed at 0% .
Future quality with offset (1-10)	8	The presence of remnant vegetation at the proposed offset sites offers the opportunity to deliver quality improvements in a shorter time frame than would be required through revegetation. All offset areas will improve site condition through alternative fencing methods (animal friendly fencing or replacing the top wire with plain wire instead of barbed wire). Offset Area 1 and 2 will improve site condition through the removal and management of invasive weeds including lantana and Siam weed. A feral cat control program will be implemented to reduce predation pressure. Construction of nesting boxes throughout higher elevated areas of the offset site will compensate for a lower density of hollow-bearing trees. Offset Area 2 aims to improve site context by increasing the area of potential habitat for the species with contiguous habitat associated with Ravenshoe Forest Reserve 1 to the north and Tully Falls National Park to the east. Offset Area 3 aims to improve site context by establishing connectivity between the Koombaloo South Forest Reserve to the east and Yourka Nature Refuge to the west.
Area of offset required and % delivered	5,903ha 169%	An offset calculator was prepared (Fig. 1.1) in accordance with the <i>Offsets Assessment Guide</i> . Based on vegetation mapping, 5,903 ha is available in the area to achieve an offset for greater glider habitat of 169% .
Confidence in result (%)	90%	Confidence in achieving a one-point increase in habitat quality over 20 years is assessed as 90% . Confidence in managing the risk of loss at the offset site is assessed as 90%. Proposed management actions include: <ul style="list-style-type: none"> ▪ Implementation of an improved bushfire management plan.

Aspect	Score	Justification
		<ul style="list-style-type: none"> ▪ Protection from selective logging to increase density and cover of denning and foraging habitat trees. ▪ Implementation of comprehensive weed management plan. ▪ Implementation of a feral cat control program. ▪ Alternative fencing to reduce direct mortality associated with collision and entanglement <p>These actions will deliver improvement to key habitat metrics shown to correlate with increased greater glider population size.</p>

EPBC offset assessment guide input justification - Koala Habitat Impact (remnant vegetation) and Offset area (remnant vegetation)

Aspect	Score	Justification
Impact site inputs		
Area of habitat (ha)	843.81 ha	The total area of known koala habitat in the impact area is 843.81 ha.
Quality	4	Koala habitat in the Project area has therefore been mapped as remnant and regrowth vegetation communities containing locally important koala tree species or ancillary tree species as identified in Youngentob et al 2021. The quality of koala habitat in the impact site is assessed as follows using <i>the Offsets Assessment Guide</i> :
Site Condition (score out of 4)	2	Site Condition – remnant and regrowth vegetation communities comprising locally important koala trees (including <i>E. crebra</i> , <i>E. exserta</i> , <i>E. grandis</i> , <i>E. melanophloia</i> , and <i>E. resinifera</i>) and ancillary habitat trees including <i>Corymbia citriodora</i> , <i>C. intermedia</i> , <i>C. tessellaris</i> , <i>E. platyphylla</i> , <i>E. portuensis</i> and <i>Lophostemon confertus</i> (per Youngentob et al. 2021) were recorded throughout the Project area. Weeds such as lantana and Siam weed are prevalent across the Project area. There is a large established population of wild dogs in the Project area. The habitat scores a 2 out of 4 for site condition.
Site Context (score out of 3)	2	Site Context - Contiguous forest patches of preferred koala habitat (locally important koala trees and ancillary trees specific to the bioregion) are well connected throughout much of the Project area and the adjacent National Parks. Sightings of Koala in the adjacent nature reserves are rare. Therefore, the habitat scores a 2 out of 3 for site context.
Stocking Rate (score out of 3)	0	Species stocking rate - No evidence of koalas was observed in the Project area during field surveys. Both landholders report never having seen koalas on their properties and its occurrence on the Yourka Nature Reserve, immediately to the south, is rare. The Project area is not a stronghold for any koala population and if koalas are present within the Project area, it is likely to be on a very sporadic basis and/or in low numbers. Therefore, the habitat scores 0 out of 3 for species stocking rate.
		The overall quality of koala habitat in remnant vegetation areas of the impact site is assessed as being a 4 out of 10 .
Offset site inputs		
Time over which loss is averted (max 20 years)	20 years	A timeframe of 20 years has been applied corresponding to the length of the active management period and consistent with the <i>Offsets Assessment Guide</i> .

