Ground-truthing of EPBC Act offset site information summary report

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Department of Climate Change, Energy, the Environment and Water
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Ground truthing of offset site survey information project
21 June 2024

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Executive summary

Introduction

Jacobs Group (Australia) Pty Ltd was engaged by the Department of Climate Change, Energy, the Environment and Water (DCCEEW or the Department) to undertake a pilot of ground-truthing data associated with offset sites established as an approval requirement for controlled actions impacting Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Ground-truthing of offset site information was piloted from April 2023 to October 2023 and compares the current state of the offset site with information contained within Offset Management Plans (OMPs) and associated reporting. The purpose of the project was to improve confidence in offset integrity and monitoring capability, identify instances where inaccurate offset information had been provided to the Department, and assert a strong regulatory posture on environment assets under the EPBC Act.

The Government has committed to implement the Nature Positive Plan, which adopts an outcomes-focused approach to regulation and focuses on nature positive decisions and outcomes. Using the data from ground-truthing, the Department sought to compare the current state of selected offset sites with reported information contained within OMPs and annual reporting to ensure that information published about offsets is accurate and reflective of the sites' current condition. Along with information in offset reporting and compliance activities, ground-truthing results add to the Department's efforts towards maintaining accurate information on the condition of approved offsets. Findings will inform longer-term activity to improve confidence in offset information and integrity.

Sites and methods

The project involved review of information relating to offset sites contained in OMPs and associated data and reporting. Information and data from these sources were ground-truthed in the field by assessing site conditions, including some replication of field assessments previously undertaken at sites in order to identify and consider differences in the data. Twenty offset sites were selected: ten within south-west and central Victoria and ten within south-east Queensland. The Victorian sites included offsets for Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP), Seasonal Herbaceous (Freshwater) Wetland of Temperate Lowland Plains (SHWTLP), Golden Sun Moth (*Synemon plana*) and Striped Legless Lizard (*Delma impar*). The Queensland sites supported offsets for Grey-headed Flying Fox (*Pteropus poliocephalus*) Koala (*Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory)) and the Greater Glider (*Petauroides volans* (southern and central)).

Both Jacobs and DCCEEW acknowledge the limitations of this ground-truthing activity providing accurate results of offset condition and should be noted when considering this report. Field survey was conducted between July and August 2023. This is outside the optimal spring flora survey period for Victorian sites and also outside the optimal flora survey period that follows the wetter summer months (May-June) in southern Queensland. This was also a period of heavy grazing for most Victorian sites and followed several months of lower than average rainfall in southern Queensland. The previous two to three years (depending on location) had been a period of high rainfall associated with La Niña weather conditions. Given these considerations, site conditions were reflective of seasonal conditions and the past years of high rainfall. This was particularly relevant for Victorian sites as these grassland sites show a strong seasonal growth response, which generally favours growth of exotic taxa during winter months. Recent years of high rainfall had also favoured weed growth and affected implementation of management activities. Ground-truthing data was compared with previous offset site assessments that were generally conducted during an optimal time for observing most flora (although this was not always the case for Queensland sites). Therefore, some differences in data collected during this survey may be representative of seasonal variation and reflective of high rainfall conditions experienced in recent years.

At the conclusion of field survey, a site report was completed for each site and provided to offset site stakeholders (approval holders, land owners/managers, ecologists). The opportunity for a meeting with the department and the collection of written feedback was provided. Feedback was incorporated and attached as an addendum in finalised site reports. This document provides a summary of the findings of those site reports.

Results

Ground-truthing found that 55% of sites sampled had maintained the site conditions, 30% of the sites have worse site conditions, 10% have improved and remaining sites having a mixed outcome. These and other findings will inform longer-term activity to improve confidence in offset information and integrity.

- **Document and data review:** DCCEEW provided the information and contact details it had for the EPBC approval associated with the selected offset sites to Jacobs. This information was often incomplete and did not necessarily connect Jacobs with the offset site owner/manager. Effort was made to source missing information however complete information was provided for only 40% of the sites. This affected the information available for ground-truthing and how sites could be ground-truthed (e.g. replication of previous methods was difficult with insufficient information).
- **Offset site and MNES extent:** Seventy percent of offset sites had inconsistencies in site area across sources (i.e. approval notice, OMP and spatial data) and 25% of offset sites had major inconsistencies in MNES extent (area of MNES community or habitat) and 30% with minor inconsistencies.
- **Vegetation Quality Assessments (VQA):**
  - VQA revealed mixed results, most assessments were within the variation that may be expected amongst assessors and associated with vegetation change over time since previous assessments.
  - Several sites showed higher levels of variation than expected and these differences may have been due to sampling differences or differences in the application of VQA methods.
  - At many sites (particularly in Queensland) minor scoring errors were detected in previous assessments and reports where scores did not reflect those calculated from the stated field data.
  - Through comparison with previous site data a general trend in vegetation conditions since OMP implementation was determined: conditions were maintained at 11 of the 20 offset sites (55%), six were worse (30%), one mixed (5%) and two (10%) resulted in a clear improvement. This assessment was conservative where only relatively large differences (e.g. 10 points) were used to determine change.
- **Implementation of management actions and achievement of targets**: Where possible, observations of management actions to be undertaken or targets to be achieved at offset sites were made during field survey in association with other ground-truthing activities. Two sites (10%) were considered to have completed, the required monitoring and 14 sites (70%) had incomplete information including two sites that lacked sufficient detail on monitoring requirements in the OMP documentation to enable an assessment; a further four sites (20%) in year 1 of the OMP implementation had not submitted monitoring reports yet.
- **Monitoring completeness:** with the information available an assessment of the monitoring completeness was made. Two sites (10%) were considered to have completed all required monitoring; 14 sites had incomplete information including two sites that lacked sufficient detail on monitoring requirements in the OMP documentation to enable an assessment; and four were in Year 1 of the OMP and thus it was too early to assesses progress of monitoring requirements.

Discussion and conclusions

Ground-truthing has identified a number of lessons for the Department to improve its processes and procedures that support effective approved offset management and monitoring. Offset sites were generally in-place and supporting the MNES or habitat for the MNES, however minor discrepancies in the actual extent were common and major inconsistencies identified at five of the 20 sites. The five major inconsistencies included four Victorian sites, that had weed covers above thresholds for NTGVVP and one Queensland site that had completed limited activity to establish Grey-headed Flying-fox and Koala habitat. Minor discrepancies related to smaller areas of offset sites not supporting the relevant MNES for a range of reasons including poor quality site conditions and offset areas not matching the extent listed in approvals. Ground-truthing found that 55% of sites sampled had maintained the site conditions, 30% of the sites have worse site conditions, 10% have improved and remaining sites having a mixed outcome.

Offset management was generally occurring and being implemented across offset sites, with most reported information broadly consistent with site conditions. However, erroneous and incomplete information led to discrepancies being common throughout the associated information. In some limited instances, site conditions as assessed were significantly different from those reported in the provided documentation, bringing into question the credibility of the information provided.

Offset site managers are generally implementing management actions although some targets are difficult to achieve and appear to set unrealistic expectations on land managers. This is most relevant for herbaceous weeds across grasslands in Victoria, which are difficult to manage and influenced heavily by season and climate (e.g. recent years of high rainfall). Management actions for Queensland sites appear more likely not to be implemented however when they are, usually have a higher degree of success. This is likely associated with it being easier to manage woody weeds and revegetation of woody ecosystems being more effective in achieving gains than restoring grasslands. Restoring

previously cleared areas, devoid of native vegetation to native woodland communities is generally a highly effective and easily measurable and detectable offset gain.

Monitoring of offset sites was often incomplete or missing information to accurately assess progress towards targets. Incomplete information and lack of detail in methods often made ground-truthing monitoring data difficult.

Ground-truthing identified a number of improvements to offset site management that approval holders and land managers can now implement and feed into subsequent OMP reporting. The high amount of variation, incompleteness, and errors among provided documents and information was a considerable challenge in undertaking ground-truthing and affected consistency in provision of offsets. Ground-truthing also identified opportunities for the Department to improve its processes and procedures that support effective offset management and monitoring. Increased consistency in approval requirements, improved information management, and standardisation and guidelines around the implementation of offsets and associated documentation is recommended. This would extend to guidance on baseline site assessments, associated GIS data, management actions and required monitoring. Consultation with offset providers/ managers when developing OMPs will also likely influence success in offset implementation.

As a trial, ground-truthing of offset sites was successful in identifying inconsistencies and challenges with offset provision and ongoing management and monitoring. To enable consistency throughout the project and improved comparison of results, future activities may benefit from more detailed initial stakeholder consultations to ensure all existing documentation and information is collated and understood prior to fieldwork commencing.

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Acronyms and abbreviations

Term	Description
ACR	Annual Compliance Report
AU	Assessment Unit
BC	BioCondition Plot identifier at Site 16
BFMP	Bush Fire Management Plan
DCCEEW	The Department of Climate Change, Energy, the Environment and Water
DCDB	Digital Cadastral Database
DSE	Victorian Department of Sustainability and Environment
EPBC Act	The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EVC	Ecological Vegetation Class
GHFF	Grey-headed Flying Fox (*Pteropus poliocephalus*)
GIS	Geographic Information System
GSM	Golden Sun Moth (*Synemon plana*)
HZ	Habitat Zone
MHQA	Modified Habitat Quality Assessment
MNES	Matters of National Environmental Significance
NTGVVP	Natural Temperate Grassland of the Victorian Volcanic Plain
OMP	Offset Management Plan
PG	Naming of Habitat Zones at Sites 2 & 6
Qld	Queensland
RE	Regional Ecosystem
SHWLTP	Seasonal Herbaceous (Freshwater) Wetland of Temperate Lowland Plains
SLL	Striped Legless Lizard (*Delma impar*)
TEC	Threatened Ecological Community
The Department	The Department of Climate Change, Energy, the Environment and Water
Vic	Victoria
VQA	Vegetation Quality Assessment

1. Introduction

1.1 Project outline

Jacobs Group (Australia) Pty Ltd was engaged by the Department of Climate Change, Energy, the Environment and Water (DCCEEW or the Department) to undertake a pilot of ground-truthing data associated with offset sites established as an approval requirement for controlled actions impacting Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Ground-truthing of offset site information was piloted from April 2023 to October 2023. Ground-truthing compares the current state of the offset site with reported information contained within Offset Management Plans (OMPs) and annual reporting. The purpose of the project was to improve confidence in offset integrity and monitoring capability, identify instances where inaccurate offset information had been provided to the Department, and assert a strong regulatory posture on environment assets under the EPBC Act.

The Government has committed to implement the Nature Positive Plan, which adopts an outcomes-focused approach to regulation and focuses on nature positive decisions and outcomes. Using the data from ground-truthing, the Department sought to compare the current state of selected offset sites with reported information contained within OMPs and annual reporting to ensure that information published about offsets is accurate and reflective of the sites' current condition. Along with information in offset reporting and compliance activities, ground-truthing results add to the Department's efforts towards maintaining accurate information on the condition of approved offsets. Findings will inform longer-term activity to improve confidence in offset information and integrity.

1.2 Summary of sites and fieldwork

The project involved review of existing information relating to offset sites contained in OMPs and annual reporting including associated spatial and non-spatial data. Information and data from these sources were ground-truthed in the field by assessing site conditions and, where possible, replicating initial data collection methods in order to identify and consider differences in the data. The fieldwork component was conducted between July and August 2023.

A total of twenty offset sites were assessed: ten within south-west and central Victoria and ten within south-east Queensland. The Victorian sites included offsets for Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP), Seasonal Herbaceous (Freshwater) Wetland of Temperate Lowland Plains (SHWTLP), Golden Sun Moth (*Synemon plana*) and Striped Legless Lizard (*Delma impar*). The Queensland sites supported offsets for Grey-headed Flying Fox (*Pteropus poliocephalus*) Koala (*Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory)) and the Greater Glider (*Petauroides volans* (southern and central)) (refer to Table 1-1.). Sites were selected that featured similar MNES, were close in proximity, and had OMPs developed by a range of consultants. Selected sites had also been under active management for between 1 and 5 years and had no prior compliance actions recorded.

Table 1-1. Offset site MNES selected for ground-truthing (by MNES).

State	Site Number	NTGVVP	SHWLTP	Golden Sun Moth	Striped Legless Lizard	Grey-headed Flying-fox	Greater Glider	Koala
Victoria	1	Yes		Yes				
Victoria	2			Yes				
Victoria	3	Yes	Yes	Yes	Yes			
Victoria	4	Yes			Yes			
Victoria	5			Yes				
Victoria	6	Yes		Yes				
Victoria	7	Yes		Yes				
Victoria	8			Yes				
Victoria	9			Yes				
Victoria	10	Yes						
Queensland	11					Yes	Yes	Yes
Queensland	12					Yes		Yes
Queensland	13					Yes		Yes

State	Site Number	NTGVVP	SHWLTP	Golden Sun Moth	Striped Legless Lizard	Grey-headed Flying-fox	Greater Glider	Koala
Queensland	14					Yes		Yes
Queensland	15					Yes		Yes
Queensland	16					Yes		Yes
Queensland	17					Yes	Yes	Yes
Queensland	18					Yes		Yes
Queensland	19					Yes		Yes
Queensland	20					Yes		Yes

NTGVVP: Natural Temperate Grassland of the Victorian Volcanic Plain, SHWLTP: Seasonal Herbaceous (Freshwater) Wetland of Temperate Lowland Plains; Golden Sun Moth (*Synemon plana*); Striped Legless Lizard (*Delma impar*), Grey-headed Flying Fox (*Pteropus poliocephalus*); Greater Glider (*Petauroides volans* (southern and central)); Koala (*Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory)).

2. Methods

2.1 Site selection

Two initial shortlists were created for Victoria and Queensland based on the following factors:

- Similarity of MNES: Offsets featuring similar MNES were selected for comparability across offset sites within state;
- Site proximity: Sites in close proximity to each other were selected to reduce need for long distance travel;
- Variability in consultant developing OMP.

Subsequent further shortlisting was then undertaken to remove sites where baseline monitoring methods differed significantly from those undertaken at the majority of other sites.

2.2 Documents and data review

Prior to field assessment, relevant documents and associated data were provided to Jacobs for review relating to the EPBC Act approval and establishment and monitoring of the offset site. These sources were reviewed to understand the offset intent, and to determine what data should have been collected and the methods undertaken. Data and information were then collated that could be ground-truthed in the field inside the scope of the projects' limitations (e.g. season of survey, project budget and timeframes).

Documents and data reviewed typically included:

- EPBC Act approval, particularly conditions that related to provision of offsets.
- Offset Management Plan: this is the document that dictates management requirements of the offset site in response to the EPBC Act approval. It is referred to differently across sites as:
  - Offset Area Management Plan
  - Offset Management Framework
  - Conservation Area Management Plan
- Baseline data reporting: this contains the baseline assessment of the offset site conditions (e.g. species presence, vegetation quality, weed cover, etc.) against which future assessments are to be compared. Often this information was incorporated in the OMP, but for some sites it was also presented as a standalone report.
- Monitoring reports: OMPs often require annual monitoring to assess progression against targets. This information is presented in monitoring reports that are usually prepared by consulting ecologists.
- Management reports: OMPs often require annual reporting against management requirements. These are different to monitoring reports in that the focus is on what management activities were undertaken rather than assessing site conditions. Sometimes monitoring reports are incorporated into management reports. Management reports are often called Annual Compliance Reports (ACRs).
- Spatial data: GIS data or spatial data is often integral to the information presented in the documentation (e.g. offset site boundaries, field survey locations, ecological community extents). Spatial data was requested to assist with the field survey associated with ground-truthing.

2.3 Ground-truthing field survey

Ground-truthing fieldwork undertaken was specific to each site depending on the existing information and methods within the reviewed OMPs and associated reports. The survey involved undertaking a site inspection over two days to assess if conditions were generally consistent with those described in the documentation. Table 2-1 provides a summary of ground-truthing field survey methods by offset site.

Table 2-1. Summary of ground-truthing field survey methods by offset site (by method).

Site	General Site Assessment	Habitat Hectare	Rapid BioCondition[1]	Replicate BioCondition[2] Plot	Vegetation Monitoring Plots	Weed Assessment
1	Yes	Yes				Yes

Site	General Site Assessment	Habitat Hectare	Rapid BioCondition[1]	Replicate BioCondition[2] Plot	Vegetation Monitoring Plots	Weed Assessment
2	Yes	Yes				Yes
3	Yes	Yes				
4	Yes	Yes			Yes	Yes
5	Yes	Yes			Yes	Yes
6	Yes	Yes				Yes
7	Yes	Yes				Yes
8	Yes	Yes			Yes	Yes
9	Yes				Yes	
10	Yes				Yes	Yes
11	Yes		Yes	Yes		
12	Yes		Yes	Yes		
13	Yes		Yes	Yes		
14	Yes		Yes	Yes		
15	Yes		Yes	Yes		
16	Yes		Yes	Yes		
17	Yes		Yes*			
18	Yes		Yes	Yes		
19	Yes		Yes	Yes		
20	Yes		Yes	Yes		

1. Qualitative rapid assessment

2. BioCondition and site condition assessments associated with *Guide to determining terrestrial habitat quality* v1.1, 1.2 or 1.3 (Queensland Government 2014, Queensland Government 2017, Queensland Government 2020) are referred to as BioCondition throughout this document for consistency.