Aspect	Score	Justification
Start quality (1-10)	4	<p>The offset site is located within the Project area and achieves a similar habitat quality score. Preferred koala habitat and a diversity of eucalyptus trees recognised as locally important koala and ancillary trees are present in the offset areas.</p> <p>Site Condition – remnant and regrowth vegetation communities comprising locally important koala trees (including <i>E. crebra</i>, <i>E. exserta</i>, <i>E. grandis</i>, <i>E. melanophloia</i>, and <i>E. resinifera</i>) and ancillary habitat trees including <i>Corymbia citriodora</i>, <i>C. intermedia</i>, <i>C. tessellaris</i>, <i>E. platyphylla</i>, <i>E. portuensis</i> and <i>Lophostemon confertus</i> (per Youngentob et al. 2021) were recorded throughout the offset areas. Preliminary offset areas in the riparian zones and close to the OHTL are severely impacted by invasive weeds including lantana (<i>Lantana camara</i>) and Siam weed (<i>Chromolaena odorata</i>). There is a large established population of wild dogs in the offset areas. Disturbed sites are estimated to achieve lower scores for species richness, species diversity and ground cover diversity. Therefore, the habitat scores 2 out of 4 for site condition.</p> <p>Site Context – Contiguous forest patches of preferred koala habitat, locally important koala trees and ancillary trees are well connected throughout much of the Project area and the adjacent National Parks. Sightings of koala in the adjacent nature reserves are rare. Therefore, the habitat scores a 2 out of 3 for site context.</p> <p>Species stocking rate - No evidence of koalas was observed in the offset areas during field surveys. Both landholders report never having seen koalas on their properties and its occurrence on the Yourka Nature Reserve, immediately to the south, is rare. Therefore, the habitat scores 0 out of 3 for species stocking rate.</p>
Time until ecological benefit	20 years	<p>Management actions described in the Preliminary Offsets Strategy aim to increase the habitat quality at the offset site by one point over 20 years.</p>
Risk of loss (%) without offset	1%	<p>Background risk of loss for the Atherton Tablelands Area is set at 0.44% according to the Assessment Guide. Risk of development on the site is low and would trigger an offset requirement under Queensland vegetation clearing laws. Risk of loss of site value for Koala habitat is driven by:</p> <p>Bushfire (altered fire regimes) – direct mortality and indirect habitat damage have been shown to significantly affect the suitability of habitat for koala.</p> <p>Selective clearing – selected clearing may be permitted under current exemptions.</p>

Aspect	Score	Justification
		<p>Vehicle strike – Mortality associated with vehicle strike on public roads and private access tracks.</p> <p>Predation by dogs – In areas where connectivity is low, koalas are at risk of predation when dispersing. The risk of loss without offset has been assessed as 1%.</p>
Future quality without offset (1-10)	3	Decline in koala habitat quality is driven by habitat loss and fragmentation due to selective logging. Extreme levels of incursion by invasive weeds, particularly <i>Lantana camara</i> in areas of preferred habitat contributes to fragmentation. Risk of extreme fire disturbance is exacerbated by high fuel loads associated with <i>L. camara</i> infestation.
Risk of loss (%) with offset	0%	Establishment of a legally secured offset title in perpetuity will significantly reduce the impact of threatening processes on the habitat quality for koala. Implementation of offset management activities will prevent the selective clearing of native vegetation and reduce the risk of bushfires. Offset site protection will persist should the land be sold in the future. Therefore, the risk of loss with the offset has been assessed at 0% .
Future quality with offset (1-10)	5	The presence of remnant vegetation at the proposed offset sites offers the opportunity to deliver quality improvements in a shorter time frame than would be required through revegetation. All offset areas will improve site condition through the removal and management of invasive weeds including lantana and Siam weed. Offset Area 2 aims to improve site context by increasing the area of potential habitat for the species with contiguous habitat associated with Ravenshoe Forest Reserve 1 and Tully Falls National Park. Offset Area 3 aims to improve site context by establishing connectivity between the Koombooloomba South Forest Reserve to the east and Yourka Nature Refuge to the west.
Area of offset required and % delivered	5,426 ha 282%	An offset calculator was prepared (Fig. 1.2) in accordance with the <i>Offsets Assessment Guide</i> . Based on vegetation mapping, 5,426 ha is available in the area to achieve an offset for koala habitat of 282% .
Confidence in result (%)	90%	Confidence in achieving a one-point increase in habitat quality over 20 years is assessed as 90% . Confidence in managing the risk of loss at the offset site is assessed as 90%. Our proposed management actions include: <ul style="list-style-type: none"> ▪ Implementation of an improved bushfire management plan. ▪ Protection from selective logging to increase density and cover of habitat trees. ▪ Implementation of a wild dog control program.