2.3.1 General site assessment

The general site assessment, included consideration across the site of:

- Site boundaries and fencing
- Extent of habitat for MNES taxa or extent of MNES community
- General vegetation and habitat conditions across the site
- Cover of weed species
- Any other relevant conditions including evidence of pest activity and other threats such as erosion, vehicle traffic and other disturbance.

2.3.2 Vegetation quality assessment

Vegetation quality assessment (VQA) previously undertaken at offset sites was ground-truthed during the current assessment.

2.3.2.1 Victoria

Eight of the Victorian sites previously assessed using the Habitat Hectare method (DSE 2004) were ground-truthed. This involved ground-truthing of vegetation community mapping (Ecological Vegetation Class (EVC)). Vegetation communities are further divided into Habitat Zones (HZ) dependant on quality. Habitat Hectare assessment was undertaken by assessing vegetation conditions across each Habitat Zone. Where Habitat Zones or EVCs were considered to be mapped incorrectly in OMPs and other reports, the area assessed was adjusted and additional zones sometimes assessed.

2.3.2.2 Queensland

In Queensland all 10 sites had previous BioCondition assessments (Eyre et al. 2015) (or related site condition assessments as per *Guide to determining terrestrial habitat quality* v1.1, 1.2 or 1.3 (Queensland Government 2014, Queensland Government 2017, Queensland Government 2020) referred to as BioCondition assessments throughout this document for consistency) that were ground-truthed. This included ground-truthing of the vegetation community mapping (Regional Ecosystem (RE) and associated Assessment Units (AU) that should represent the different quality or conditions states of each RE.

Replicate BioCondition assessment at previous sites was undertaken (where possible) along with rapid BioCondition assessments which involved assessing conditions across the AU more broadly to determine if assessment sites presented in the OMP were reflective of the AU. This involved estimation of key metrics used in BioCondition assessments to provide a more rapid approach that could assess broad areas within the two days of field work allocated. This streamlined approach was used for comparative purposes and aimed to identify if the baseline data was representative of each AU.

2.3.3 Monitoring plots

In addition to VQA, monitoring plots were included in some OMPs. This was most common in Victoria and were often critical in assessing OMP targets. This is linked to Habitat Hectare assessment not being plot based and undertaken across a whole HZ. Sites often had one HZ and thus one Habitat Hectare assessment across the whole offset site. As such additional plot sampling was often included in Victorian OMPs to provide a more detailed assessment of vegetation conditions (e.g. weed cover, native cover, bare-ground, species cover, etc.).

Data from monitoring plots was ground-truthed by replicating the method as detailed in the OMP and associated monitoring reports. Where possible the same plot location was used. Spatial accuracy of monitoring plots was variable. Some plots were marked with a picket and therefore located to a high degree of accuracy while others may have been located with GIS only and the accuracy of the recorded location was not documented. Methods for assessing monitoring plots varied for each site and were often unclear in existing documentation; clarification was often required to ensure results were comparable.

BioCondition is a plot-based assessment method, so additional sampling assessing vegetation conditions (e.g. monitoring plots) was less common in Queensland OMPs. Where used, they were often transects focussed on assessing weed cover. Due to time constraints, this method was not replicated, but weed cover assessed in association with BioCondition ground-truthing.

2.3.4 Mapping and spatial data

It was not the intent of ground-truthing to remap offset site values. However, where spatial data was available existing mapping (e.g. site boundaries, habitat extent, vegetation communities) was assessed for accuracy in the field using ESRI Field Maps. Victorian sites were assessed with a Trimble DA2 using a Catalyst 30 subscription to provided sub-metre accuracy. Queensland sites were assessed using inbuilt receivers in handheld units (e.g. iPhone) accurate to approximately 3 m. In instances where spatial data was not available, maps produced in OMPs and associated documentation were compared to conditions in the field.

Spatial data was collected in the field to record ground-truthing observations.

2.4 Site reporting and stakeholder feedback

At the completion of field survey, a site report was completed for each site and provided to offset site stakeholders (approval holders, land owners/managers, ecologists). The opportunity for a stakeholder meeting with the Department and the collection of written feedback was provided. Stakeholder feedback was incorporated into finalised site reports as appropriate and also attached as an addendum. This document provides a summary of the findings of those site reports.

2.5 Limitations

The following details project limitations:

- The sole purpose of this report is to provide a summary review of the ground-truthing of offset sites undertaken by Jacobs for DCCEEW. This report should be read in full, and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context. The passage

of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

- Information presented in this report is based on conditions at the time of the assessment. Changes to the ecological conditions occur over time through natural and human influences and may alter the conclusions of this report.
- The findings of this report are based on a sample of 20 offset sites and may not apply to other sites.
- Field assessment for the project was undertaken between July and August 2023, a suboptimal time for observing most flora. Therefore, some taxa may have been overlooked or identified only to generic level. Prior landowner and ecological consultant assessments were generally conducted during an optimal time for observing most flora. Therefore, differences in data collected during this survey may be representative of seasonal variation; flora generally responds to changes in season which can promote or inhibit productivity.
- Field assessment was undertaken following two to three years (depending on location) of high rainfall associated with La Niña weather conditions. Such conditions are likely to have altered vegetation conditions on-site compared with drier periods.
- For several sites, particularly Victorian Sites, vegetation was heavily grazed at the time of assessment limiting identification of some taxa and influencing relative abundances of native versus exotic taxa. This issue was also often compounded by apparent preferential grazing of some native species such as Wallaby-grass (*Rytidosperma* spp.) and Spear-grass (*Austrostipa* spp.).
- In several cases, ground-truthing was undertaken several years after previous assessments and natural variance in vegetation communities and MNES habitats can be expected.
- Much of the field assessment associated with the project required estimation of cover levels across broad habitat areas. The larger and more varied an assessment area is, the more likely variation in cover is to occur between assessors.
- To ensure suitably locally skilled ecologists undertook work as appropriate, various Jacobs staff undertook fieldwork and prepared reports. This likely resulted in some discrepancies in style and structure of individual reports and some assessment variation.
- Often it was not possible to exactly replicate all methods utilised in previous assessments during ground-truthing:
  - For Queensland sites, rapid BioCondition assessments were undertaken in representative locations of the target AU to capture variability of vegetation conditions across the site and facilitate the ground-truthing process. As such some variance in scores between ground-truthing results and previous assessments is attributable to this.
  - Site assessments often did not assess all elements as per previous assessments and therefore could not provide comparison of such elements. For example, for relevant Queensland sites, site context and species stocking rates informing MHQA results for Koala and GHFF were not assessed.
- For several sites, various data elements were missing or incomplete resulting in difficulties during ground-truthing:
  - Spatial data relating to locality of site boundaries, vegetation communities (EVCs, REs, HZs and AUs) and assessment/monitoring sites was not always available in advance of field assessments. As such several assumptions were made to undertake vegetation assessments and discrepancies in positioning of ground-truthing data and that of previous assessments is likely.
  - Dates of previous assessments were sometimes not provided or unclear. As such unknown temporal factors in observed variation may be impacting results.
- Vegetation assessment data provided for some offset sites contained errors or discrepancies such as those associated with inconsistencies in benchmark versions, assigning scores to field values or miscalculating totals which may have impacted comparability of data sets.

- Existing information and spatial data, where provided, were the most current available at the time of assessment. Any changes to these may alter report conclusions.

3. Results

3.1 Approval offset requirements

For the purposes of comparison, requirements relating to offsets in each EPBC Act approval have been categorised and are presented in Table 3-1.

Table 3-1. Offset requirements included in EPBC Act approval for each assessed site

Approval Requirements	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20
Legal Securing of Offsets	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Offset Management Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Ecology Surveys and Report			Yes	Yes					Yes			Yes	Yes		Yes			Yes	Yes	Yes
Environmental Condition Targets and/or Management Plans		Yes													Yes	Yes				
Native Vegetation Condition Targets		Yes									Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Pest and Weed Targets and/or Management Plans		Yes									Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Native Fauna Population Targets and/or Management Plans		Yes										Yes	Yes		Yes	Yes		Yes	Yes	Yes
Revegetation and Tree Planting Targets												Yes	Yes			Yes		Yes	Yes	
Habitat Quality Score Targets											Yes			Yes			Yes			
Livestock Management and Reporting											Yes	Yes						Yes		
Ecology/Environmental Monitoring and Performance Reporting		Yes	Yes	Yes					Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Compliance and Non-Compliance Reporting	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

3.2 Documents and data review

Table 3-2 provides a review of the documents and data provided for each site, including a list of missing information. As shown in Figure 3-1, 40% of offset sites had all documentation (not including outstanding GIS data) available for ground-truthing and for 60% of sites documentation was incomplete.