Aspect	Score	Justification
		<ul style="list-style-type: none"><li data-bbox="751 237 1326 304">▪ Implementation of comprehensive weed management plan. <p data-bbox="751 309 1385 365">These actions will deliver improvement to key metrics associated with suitability for koala habitability.</p>

Table 4 EPBC offset assessment guide input justification – Magnificent Brood Frog Habitat Impact (remnant vegetation) and Offset area (remnant vegetation)

Aspect	Score	Justification
Impact site inputs		
Area of habitat (ha)	120.5ha	The total area of known magnificent brood frog habitat in the impact area is 120.5ha.
Quality	8	Potential breeding habitat for magnificent brood frog was mapped as potential seepages, and zero and first order streams on rhyolites of the Glen Gordon volcanics. Non-breeding habitat was mapped as open eucalypt forest within a 50 m buffer around the potential breeding habitat. The quality of magnificent brood frog habitat in the impact site is assessed as follows using <i>the Offsets Assessment Guide</i> .
Site Condition (score out of 4)	3	Site Condition – Preferred habitat exists within the project area as seepage areas and drainage lines in open eucalypt forest with an understorey of <i>Themada triandra</i> . Trampling and erosion associated with historical and ongoing grazing in areas of known and potential magnificent brood frog habitat were observed. The habitat scores 3 out of 4 for site condition.
Site Context (score out of 3)	2	Site Context – Areas of potential habitat were mapped throughout the Project area. Of the 11 locations where the species has been recorded within the Project area, 8 are below 800m asl, which contradicts the published lower limit of the species' elevation range and may suggest a higher level of connectivity for the species within the site. The habitat scores 2 out of 3 for site context.
Stocking Rate (score out of 3)	3	Species stocking rate – Magnificent brood frog has previously been recorded within the Project Area and was observed at 11 locations. Two observations each comprised a relatively large group of male frogs (numbering approximately 15 and 20 individuals). Therefore, species stocking rate for the habitat was assessed as 3 out of 3 .
		The overall quality of magnificent brood frog habitat in remnant vegetation areas of the impact site is assessed as being an 8 out of 10 .
Offset site inputs		
Time over which loss is averted (max 20 years)	20 years	A timeframe of 20 years has been applied corresponding to the length of the active management period and consistent with the <i>Offsets Assessment Guide</i> .
Start quality (1-10)	6	Site Condition – Preferred habitat exists within each of the offset areas as seepage areas and drainage lines in open eucalypt forest with an understorey of <i>Themada triandra</i> . Trampling and erosion associated

Aspect	Score	Justification
		<p>with historical and ongoing grazing were observed. The habitat scores 3 out of 4 for site condition.</p> <p>Site Context – Areas of potential habitat were mapped throughout the Project area. The offset areas score 2 out of 3 for site context.</p> <p>Species stocking rate – Magnificent brood frog was recorded in one of the three proposed offset areas, with reasonable separation between this record and the next closest observation. Therefore, species stocking rate for the offset areas was assessed as 1 out of 3.</p>
Time until ecological benefit	20 years	Management actions described in the Preliminary Offsets Strategy aim to increase the habitat quality at the offset site by one point over 20 years .
Risk of loss (%) without offset	1	<p>Background risk of loss for the Atherton Tablelands Area is set at 0.44% according to the Assessment Guide. Risk of development on the site is low and would trigger an offset requirement under Queensland vegetation clearing laws. Risk of loss of site value for magnificent brood frog habitat is driven by:</p> <p>Selective clearing – selected clearing may be permitted under current exemptions.</p> <p>Grazing - Grazing and trampling has the potential to degrade and destroy the seepage areas used by the frogs for breeding. Similarly, erosion and subsequent siltation may cover seepage areas if future logging or clearing occurs. Roads and cuttings can alter the water quality and hydrology and may affect seepage areas and first order streams.</p>
Future quality without offset (1-10)	5	Decline in MBF habitat quality in the offset area is driven by habitat loss and fragmentation due to selective logging. Extreme levels of incursion by invasive weeds, particularly <i>Lantana camara</i> in areas of preferred habitat contributes to fragmentation. Risk of extreme fire disturbance is exacerbated by high fuel loads associated with <i>L. camara</i> infestation.
Risk of loss (%) with offset	0	Establishment of a legally secured offset title in perpetuity will significantly reduce the impact of threatening processes on the habitat quality for magnificent brood frog. Implementation of offset management activities will prevent the selective clearing of native vegetation and reduce the risk of bushfires. Offset site protection will persist should the land be sold in the future. Therefore, the risk of loss with the offset has been assessed at 0% .
Future quality with offset (1-10)	7	The offset areas would protected against grazing pressures. Maintaining remnant vegetation uses less water than regrowth and therefore has the potential to increase the supply of seepages suitable for MBF habitat (McDonald et al 2000).