Table 3-2. Document and data review

Site	Approval date	OMP prepared by	OMP start date	Length of OMP (years)	Year of OMP at time of ground-truthing	Manage-ment reporting required	Manage-ment reporting provided	Monitoring reporting required (numbers indicate OMP year)	Monitoring reporting provided	Monitoring completed by	Spatial data received	Documents/ data missing
1	01/04/2020	A	11/2020	10	3	Annually	Partial	VQA – 2, 5, 8 & 10 GSM – 1, 2, 4, 6, 8 & 10	Partial	A	Yes	▪Year 2 Management Report ▪Year 1 GSM monitoring Report
2	09/10/2019	B	2020	10	3	Year 1, 2, 5 and 10	Partial	GSM – 1, 2, 3, 4, 6, 8 &10	Yes	B	Partial	▪Year 1 Management Report ▪Year 2 Management Report ▪Photopoint GIS data
3	01/08/2019	A	17/07/2020	10	4	Annually	None provided	GSM & SLL -1 to 4, 6, 8 and 10 VQA – 2, 5, 8, 10	Partial	A K	Partial	▪Year 1 - 3 Annual Monitoring Report ▪Year 2 SLL Report ▪Habitat zone GIS data
4	09/2017	B	2019	10	5	Annually	Yes	VQA & SLL – 1 to 4, 6, 8 & 10	Yes	L	Yes	None
5	25/10/2020	C	2020 (Yr 0)	20	3	Annually	Yes	VQA – Annually GSM - 1, 3, 5, 7, 9	Partial	M	Yes	▪Year 1 Ecological Monitoring Report ▪Year 2 Ecological Monitoring Report
6	04/05/2021	B	2022	10	1	Annually	None provided	VQA & GSM - 1 to 4, 6, 8 & 10†	None provided	N/A	Partial	▪Habitat Zone GIS data
7	04/05/2021	B	2022	10	1	Annually	None provided	VQA & GSM – 1, 3, 5, 8 & 10	None provided	N/A	Yes	▪ Current GIS data of site boundaries
8	25/10/2020	C	2022	10	2	Annually	Yes	Annual monitoring report (vegetation plots, VQA, weeds, etc,) GSM – 1, 3, 5, 7 & 9	Partial (some data provided but no report)	N O	Yes	▪Year 1 Monitoring report
9	25/09/2018	C	2019	10	3	Annually	Yes	Annual monitoring report (vegetation plots, VQA, weeds, etc,) GSM – 2, 4, 6 8 & 10†	Partially incorporated with management reports	M	Yes	Some monitoring requirements: - Site flora list - Weed mapping - Baseline monitoring plot data
10	09/01/2018	C	06/2018	10	5	Annually	Yes	Ecological monitoring including vegetation plots, –1, 3, 5 & 10 (minimum)	Yes	P C	Yes	None

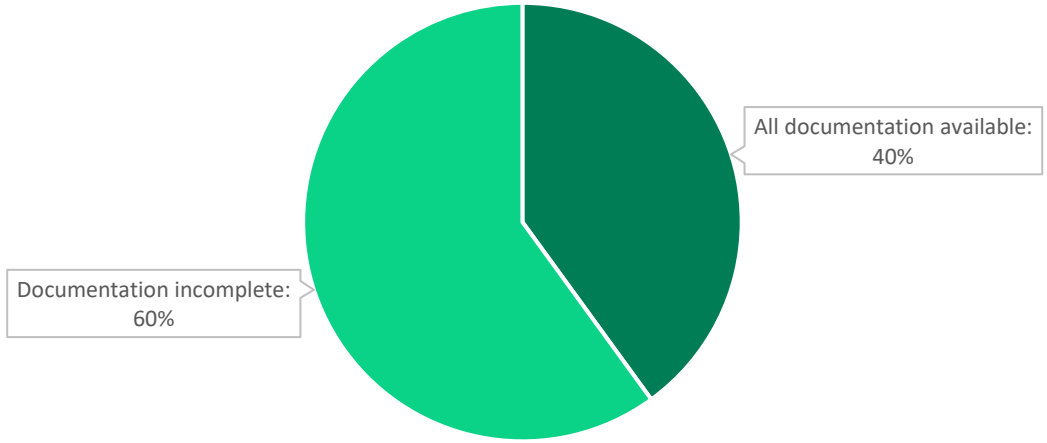
Site	Approval date	OMP prepared by	OMP start date	Length of OMP (years)	Year of OMP at time of ground-truthing	Manage-ment reporting required	Manage-ment reporting provided	Monitoring reporting required (numbers indicate OMP year)	Monitoring reporting provided	Monitoring completed by	Spatial data received	Documents/ data missing
11	03/03/2022	D	2023	20	1	Annually	No	Habitat condition assessment – 1 - 5, 7, 9, 11, 13, 15 & 20 (reported quarterly)	None provided	N/A	None provided	▪Final Offset Area Management Plan ▪Offset Area GIS data ▪RE and AU GIS data ▪BioCondition site GIS data
12	23/11/2020 (approval) 25/05/2022 (variation)	E	11/03/2021	20	3	Annually	Yes	Pest monitoring annually MHQA – every 5 years Photo monitoring weed mapping annually Planting survival rate every two years	Partial – some information with management reports	E	Yes	Only some of required monitoring information provided
13	12/02/2019	E	15/3/2019 (Action commenced) 23/12/2021 (OMP approved)	20	5/3	Annually	Yes	MHQA and weed transects – every 5 years Photo monitoring weed mapping annually Planting survival rate every two years Pest monitoring annually	Partial – some information with management reports	E	Yes	Only some of required monitoring information provided
14	23/06/2016	F	16/6/2021	20	3	Biennial	Partial	Ecological monitoring - Biennial	Yes	F	Partial	▪AU GIS data
15	30/11/2020	G	2021	12	3	Annually	Yes	Not clearly described	None provided	N/A	Partial	▪AU GIS data
16	03/12/2019	H	03/12/2019	21	4	Annually	Yes	Annually - vegetation monitoring, Koala monitoring, bushfire and pest management	Partial	H Q	Partial	▪ Year 3 Koala Monitoring Report ▪AU GIS data
17	03/03/2022	D	2023	20	1	Annually	None provided	Habitat Condition Assessment – 1 - 5, 7, 9, 11, 13, 15 & 20 (reported quarterly)	None provided	N/A	None provided	▪Final Offset Area Management Plan ▪Site boundary GIS data ▪RE and AU GIS data ▪BioCondition site GIS data

Site	Approval date	OMP prepared by	OMP start date	Length of OMP (years)	Year of OMP at time of ground-truthing	Manage-ment reporting required	Manage-ment reporting provided	Monitoring reporting required (numbers indicate OMP year)	Monitoring reporting provided	Monitoring completed by	Spatial data received	Documents/ data missing
18	27/05/2021	I	3/10/2023	20	0	Annually	None provided	Annually- BioCondition, Koala, pest animals	None provided	N/A	Partial	▪AU GIS data
19	12/02/2019	E	15/3/2019 (Action commenced) 23/12/2021 (OMP approved)	20	5/3	Annually	Yes	MHQA and weed transects – every 5 years Photo monitoring weed mapping annually Planting survival rate every two years Pest monitoring annually	Partial – some information with management reports	E	Yes	Only some of required monitoring information provided
20	30/10/2020	J	06/2022	10	2	Annually	Yes	Not described	None provided	N/A	Partial	▪AU GIS data

* Letters in table correspond to different consultancies/entities responsible for preparing OMPs and monitoring reports

N.B. Since the Department could not act as a sole source for the most up to date data, information provided as part of the assessment was obtained from various sources including consultants and offset site land managers.

Figure 3-1. Overview of documentation provided (refer to Table 3-2 for detail)



3.3 Offset site and MNES extent

Table 3-3 provides a summary and comparison of offset site area requirements as outlined within the approval decision, OMP and GIS polygons provided for each offset site. Fourteen of the twenty sites (70%) had inconsistencies with the offset area across sources, these have been classified as minor or moderate, and none are considered major. GIS data for two sites was not provided and could not be assessed against OMP stated area. This is discussed further in section 4.3.1