Aspect	Score	Justification
Area of offset required and % delivered	1,409ha 259%	An offset calculator was prepared (Fig. 1.3) in accordance with the <i>Offsets Assessment Guide</i> . Based on vegetation mapping, 1,409 ha is available in the area, upstream of any Project footprint, to achieve an offset for magnificent brood frog habitat of 259% .
Confidence in result (%)	90%	<p>Confidence in achieving a one-point increase in habitat quality over 20 years is assessed as 90%. Confidence in managing the risk of loss at the offset site is assessed as 90%. Our proposed management actions include:</p> <ul style="list-style-type: none"> ▪ Removal/reduction of grazing pressures (trampling, erosion, siltage). ▪ Protection from selective logging to increase density and cover of habitat trees. ▪ Implementation of comprehensive weed management plan. ▪ Implementation of an improved bushfire management plan. <p>These actions will deliver improvement to the quality of habitat identified as suitable for magnificent brood frog.</p>

EPBC offset assessment guide input justification – Masked Owl (Northern) Habitat Impact (remnant vegetation) and Offset area (remnant vegetation)

Aspect	Score	Justification
Impact site inputs		
Area of habitat (ha)	1026.3 ha	The total area of known masked owl habitat in the impact area is 1026.3 ha .
Quality	7	Potential nesting habitat was mapped as rainforest, riparian forest or open eucalypt forest containing “large trees” at a density of > 25 trees per ha and additional foraging habitat was mapped as rainforest, riparian forest and open eucalypt forest within a buffer area around nesting habitat based on a core range of 155 ha. The quality of masked owl habitat in the impact site is assess as follows using <i>the Offsets Assessment Guide</i> .
Site Condition (score out of 4)	2	Site Condition - Riparian habitats within the Project area typically consist of forest red gum (<i>E. tereticornis</i>) with sub-dominant river she-oak (<i>Casuarina cunninghamiana</i>) and/or poplar gum (<i>E. platyphylla</i>). These areas represent preferred habitats for species that nest or den in large hollows in old growth trees, such as masked owl. Tree height and DBH was greater at the sites of lower elevation, and this is associated with large hollow-bearing trees. Species such as <i>E. tereticornis</i> (forest red gum), <i>E. portuensis</i> (white mahogany) and <i>C. intermedia</i> (pink bloodwood) were observed to have a taller tree structure, achieving heights closer to 17-20 m at the same DBH within the Project area. A density of 25 large trees per hectare was considered indicative of the species’ preference for nesting in “closed forest”. Fewer hollow-bearing trees were observed at the upper and mid-slope sites. The masked owl was recorded at two locations within the Project area during the January 2021 surveys. The habitat scores 2 out of 4 for site condition.
Site Context (score out of 3)	3	Site Context - Contiguous forest patches of preferred masked owl habitat are well connected throughout much of the project area and the adjacent National Parks. Limited fragmentation of habitat within the study area allows for good dispersal ability and modelling. The site scores 3 out of 3 for site context.
Stocking Rate (score out of 3)	2	Species stocking rate – Historical records show masked owl within the Project area, to the north of the Project area and to the south within the Yourka Nature Reserve. During the January 2021 surveys masked owl was recorded vocalising at two locations on the Glen Gordon property; on multiple occasions alongside Blunder Creek (within riparian vegetation dominated by <i>Eucalyptus tereticornis</i> and <i>Casuarina</i>

Aspect	Score	Justification
		<i>cunninghamiana</i>) and once within mixed Eucalypt woodland dominated by <i>Corymbia intermedia</i> , <i>E. resinifera</i> and <i>E. portuensis</i> . The habitat scores 2 out of 3 for species stocking rate.
		The overall quality of masked owl habitat in remnant vegetation areas of the impact site is assessed as being a 7 out of 10 .
Offset site inputs		
Time over which loss is averted (max 20 years)	20 years	A timeframe of 20 years has been applied corresponding to the length of the active management period and consistent with the <i>Offsets Assessment Guide</i> .
Start quality (1-10)	7	<p>The offset site is located adjacent the impact site and achieves a similar habitat quality score.</p> <p>Site Condition – The ecologically dominant canopy and sub-canopy layers of the upper and mid-slope sites were of relatively small stature and DBH with little opportunity for large hollows to form and hence a lower density and smaller distribution of hollow-bearing trees with large hollows present on elevated slopes. Hollow-bearing trees inclusive of large hollows with diameters greater than 8 cm at least 8 m from the ground were more prevalent with a considerably taller and more diverse ecological dominant layer, therefore representing higher quality of required habitat features in the lower slope assessment site. Species such as <i>E. tereticornis</i> (forest red gum), <i>E. portuensis</i> (white mahogany) and <i>C. intermedia</i> (pink bloodwood) were observed to have a taller tree structure, achieving heights closer to 17-20 m at the same DBH within the Project area. A density of 25 large trees per hectare was considered indicative of the species' preference for nesting in "closed forest". Preliminary offset areas in the riparian zones and close to the OHTL are severely impacted by invasive weeds including lantana (<i>Lantana camara</i>) and Siam weed (<i>Chromolaena odorata</i>). Exotic plant species density has been associated with reductions in masked owl populations. These areas have been disturbed by previous clearing and contain fewer large, hollow-bearing trees. Disturbed sites are estimated to achieve lower scores for species richness, species diversity and ground cover diversity. Therefore, the habitat scores a 2 out of 4 for site condition.</p> <p>Site Context – Contiguous patches of preferred masked owl habitat are well connected throughout much of the project area and the adjacent National Parks. Limited fragmentation of habitat within the study area allows for good dispersal ability.</p>

Aspect	Score	Justification
		<p>Therefore, the habitat scores a 3 out of 3 for site context.</p> <p>Species Stocking Rate – Masked owl presence was recorded on multiple locations across the Project area. Historical records document the presence of the species within the Project area Therefore, the habitat scores 2 out of 3 for stocking rate.</p>
Time until ecological benefit	20 years	Management actions described in the Preliminary Offsets Strategy aim to increase the habitat quality at the offset site by one point over 20 years .
Risk of loss (%) without offset	1%	<p>Background risk of loss for the Atherton Tablelands Area is set at 0.44% according to the Assessment Guide. Risk of development on the site is low and would trigger an offset requirement under Queensland vegetation clearing laws. Risk of loss of site value for masked owl is driven by:</p> <p>Bushfire – extreme bushfire has been shown to significantly reduce the suitability of habitat for masked owl populations.</p> <p>Selective clearing – selected clearing may be permitted under current exemptions.</p> <p>Invasive weeds and feral animals – Extreme levels of incursion by invasive weeds, particularly <i>Lantana camara</i> and pasture grasses, and grazing of livestock in areas of preferred habitat contributes to fragmentation.</p> <p>The risk of loss without offset has been assessed as 1%.</p>
Future quality without offset (1-10)	6	<p>Expected decline in habitat quality is driven by threatening processes continuing in the absence of offset management. Masked owl is impacted by habitat loss and fragmentation by selective clearing. Intense and frequent fires are thought reduce the availability of suitable nesting habitat trees. Habitat degradation due to invasive weed incursion is also expected to degrade site quality over time.</p> <p>In the absence of offset establishment and management activities, these threats have been assessed as reducing the future habitat quality of the site to 6 out of 10.</p>
Risk of loss (%) with offset	0%	<p>Establishment of a legally secured offset title in perpetuity will significantly reduce the impact of threatening processes on the habitat quality for masked owl. Implementation of offset management activities will prevent the selective clearing of native vegetation and reduce the risk of bushfires. Offset site protection will persist should the land be sold in the future. Therefore, the risk of loss with the offset has been assessed at 0%.</p>
Future quality with offset (1-10)	8	The presence of remnant vegetation at the proposed offset sites offers the opportunity to deliver quality

Aspect	Score	Justification
		<p>improvements in a shorter time frame than would be required through revegetation. All offset areas will improve site condition through alternative fencing methods (animal friendly fencing or replacing the top wire with plain wire instead of barbed wire). Offset Area 1 and 2 will improve site condition through the removal and management of invasive weeds including lantana and Siam weed. Construction of nesting boxes in less elevated areas of the offset site will compensate for a lower density of hollow-bearing trees. Offset Area 2 aims to improve site context by increasing the area of potential habitat for the species with contiguous habitat associated with Ravenshoe Forest Reserve 1 to the north and Tully Falls National Park to the east. Offset Area 3 aims to improve site context by establishing connectivity between the Koombooloomba South Forest Reserve to the east and Yourka Nature Refuge to the west.</p>
Area of offset required and % delivered	7,425 ha 184%	<p>An offset calculator was prepared (Fig. 1.4) in accordance with the <i>Offsets Assessment Guide</i>. Based on vegetation mapping, 7,425 ha is available in the area to achieve an offset for masked owl habitat of 184%.</p>
Confidence in result (%)	90%	<p>Confidence in achieving a one-point increase in habitat quality over 20 years is assessed as 90%. Confidence in managing the risk of loss at the offset site is assessed as 90%. Our proposed management actions include:</p> <ul style="list-style-type: none"> ▪ Implementation of an improved bushfire management plan. ▪ Protection from selective logging to increase density and cover of foraging and nesting habitat trees. ▪ Implementation of comprehensive weed management plan. <p>These actions will deliver improvement to key habitat metrics shown to correlate with increased masked owl population size.</p>

EPBC offset assessment guide input justification – Spectacled Flying-fox Habitat Impact (remnant vegetation) and Offset area (remnant vegetation)