Table 3-3. Offset site areas

Site	Offset area detail in approval (ha)	Difference between OMP and GIS data (ha)*	Area notes/inconsistencies	Offset area consistent across all sources?
1	No area explicitly listed (a map is included with approval and is the same as map in OMP).	0.01	GIS polygon overlaps adjacent offset site to the south (Site 7). Another map (but no GIS data) was provided later with different boundaries to avoid overlap, although these do not appear to align with approval/ OMP maps raising concern that disturbance areas (e.g., dams) are now included in the offset site.	No (moderate)
2	Not listed (basic map included, as in OMP).	0.09	Initial GIS polygons provided were inconsistent with OMP. Later GIS polygons provided appear consistent with OMP.	Yes
3	Not listed (map of area included however offset location not noted).	-0.31	Appear visually consistent between OMP figure and GIS polygon. Very minor area difference.	No (minor)
4	Listed and matches OMP	0	Appear visually consistent between OMP figure and GIS polygon.	Yes
5	Not listed (map included, as in OMP).	0.05	Slight discrepancies in on-ground perimeter fencing between GIS polygon and OMP map extent, with additional inclusion of small dam.	No (moderate)
6	Not listed (map included, as in OMP).	0.03	GIS polygon boundary extends into neighbouring parcel of land to the southeast, which is not a part of the offset site.	No (moderate)
7	Not listed (map included, is similar to figure in OMP however does not include water point exclusion zone in northwest corner of offset site).	0	GIS polygon overlaps adjacent offset site to the north (Site 1). Also appears to overlap on OMP maps with one polygon underneath the other.	No (moderate)
8	Not listed (map included, however different to OMP).	-1.92	Inconsistencies between approval notice, OMP and GIS polygons. Additional area included to the west of the site in GIS polygons and map provided in approval decision.	No (moderate)
9	Not listed (map of offset area not included).	0	GIS polygon of offset area falls outside the property along several of the site's boundary fences. Likely resulting in an offset area smaller than indicated by the OMP and current GIS polygons.	No (moderate)
10	Listed and is 0.39 ha smaller than area listed in OMP	0.01	Appear visually consistent between OMP figure and GIS polygon. Approval area required slightly less than actual OMP and polygon area.	No (minor)
11	Not listed (map included, similar to OMP).	No GIS data provided.	No comparison possible as GIS data not available.	N/A
12	Listed and is 0.803 ha larger than area listed in OMP	-0.177	Appear visually consistent between OMP figures and GIS polygon. However, a small area is excluded from the centre of the offset site and likely cause of discrepancy between approval and OMP areas.	No (minor)
13	Not listed (basic map included).	-0.01	Appear visually consistent between OMP figures and GIS polygon.	No (minor)
14	Listed and is 0.39 ha smaller than area listed in OMP	0.17	Appear visually consistent between OMP figures and GIS polygon. Approval area required slightly less than actual OMP and GIS polygon area.	No (minor)
15	Listed and matches OMP	0.11	Appear visually consistent between OMP figures and GIS polygon.	Yes
16	Not listed (map included, as in OMP).	3.51	Appear visually consistent between OMP figures and GIS polygon, however area differences.	No (moderate)
17	Not listed (map included, similar to OMP).	No GIS data provided.	No comparison possible as GIS data not available.	N/A

Site	Offset area detail in approval (ha)	Difference between OMP and GIS data (ha)*	Area notes/inconsistencies	Offset area consistent across all sources?
18	Listed and matches OMP	-0.05	Appear visually consistent between OMP figures and GIS polygon. Areas consistent between approval and OMP, area of GIS polygon slightly smaller.	No (minor)
19	Not listed (basic map included).	0	Areas consistent between OMP and GIS polygon.	Yes
20	Listed and matches OMP	-2.96	Appear visually consistent between OMP figures and GIS polygon, however GIS area less than required.	No (moderate)

*The area as per the OMP has been subtracted from the area as per the GIS data, hence negative numbers indicate GIS data is a smaller area than that listed in OMP

Table 3-4 provides a summary of the findings of MNES extent ground-truthing. It considers if the extent of habitat for fauna or extent of TEC (Threatened Ecological Community) observed during ground-truthing is consistent with that recorded in OMPs and associated data. As shown in Figure 3-2, it was consistent for 55% of the sites. This is discussed further in section 4.3.2.

Table 3-4. MNES extent overview

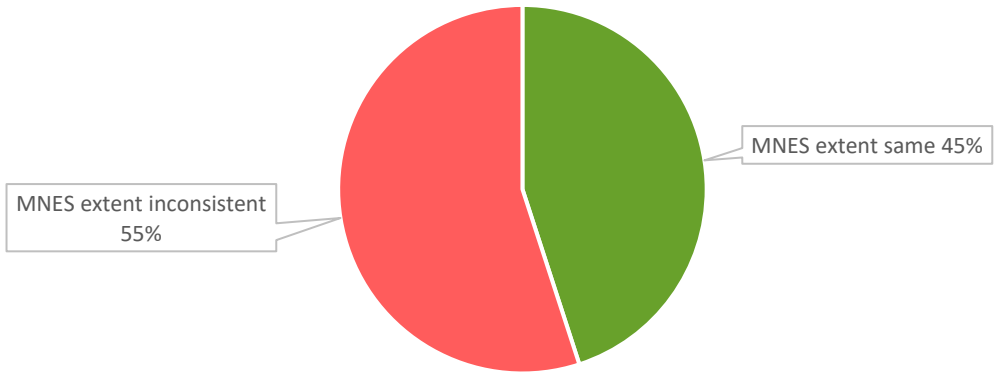
Site	Is MNES extent (extent of habitat or TEC) the same as OMP?	Size of inconsistency^	Comment/Justification*
1	Inconsistent	Minor	▪ Ground damage and areas of disturbance reduce quantity of NTGVVP ▪ Offset site overlaps adjacent one
2	Inconsistent	Moderate	▪ One GSM preferred EVC type stated in OMP. Additional EVCs lacking GSM food source plants identified ▪ Inconsistencies in native vegetation extent ▪ Ground disturbance recorded
3	Inconsistent	Major	▪ High perennial weed cover and presence of drainage line reduces NTGVVP extent ▪ Presence of contra-indicator species reduces SHWLTP extent
4	Inconsistent	Major	▪ Weed cover and ground damage reduce extent of NTGVVP
5	Same	n/a	▪ GSM habitat consistent with OMP
6	Inconsistent	Major	▪ GSM habitat extent and quality lower than OMP (larval food plants & bare ground cover limited, several areas unsuitable for GSM included & boundary extends into adjacent property) ▪ No vegetation qualifies as NTGVVP against condition threshold
7	Inconsistent	Moderate	▪ Gilgai formations and ground damage identified reduce extent of NTGVVP and suitable GSM habitat ▪ Offset site overlaps adjacent one
8	Inconsistent	Minor	▪ Additional forested area included in approval notice and not included in OMP reduces extent of GSM habitat
9	Inconsistent	Minor	▪ Areas unsuitable to support GSM due to low inter-tussock and larval feed species covers
10	Inconsistent	Major	▪ Misidentification of Bulbous Meadow-grass (*Poa bulbosa*) incorrectly attributed areas of high weed cover as NTGVVP ▪ Areas of SHWLTP mapped as NTGVVP
11	Same	n/a	▪ Habitat as described in OMP
12	Same	n/a	▪ Habitat as described in OMP
13	Same	n/a	▪ Habitat as described in OMP
14	Inconsistent	Minor	▪ Some assessment units considered to provide limited habitat for Koala due to sparseness of eucalypts
15	Same	n/a	▪ Habitat as described in OMP
16	Same	n/a	▪ Habitat as described in OMP
17	Same	n/a	▪ Habitat as described in OMP
18	Same	n/a	▪ Habitat as described in OMP
19	Same	n/a	▪ Habitat as described in OMP

Site	Is MNES extent (extent of habitat or TEC) the same as OMP?	Size of inconsistency^	Comment/Justification*
20	Inconsistent	Major	▪ Majority of site cleared paddock with negligible foraging value for GHFF and Koala hence requiring significant management to achieve target. Management actions not commenced

^Size of inconsistency is guided by an estimation of how much of the site inconsistency applies to: Minor: <5% of site; Moderate: >5-30% of site; Major: >30% of site .

MNES Abbreviations: NTGVVP: Natural Temperate Grassland of the Victorian Volcanic Plain, SHWLTP: Seasonal Herbaceous (Freshwater) Wetland of Temperate Lowland Plains, GSM: Golden Sun Moth (*Synemon plana*), SLL: Striped Legless Lizard (*Delma impar*); GHFF: Grey-headed Flying Fox (*Pteropus poliocephalus*).

Figure 3-2. Overview of MNES extent ground-truthing findings



3.4 Vegetation Quality Assessment summary

Table 3-5 provides a summary of the results of the VQA ground-truthing. Where a standardised method (i.e. Habitat Hectares or BioCondition) has not been used, such as Sites 9 and 10, selected attributes from ground-truthing monitoring plots are included to provide a comparison between ground-truthing results and previously reported results.