Aspect	Score	Justification
Impact site inputs		
Area of habitat (ha)	976.1 ha	The total area of known spectacled flying-fox habitat in the impact area is 976.1 ha.
Quality	7	There is insufficient rainforest vegetation within the Project area to support a camp. Foraging habitat has been mapped as all eucalypt forest and rainforest within the Project area. The quality of Spectacled Flying-fox habitat in the impact site is assessed as follows using <i>the Offsets Assessment Guide</i> :
Site Condition (score out of 4)	3	Site Condition – The Project area is predominantly remnant woodland and open forest dominated by communities of <i>Corymbia citriodora</i> , <i>C. intermedia</i> , <i>Eucalyptus portuensis</i> and <i>E. reducta</i> with lower-lying areas dominated by <i>E. crebra</i> , <i>C. clarksoniana</i> and <i>C. citriodora</i> , <i>E. tereticornis</i> and <i>E. platyphylla</i> . These areas represent a range of potential foraging habitats for the species. As outlined in the Conservation Advice (TSSC 2019b) and Recovery Plan (DERM 2010), barbed-wire fencing and powerlines are known threats to the species and are both present within the Project area. This poses a high risk of collision and entanglement leading to an increased mortality rate. The habitat scores 3 out of 4 for site condition.
Site Context (score out of 3)	3	Site Context - Contiguous forest patches of preferred spectacled flying-fox foraging habitat are well connected throughout much of the project area and the adjacent National Parks. Limited fragmentation of remnant habitat within the study area allows for good dispersal ability. The site scores 3 out of 3 for site context.
Stocking Rate (score out of 3)	1	Species stocking rate – Historical records show spectacled flying-fox immediately adjacent to the north of the Project Area, in the Ravenshoe Forest Reserve 1 (ALA 1999). The species has not been recorded within the Project area. The habitat scores 1 out of 3 for species stocking rate.
		The overall quality of spectacled flying-fox habitat in remnant vegetation areas of the impact site is assessed as being a 7 out of 10 .
Offset site inputs		
Time over which loss is averted (max 20 years)	20 years	A timeframe of 20 years has been applied corresponding to the length of the active management period and consistent with the <i>Offsets Assessment Guide</i> .
Start quality (1-10)	7	The offset site is located within the Project area and achieves a similar habitat quality score.

Aspect	Score	Justification
		<p>Site Condition – The ecologically dominant canopy and sub-canopy layers of vegetation communities at all elevations of the site are dominated by preferred food trees (Eucalypt spp., Corymbia spp.). As outlined in the Conservation Advice (TSSC 2019b) and Recovery Plan (DERM 2010), barbed-wire fencing and powerlines are known threats and are both present within the Project area. This poses a high risk of collision and entanglement leading to an increased mortality rate. Therefore, the habitat scores a 3 out of 4 for site condition.</p> <p>Site Context – Contiguous patches of preferred spectacled flying-fox foraging habitat are well connected throughout much of the project area and the adjacent National Parks. The species' preferred food trees (Eucalypt spp., Corymbia spp.) occur throughout the Project area. Limited fragmentation of remnant habitat within the study area allows for good dispersal ability. Therefore, the habitat scores a 3 out of 3 for site context.</p> <p>Species Stocking Rate – Historical records show spectacled flying-fox immediately adjacent to the north of the Project Area, in the Ravenshoe Forest Reserve 1 (ALA 1999). However, the species has not been recorded within the Project area. Therefore, the habitat scores 1 out of 3 for stocking rate.</p>
Time until ecological benefit	20 years	Management actions described in the Preliminary Offsets Strategy aim to increase the habitat quality at the offset site by one point over 20 years .
Risk of loss (%) without offset	1%	Background risk of loss for the Atherton Tablelands Area is set at 0.44% according to the Assessment Guide. Risk of development on the site is low and would trigger an offset requirement under Queensland vegetation clearing laws. Risk of loss of site value for spectacled flying-fox is driven by: Barbed-wire fencing and powerlines – Mortality associated with collision and/or entanglement. Selective clearing – selected clearing may be permitted under current exemptions. The risk of loss without offset has been assessed as 1% .
Future quality without offset (1-10)	6	Expected decline in habitat quality is driven by threatening processes continuing in the absence of offset management. Spectacled flying-fox is impacted by habitat loss and fragmentation by selective clearing and the potential of increased mortality associated with collision and/or entanglement with barbed-wire fencing and powerlines present in the site. In the absence of offset establishment and management activities, these threats have been