Table 3-5. Vegetation quality assessment summary results

State	Site	Ground truthing method^	Max score	Assessed area	Jacobs' score	Year of baseline score	Base line score	Jacobs variation from baseline	Year of latest score	Last score#	Jacobs variation from last score	Comment
VIC	1	Hab-ha	100	Whole site	57.52	2019	63.09◊	-5.57	2022	57.52	0	Baseline score is assessment of wider area not just offset
VIC	2	Hab-ha	75	PG1	42.16	2019	46.24	-4.08	2021	46.24	-4.08	HZs changed over time and Jacobs identified multiple EVCs within one HZ.
		Hab-ha	75	PG2	32.64	2019	n/a	n/a	n/a	n/a	n/a	Area of Creekline Tussock Grassland identified in Plains Grassland
		Hab-ha	75	n/a	46.24	n/a	n/a	n/a	n/a	n/a	n/a	Area of Plains Grassy Wetland identified in Plains Grassland
		Hab-ha	75	East Creek	48.96	n/a	n/a	n/a	2021	46.24	2.72	Area not assessed in baseline report
VIC	3	Hab-ha	100	1A	36.04	2017	60.52	-24.48	2022	67.32	-31.28	
		Hab-ha	100	2A	36.04◊	2017	60.52	-24.48	2022	60.52	-31.28	Jacobs assessed as both Plains Grassy Wetland and Heavier-soils Plains Grassland (both scored the same)
		Hab-ha	100	3A	36.04	2017	60.52	-24.48	2022	70.04	-34	
		Hab-ha	100	4A	29.24	2017	60.52	-31.28	2022	70.04	-40.8	
		Hab-ha	100	4B	45.56	2017	53.72	-8.16	2022	56.44	-10.88	
		Hab-ha	100	4C	29.24	2017	53.72	-24.48	2022	56.44	-27.2	
		Hab-ha	100	6A	36.04	2017	60.52	-24.48	2022	76.84	-40.8	
		Hab-ha	100	7A	36.04	2017	60.52	-24.48	2022	76.84	-40.8	
		Hab-ha	100	8A	36.04	2017	60.52	-24.48	2022	70.04	-34	
VIC	4	Hab-ha	100	Whole site	47	2019	43	4	2022	48	-1	
VIC	5	Hab-ha	100	Whole site	57	2019	46	11	2022	60	-3	Score similar to recent but increase since baseline, however this is largely due to woody species recruitment which the OMP aims to prevent to maintain GSM habitat.
VIC	6	Hab-ha	100	PG1	13.24	2020	59.52	-46.28	2020	59.52	-46.28	Smaller area assessed due to large areas not considered native vegetation
VIC	7	Hab-ha	100	Whole site	60.24	2019	63.09◊	-2.85	2019	63.09◊	-2.85	Baseline score is assessment of wider area not just offset area
VIC	8	Hab-ha	100	Whole site	44	2020	45	-1	2022	44	0	
VIC	9	Veg. cover (%)	n/a	Ave. 15 plots	89.9	n/a	n/a	n/a	2022	89.3	0.6	No baseline data
VIC	9	% veg. cover native	n/a	Ave. 15 plots	19.6	n/a	n/a	n/a	2022	21	-1.4	No baseline data

State	Site	Ground truthing method^	Max score	Assessed area	Jacobs' score	Year of baseline score	Base line score	Jacobs variation from baseline	Year of latest score	Last score#	Jacobs variation from last score	Comment
VIC	10	Native veg. cover (%)	n/a	Ave. 20 plots	35	2018	52.25	-17.25	2019	57	-22	Previous assessments may have misidentified Bulbous Meadow-grass and incorrectly attributed the areas as NTGVVP.
		Weed cover (%)	n/a	Ave. 20 plots	45	2018	31.25	13.75	2019	28	17	Jacobs recorded a higher cover of Bulbous Meadow-grass and Yorkshire Fog (*Holcus lanatus*) than previous assessments.
QLD	11	Rapid BC	60	AU1	45	2018	42*	3	2018	42*	3	
		Rapid BC	60	AU2	32	2018	36.38*	-4.38	2018	36.38*	-4.38	
		Rapid BC	60	AU2a◊	44	2018	36.38*	7.62	2018	36.38*	7.62	Additional area within AU2 deemed different to rest of AU by Jacobs.
		BC	80	Plot 3 (AU2)	49	2018	45.5*	3.5	2018	45.5*	3.5	
		Rapid BC	60	AU3	44.5	2018	41*	3.5	2018	41*	3.5	
		Rapid BC	60	AU4	17.5	2018	20.5*	-3	2018	20.5*	-3	
QLD	12	Rapid BC	80	AU1	54.17	2019	49.49	4.68	2018	49.49	4.68	
		Rapid BC	80	AU2	57.17	2019	51.66	5.51	2018	51.66	5.51	
		BC	80	Plot 1 (AU3)	61	2019	48.75*	12.25	2018	48.75*	12.25	Jacobs recorded higher native grass cover and woody species recruitment. However, some spatial variation in assessment location also likely to account for some differences.
QLD	13	Rapid BC	80	AU1	49.5	2018/19	56*	-6.5	2018/19	56*	-6.5	
		Rapid BC	80	AU2	54.67	2018/19	57*	-2.33	2018/19	57*	-2.33	
QLD	14	Rapid BC	60	AU1	29	2018	40.25	-11.25	2023	42	-13	Jacobs recorded higher non-native plant cover (%) across the site.
		Rapid BC	60	AU3	47	2018	42	5	2023	47.5	-0.5	
		Rapid BC	60	AU4	35	2018	43.5	-8.5	2023	52.5	-17.5	Jacobs recorded higher non-native plant cover (%) across the site. Reduced Large Tree scores as Jacobs did not count eucalypt trees as Large Trees given they are not listed in the benchmark.
		BC	80	Plot 10 (AU5)	37	2018	28.5	8.5	2023	46*	-9	
		Rapid BC	60	AU7	38	2018	43.5	-5.5	2023	43	-5	
QLD	14	Rapid BC	60	AU8	27.5	2018	33.13	-5.63	2023	34.5	-7	
		Rapid BC	60	AU10	31	2018	34.5	-3.5	2023	35.5	-4.5	
QLD	15	Rapid BC	80	12.12.2 (T2)	58.5	2021	49*	9.5	2021	49*	9.5	

State	Site	Ground truthing method^	Max score	Assessed area	Jacobs' score	Year of baseline score	Base line score	Jacobs variation from baseline	Year of latest score	Last score#	Jacobs variation from last score	Comment
		Rapid BC	80	12.9-10.14b (T3)	56	2021	33.5*	22.5	2021	33.5*	22.5	Numerous factors contributing to a higher score, including lower weed cover, woody regeneration, native perennial grass cover, organic litter and large trees – this last attribute indicating considerable variation in AU.
		Rapid BC	80	12.9-10.17c (T4)	53	2021	51*	2	2021	51*	2	
		Rapid BC	80	12.9-10.17c (T7)	61.5	2021	52*	9.5	2021	52*	9.5	
		Rapid BC	80	12.12.23	50.5	2021	43.25*	7.25	2021	43.25*	7.25	
		BC	80	12.12.23 (T5)	47.5	2021	41.5*	6	2021	41.5*	6	
		Rapid BC	80	12.3.7 (T9)	51	2021	12.5*	38.5	2021	12.5*	38.5	Locality of assessment likely to have impacted observed variation; only northern section of RE assessed due to dense vegetation indicating variation across AU.
QLD	16	Rapid BC	100	RE 12.9-10.2	77	2021	65.86*	11.14	2021	65.86*	11.14	Reduced weed cover recorded by Jacobs.
		Rapid BC	100	RE 12.8.17	67	2021	59*	8	2021	59*	8	Reduced weed cover recorded by Jacobs.
		BC	100	BC5	80.5	2021	66.5*	14	2021	66.5*	14	Jacobs recorded increased coarse woody debris and reduced weed cover. Weed control practices likely carried out in the plot.
QLD	17	BC	80	AU1; Site 7	33	2018	28.5	4.5	2018	28.5	4.5	
QLD	18	BC	80	AU1; Site 3	63.5	2016	64.5*	-1	2016	64.5*	-1	
		Rapid BC	80	AU-01	69.5	2016	63.25*	6.25	2016	63.25*	6.25	
		Rapid BC	80	AU-02	66.5	2016	59.25*	7.25	2016	59.25*	7.25	
		Rapid BC	80	AU-03	25.5	2016	11.5*	14	2016	11.5*	14	Tree and shrub revegetation.
QLD	19	Rapid BC	80	AU1	39.5	2018/19	52*	-12.5	2018/19	52*	-12.5	Jacobs recorded lower for Large trees, Non-native plant cover as well as the richness and height of shrubs. Few large trees were noted across the AU, most trees had a DBH< 25cm or were you regenerating trees. Much of the AU contains Lantana, the density of the infestations vary, however management of the weed is evident.
		Rapid BC	80	AU2	49.75	2018/19	50.5*	-0.75	2018/19	50.5*	-0.75	
		Rapid BC	80	AU3	61.25	2018/19	51*	10.25	2018/19	51*	10.25	Variation attributable to several small differences across scoring potentially associated with rapid assessment method.

State	Site	Ground truthing method^	Max score	Assessed area	Jacobs' score	Year of baseline score	Base line score	Jacobs variation from baseline	Year of latest score	Last score#	Jacobs variation from last score	Comment
		Rapid BC	80	AU4	66.5	2018/19	48*	18.5	2018/19	48*	18.5	Variation attributable to several small differences across scoring potentially associated with rapid assessment method.
QLD	20	Rapid BC	80	RE 12.11.3 (Site 1)	58	2018	58.5*	-0.5	2018	58.5*	-0.5	
		Rapid BC	80	RE 12.3.11 (Site 2)	52	2018	51.5	0.5	2018	51.5	0.5	
		BC	80	Site 3	36.5	2018	41	-4.5	2018	41	-4.5	
		Rapid BC	80	12.11.3 (Site 5 & 6)	5	2018	13*	-8	2018	13*	-8	

^Hab-ha = Habitat Hectare; BC = BioCondition

*Score adjusted by Jacobs due to error in original data

Last score as provided in offset documentation and referenced in site ground-truthing report; where latest score is same as baseline, score is shown in bold.

Variation from last score shaded as such Green: >10 increase; Yellow: >0-10 increase; Orange: >0-10 decrease; Red: >10 increase

Table 3-6 provides details of discrepancies in vegetation assessment method identified during ground-truthing and data review. Of the 20 sites ground-truthed, 16 sites had discrepancies in the vegetation assessment. In Victoria, most of these pertained to errors in vegetation assessment and management plans being unclear on the methods used. In Queensland, most of these pertained to scoring errors and incomplete mapping of assessment units. In some circumstances, no mapping was provided which impacted the locality of ground-truthing assessments. Benchmark version used for assessments was not stated for any Queensland site and were often not consistent with the current (v3.4) benchmarks (Queensland Herbarium 2023). The inconsistency may be representative of errors in the data or a result of changes in benchmarks since the baseline data was collected. Often rescoring of field data included in supplied documentation against the current benchmark was necessary to enable comparison with ground-truthing.

Table 3-6. Discrepancies in vegetation assessment

Site	Were there discrepancies in vegetation assessment?	What were the discrepancies?	Benchmark concern?	What were the concerns?
1	No	n/a	No	n/a
2	Yes	▪ Tallied weed cover scores amount to >100% and inconsistently presented. ▪ Multiple EVCs and spatially separated areas assessed as one habitat zone	No	n/a
3	No	n/a	No	n/a
4	Yes	Relative weed cover used erroneously within habitat hectares assessment (assessment requires non-relative assessment, i.e. projective foliage cover)	No	n/a
5	Yes	▪ Errors in vegetation assessment scoring ▪ Monitoring reports not explicit regarding methods used to assess vegetation covers in monitoring plots	No	n/a
6	No	n/a	No	n/a
7	Yes	▪ Tallied weed cover scores amount to >100%	No	n/a
8	Yes	▪ Monitoring reports not explicit regarding methods used to assess vegetation covers in monitoring plots	No	n/a
9	Yes	▪ Monitoring reports not explicit regarding methods used to assess vegetation covers in monitoring plots; ▪ OMP includes requirement to reduce introduced perennial grass cover by at least 50% of baseline by the end of year ten. Percentage cover of introduced perennial grasses not included in previous monitoring	No	n/a
10	Yes	▪Monitoring reports not explicit regarding methods used to assess vegetation covers in monitoring plots ,(vegetation cover, inter-tussock space)	No	n/a
11	Yes	Scoring errors*	Yes	Benchmark version not stated and not consistent with current version across all previous assessments. Comparability of baseline and ground-truthing scores likely impacted.
12	Yes	Scoring errors*	Yes	Benchmark version not stated. Large tree benchmark not consistent with current version. Comparability of baseline and ground-truthing scores likely impacted.
13	Yes	Scoring errors*	Yes	Benchmark version not stated and not consistent with current version for previous assessments. Results rescored for comparability.
14	Yes	▪Scoring errors* ▪Jacobs recorded higher weed scores across most assessments. Stakeholder feedback indicated differences in the interpretation of the method for	Yes	Benchmark version not stated. Ground-truthing data assessed against benchmarks listed in annual reporting.

Site	Were there discrepancies in vegetation assessment?	What were the discrepancies?	Benchmark concern?	What were the concerns?
		assessing this between ground-truthing and other previous data collection.		
15	Yes	▪ Scoring errors* ▪ Mapping of AUs not provided affecting locality of ground-truthing assessment	Yes	Benchmarks not provided and benchmark version not stated. Baseline data re-scored against current benchmark for comparability.
16	Yes	▪ Scoring errors* ▪ Mapping of AUs not provided affecting locality of ground-truthing assessment	Yes	Benchmark version not stated, so concern in correcting scoring errors.
17	Yes	▪ Scoring errors* ▪ Inconsistent use of large tree thresholds ▪ Mapping of AUs not provided affecting locality of ground-truthing assessment	Yes	Benchmark version not stated and not consistent with current version for previous assessments. Baseline data re-scored against current benchmark for comparability.
18	No	n/a	Yes	Benchmarks not provided and benchmark version not stated. Baseline data re-scored against current benchmark for comparability except where field data not provided.
19	Yes	▪ Scoring errors* ▪ Clarity of transect locations prevented assessment of all areas during ground-truthing	Yes	Benchmark version not stated. Baseline data re-scored against current benchmark for comparability.
20	Yes	▪Scoring errors* ▪Calculation errors◊ ▪ Mapping of AUs unclear affecting locality of ground-truthing assessment	Yes	Benchmark version not stated and not consistent with current version for previous assessments. Comparability of baseline and ground-truthing scores likely impacted.

Figure 3-3 displays change in offset site condition since baseline by percentage of sites. Over half of the sites involved in ground-truthing maintained site condition since OMP implementation. Approximately, 30% of the sites ground-truthed have worsened, with remaining sites either improved or having a mixed outcome.

Table 3.7 describes the changes in vegetation condition since OMP implementation on a site-by-site basis and corresponding year of OMP. Table 3-7 expands on the results of Table 3-5 and incorporates other relevant data such as monitoring plots and weed assessments, to provide a summary of current vegetation condition status (worsened, maintained or improved) and associated justification. To account for variation between assessors, this assessment has taken a relatively conservative approach, where only relatively large differences (e.g. 10 points) have been used in determining whether a change in condition has occurred.

The sites reported to have decreased vegetation condition are all located in Victoria. The sites considered to have improved vegetation condition and/or mixed outcomes are in Queensland. See Section 4.3.4 for further discussion.