Aspect	Score	Justification
		assessed as reducing the future habitat quality of the site to 6 out of 10 .
Risk of loss (%) with offset	0%	Establishment of a legally secured offset title in perpetuity will significantly reduce the impact of threatening processes on the habitat quality for spectacled flying-fox. Implementation of offset management activities will prevent the selective clearing of native vegetation and reduce the risk of bushfires. Offset site protection will persist should the land be sold in the future. Therefore, the risk of loss with the offset has been assessed at 0% .
Future quality with offset (1-10)	8	The presence of remnant vegetation at the proposed offset sites offers the opportunity to deliver quality improvements in a shorter time frame than would be required through revegetation. All offset areas will improve site condition through alternative fencing methods (animal friendly fencing or replacing the top wire with plain wire instead of barbed-wire). Offset Area 2 aims to improve site context by increasing the area of potential habitat for the species with contiguous habitat associated with Ravenshoe Forest Reserve 1 and Tully Falls National Park. Area 3 aims to improve site context by establishing connectivity between the Koombuloomba South Forest Reserve to the east and Yourka Nature Refuge to the west.
Area of offset required and % delivered	6,803 ha 145%	An offset calculator was prepared (Fig. 1.5) in accordance with the <i>Offsets Assessment Guide</i> . Based on vegetation mapping, 6,803 ha is available in the area to achieve an offset for spectacled flying-fox habitat of 145% .
Confidence in result (%)	90%	Confidence in achieving a one-point increase in habitat quality over 20 years is assessed as 90% . Confidence in managing the risk of loss at the offset site is assessed as 90%. Our proposed management actions include: <ul style="list-style-type: none"> ▪ Implementation of an improved bushfire management plan. ▪ Protection from selective logging to increase density and cover of habitat trees. ▪ Alternative fencing to reduce direct mortality associated with collision and entanglement. These actions will deliver improvement to key habitat metrics shown to correlate with increased spectacled flying-fox population size.

References:

Eyre T.J., Ferguson D.J., Hourigan C.L., Smith G.C., Mathieson M.T., Kelly A.L., Venz M.F., Hogan L.D. & Rowland J. (2018) Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Department of Environment and Science, Queensland Government.

MacHunter, J., Brown, G., Loyn, r. and Lumsden, L. (2011) Approved Survey Standards: Greater Glider *Petauroides Volans*. Victorian Department of Sustainability and Environment

McLean, M., Kavanagh, R. P., Penman, T., Bradstock, R. (2018) The threatened status of the hollow dependent arboreal marsupial, the Greater Glider (*Petauroides Volans*), can be explained by impacts from wildfire and selective logging. *Forest Ecology and Management*. Volume 415-416, Pages 19-25.

Department of Agriculture, Water and the Environment (DAWE) (2021) National Flying Fox Monitoring Viewer accessed at: <http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>

Department of Environment and Resource Management (DERM) (2010). National Recovery Plan for the spectacled flying-fox *Pteropus conspicillatus*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.

TSSC (2019b) Conservation Advice *Pteropus conspicillatus* (spectacled flying fox). Canberra, Department of the Environment and Energy.

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Koala
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes		Area	843.81	Hectares	
			Quality	4	Scale 0-10	
			Total quantum of impact	337.52	Adjusted hectares	
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																				
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source				
<i>Ecological Communities</i>																				
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)												
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0										
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)											
<i>Threatened species habitat</i>																				
Area of habitat	Yes	337.52	Adjusted hectares		Time over which loss is averted (max. 20 years)	20	Start area (hectares)	5426.94	Risk of loss (% without offset)	1%	Risk of loss (% with offset)	0%								
					Time until ecological benefit	20	Start quality (scale of 0-10)	4	Future area without offset (adjusted hectares)	5372.7	Future area with offset (adjusted hectares)	5426.9	54.27	90%	48.84	46.93	952.66	282.25%	Yes	
							Future quality without offset (scale of 0-10)	3	Future quality with offset (scale of 0-10)	5	2.00	90%	1.80	1.73						
<i>Threatened species</i>																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g. Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
					Birth rate	0	
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	337,524	952.66	282.25%	Yes	\$0.00	N/A	\$0.00
Area of community	0				\$0.00		\$0.00
					\$0.00	\$0.00	\$0.00

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Magnificent Brood Frog
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes		Area	120.5	Hectares	
			Quality	8	Scale 0-10	
			Total quantum of impact	96.40	Adjusted hectares	
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																						
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source						
<i>Ecological Communities</i>																						
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset) Future area without offset (adjusted hectares)	0.0	Risk of loss (% with offset) Future area with offset (adjusted hectares)	0.0												
					Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)														
					→																	
<i>Threatened species habitat</i>																						
Area of habitat	Yes	96.40	Adjusted hectares		Time over which loss is averted (max. 20 years)	20	Start area (hectares)	1409	Risk of loss (% without offset) Future area without offset (adjusted hectares)	1%	1394.9	Risk of loss (% with offset) Future area with offset (adjusted hectares)	0%	1409.0	14.09	90%	12.68	12.18	249.78	259.11%	Yes	
					Time until ecological benefit	20	Start quality (scale of 0-10)	6	Future quality without offset (scale of 0-10)	5	Future quality with offset (scale of 0-10)	7	2.00	90%	1.80	1.73						
					→																	
<i>Threatened species</i>																						
Number of features e.g. Nest hollows, habitat trees	No																					
Condition of habitat Change in habitat condition, but no change in extent	No																					
Birth rate e.g. Change in nest success	No																					
Mortality rate e.g. Change in number of road kills per year	No																					
Number of individuals e.g. Individual plants/animals	No																					

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	96.4	249.78	259.11%	Yes	\$0.00	N/A	\$0.00
Area of community	0				\$0.00		\$0.00
					\$0.00	\$0.00	\$0.00

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

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Matter of National Environmental Significance	
Name	Masked Owl
EPBC Act status	Vulnerable
Annual probability of extinction <small>Based on IUCN category definitions</small>	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes		Area	1026.3	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	718.41	Adjusted hectares	
<i>Threatened species</i>						
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																	
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source	
<i>Ecological Communities</i>																	
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)									
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0							
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)								
<i>Threatened species habitat</i>																	
Area of habitat	Yes	718.41	Adjusted hectares		Time over which loss is averted (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)									
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	7351.2	Future area with offset (adjusted hectares)	7425.5	74.25	90%	66.83	64.21	1322.76	184.12%	Yes
							Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	8	2.00	90%	1.80	1.73			
<i>Threatened species</i>																	
Birth rate <small>e.g. Change in nest success</small>	No																
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																
Number of individuals <small>e.g. Individual plants/animals</small>	No																

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	718.41	1322.76	184.12%	Yes	\$0.00	N/A	\$0.00
Area of community	0				\$0.00		\$0.00
					\$0.00	\$0.00	\$0.00

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Matter of National Environmental Significance	
Name	Greater Glider
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator							
Impact calculator	Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact	Units	Information source	
	<i>Ecological communities</i>						
	Area of community	No		Area			
				Quality			
				Total quantum of impact	0.00		
	<i>Threatened species habitat</i>						
	Area of habitat	Yes		Area	888	Hectares	
				Quality	7	Scale 0-10	
				Total quantum of impact	621.60	Adjusted hectares	
	<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No						
Mortality rate e.g. Change in number of road kills per year	No						
Number of individuals e.g. Individual plants/animals	No						

Offset calculator																					
Offset calculator	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source				
	<i>Ecological Communities</i>																				
	Area of community	No					Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset											
							Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0									
									Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)										
	<i>Threatened species habitat</i>																				
	Area of habitat	Yes	621.60	Adjusted hectares			Time over which loss is averted (max. 20 years)	20	Start area (hectares)	5903.91	Risk of loss (%) without offset	1%	Risk of loss (%) with offset	0%							
							Time until ecological benefit	20	Start quality (scale of 0-10)	7	Future area without offset (adjusted hectares)	5844.9	Future area with offset (adjusted hectares)	5903.9	59.04	90%	53.14	51.05	1051.71	169.19%	Yes
									Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	8	2.00	90%	1.80	1.73					
	<i>Threatened species</i>																				
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g. Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary								
Summary	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
						Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
	Birth rate	0				\$0.00		\$0.00
	Mortality rate	0				\$0.00		\$0.00
	Number of individuals	0				\$0.00		\$0.00
	Number of features	0				\$0.00		\$0.00
	Condition of habitat	0				\$0.00		\$0.00
	Area of habitat	621.6	1051.71	169.19%	Yes	\$0.00	N/A	\$0.00
	Area of community	0				\$0.00		\$0.00
						\$0.00	\$0.00	\$0.00

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Matter of National Environmental Significance	
Name	Spectacled Flying-fox
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes		Area	976.1	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	683.27	Adjusted hectares	
<i>Threatened species</i>						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g. Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator																		
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)	Start area and quality	Future area and quality without offset	Future area and quality with offset	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source		
<i>Ecological Communities</i>																		
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)										
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
							Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
<i>Threatened species habitat</i>																		
Area of habitat	Yes	683.27	Adjusted hectares		Time over which loss is averted (max. 20 years)	Start area (hectares)	Risk of loss (% without offset)	Risk of loss (% with offset)										
					Time until ecological benefit	Start quality (scale of 0-10)	Future area without offset (adjusted hectares)	6735.2	Future area with offset (adjusted hectares)	6803.3	68.03	90%	61.23	48.23	993.61	145.42%	Yes	
							Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	8	2.00	90%	1.80	1.42				
<i>Threatened species</i>																		
Birth rate e.g. Change in nest success	No																	
Mortality rate e.g. Change in number of road kills per year	No																	
Number of individuals e.g. Individual plants/animals	No																	

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	683.27	993.61	145.42%	Yes	\$0.00	N/A	\$0.00
Area of community	0				\$0.00		\$0.00
					\$0.00	\$0.00	\$0.00