Figure 3-3. Change in offset site vegetation condition since OMP implementation

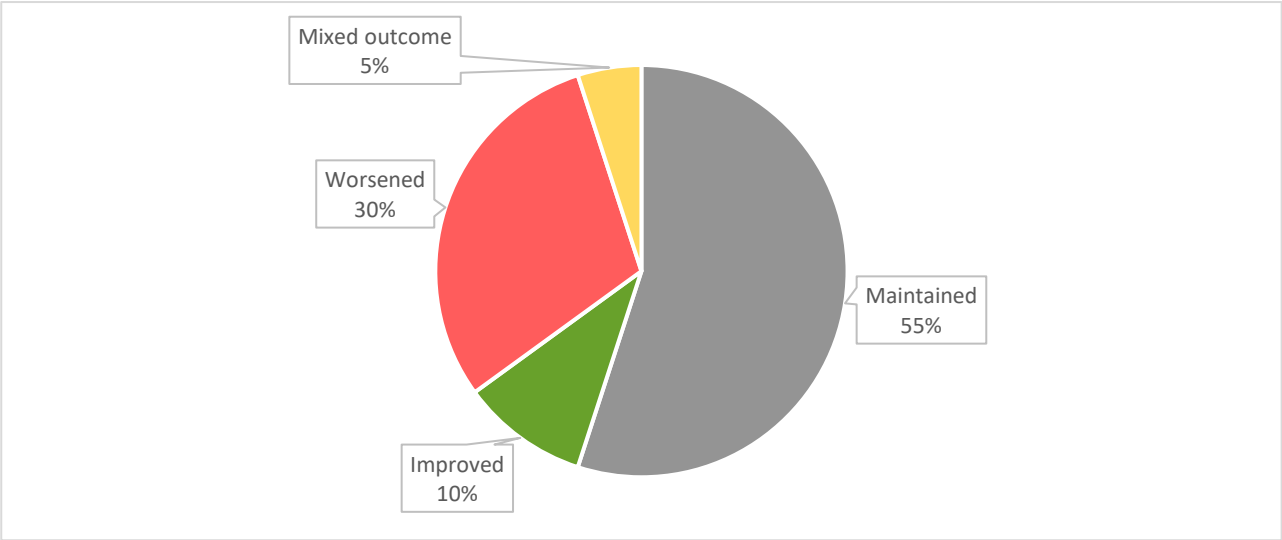


Table 3-7. Change in vegetation condition since OMP implementation

Site	Has vegetation condition improved for MNES with OMP implementation?	Year of OMP	Justification
1	Maintained	3	▪ VQA score consistent with Year 2 (baseline score was for wider area than offset area) ▪ Increased cover of some weeds but less of others.
2	Maintained	3	▪ VQA scores and overall weed cover similar to previous, although discrepancies in weed scores and Habitat Zones confounds comparison
3	Worsened	4	▪ VQA score much lower than baseline (and Year 2) ▪ Weed cover higher than baseline
4	Worsened	5	▪ VQA score similar to previous ▪ Weed cover higher than baseline due to species misidentification in previous reports and other weed species trending up
5	Worsened	3	▪ VQA score has improved since baseline however mostly due to woody species recruitment which the OMP aims to prevent to maintain GSM habitat ▪ Weed cover higher than baseline
6	Worsened	1	▪VQA score much lower than baseline ▪ Weed cover higher than baseline
7	Maintained	1	▪ VQA score similar to baseline ▪ Weed cover similar to baseline
8	Worsened	2	▪ VQA score similar to baseline ▪ High threat weed cover higher than baseline
9	Maintained	3	Averaged scores of plot assessments consistent with Year 2
10	Worsened	5	Averaged scores of plot assessments lower than Year 1
11	Maintained	1	Observed differences in BioCondition scores within 10 points of baseline
12	Maintained	3	▪ BioCondition scores generally increased but similar to baseline ▪ Some trends such as increases in native grass cover and woody species recruitment are most likely associated with high rainfall during the La Niña weather conditions in the past two years. These gains however occur in association with increases in weed cover. At the time of ground-truthing, there had been no active management of the offset site since OMP implementation.
13	Maintained	3	Averaged BioCondition scores similar to baseline
14	Maintained	3	▪ BioCondition scores generally lower but most within 10 points of baseline and some improved. ▪ Weed cover in some AUs significantly higher than previous assessments although this appears to be driven by differences in the interpretation of assessment methods.
15	Maintained	3	▪ BioCondition scores higher but largely within 10 points of baseline.

Site	Has vegetation condition improved for MNES with OMP implementation?	Year of OMP	Justification
			▪ Larger variations in scores likely due spatial variation of assessment sites from baseline indicating variability within AUs. ▪ Weed cover was sometimes higher and sometimes lower than baseline. ▪ High levels of variation across the assessments make it difficult to assess trends.
16	Improved	4	▪ BioCondition scores higher than baseline ▪ Weed cover lower than baseline
17	Maintained	1	BioCondition score consistent with baseline
18	Improved	0/1	BioCondition scores higher but largely within 10 points of baseline except revegetation area which showed larger gains
19	Improved/Mixed	3	BioCondition scores both higher and lower than baseline with no clear trend evident
20	Maintained	2	BioCondition scores predominantly lower but within 10 points of baseline Lack of other detail such as AU and weed mapping makes comparison difficult

3.5 Management and monitoring

Where possible during field survey and in association with other ground-truthing activities, observations on management actions to be undertaken or achieved at offset sites were made during the field assessment. Discrepancies in reported information and management plans observed during ground-truthing were noted and a summary is presented in Table 3-8 of management actions that have not been undertaken or achieved. Note this should not be considered exhaustive but rather incidental observations recorded in relation to other ground-truthing activities. Management actions not implemented to levels as described within the OMP were observed across all but one offset site; most actions required by the OMP had commenced at six sites (30%), some actions had commenced at 13 sites (65%) and no management actions commenced at one site.

Similarly, Table 3-8 also presents a summary of monitoring activities that have not been undertaken or achieved. This may be in the form of monitoring reports not provided or where a report was provided but particular monitoring as specified in an approval or OMP was not undertaken. It also includes where targets have been set in OMPs but there is no monitoring or plan to monitor progress towards these targets. Two sites (10%) were considered to have completed the required monitoring and 14 sites (70%) had incomplete information including two sites that lacked sufficient detail on monitoring requirements in the OMP documentation to enable an assessment; a further four sites (20%) were in Year 1 of the OMP and thus it was too early to assesses progress of monitoring requirements. Although also in the first year of the OMP, Site 18 was missing key elements of baseline monitoring required to successfully inform future monitoring targets and is included within the twelve sites with incomplete monitoring.

Table 3-8. Summary of management and monitoring

Site	Have management actions required by OMP been undertaken?	Management actions not undertaken / achieved	Monitoring completeness – were all attributes that required assessment measured?	Monitoring not undertaken
1	Some	▪ Physical marking of photo-point monitoring locations ▪ Year 1 management report	No	▪ Year 1 GSM monitoring
2	Some	▪ Achieving weed cover target ▪ Maintaining perimeter fence ▪ Management reporting	No	▪ No weed inventory recorded. Required to achieve target of eradicating new and emerging weeds ▪ Year 1 and 2 management reporting (including pest and weed monitoring)
3	Most	▪ Maintaining weed cover below baseline	No	▪ Annual Monitoring reporting ▪ Year 2 SLL monitoring
4	Most	▪ Achieving weed cover target ▪ Maintaining biomass	Yes	n/a
5	Some	▪ Maintaining perimeter fence ▪ Achieving biomass target ▪ Year 1 ecological burn	No	▪ Year 2 whole site VQA ▪ Year 2 whole site weed cover levels

Site	Have management actions required by OMP been undertaken?	Management actions not undertaken / achieved	Monitoring completeness – were all attributes that required assessment measured?	Monitoring not undertaken
				▪ Year 1 and 2 VQA of monitoring plots ▪ Assessment of control monitoring plots
6	Unsure	Only year 1 of OMP (targets not achieved)	n/a (Year 1 of OMP)	n/a
7	Unsure	Only year 1 of OMP (targets not achieved)	n/a (Year 1 of OMP)	n/a
8	Some	▪ Prevention of pests ▪ Achieving weed cover target ▪ Achieving bare ground target	No	▪ Weed cover to nearest 5% required to inform progress towards target▪ Year 1 monitoring reporting
9	Some	▪ Maintaining tree density ▪ Maintaining weed cover ▪ Achieving inter-tussock target	No	▪ Introduced perennial grass cover required to inform progress towards target ▪ Baseline monitoring requirements: - Site flora list - Weed mapping - Baseline monitoring plot data
10	Most	▪ Prevention of pests ▪ Achieving inter-tussock target	No	▪ High-threat weed cover required to inform progress towards target
11	Some	▪ Implementing internal fencing ▪ Removal of livestock ▪ Production of final OMP	n/a (Year 1 of OMP)	n/a
12	None	▪ All management actions	No	▪ Pest and weed monitoring not discussed in annual reporting
13	Some	▪ Pest control	No	▪ No monitoring actions detailed in annual compliance reports
14	Some	▪ Planting ▪ Provision of progress reporting	Yes	n/a
15	Most	▪ Year 2 ecological burn	No/Unknown	Monitoring requirements not clearly described
16	Most	▪ Achieving Year 3 fencing target	No	▪ Exotic groundcover required to inform progress towards target ▪ Year 3 Koala Monitoring
17	Unsure	▪ Production of final OMP	n/a (Year 1 of OMP)	n/a
18	Unsure	▪ Provision of updated baseline report ▪ Assessment of all exotic species	No	▪ Weed cover and species lists required to inform progress towards target
19	Some	▪ Commencement of weed management actions	No	▪ No monitoring actions detailed in annual compliance reports
20	Some	▪ Removal of fencing ▪ Removal of livestock ▪ Weed management	No/Unknown	▪ Monitoring requirements not described ▪ Weed cover required to inform progress towards target

4. Discussion

4.1 Documentation and data challenges

The ability to assess whether offset site information is consistent and in accordance with the approval conditions specified by the Department is inherently linked to the documentation and data that is referred to or provided to the Department. In most cases, the documentation and data provided was incomplete as outlined in the following sections.

4.1.1 Contact information

Contact information of approval holders, consultants who conducted baseline monitoring and offset land managers was often inaccurate or out of date. In some circumstances, the relevant contact details were sourced through various email correspondence, which could have impacted the reputation of the Department. Consultants were often best placed to provide the relevant contact details, with approval holders often unaware of the key contact details for offset land managers managing the offset sites.

This transactional relationship between approval holders and offset providers (i.e. fee for service) somewhat conflicts with the approval holder being liable for non-compliance – rather there should be a maintained interest in the offset site.

4.1.2 Documentation and data collection

Information and data provided by the Department was not comprehensive and at times out of date. Consequently, a review process to identify what information should be available for ground-truthing was undertaken, starting with the approval requirements as sourced from the Department's website. The approvals generally reference an OMP, or the need for an OMP. Consequently, the OMP was reviewed to identify what other documentation should have been provided to the Department (e.g. baseline reports, annual management/compliance reports, monitoring reports) and other data that could be ground-truthed (e.g. spatial data). Where missing information was identified, it was then requested from the offset site contact, and it was often provided, however, not necessarily within the timeframe scheduled for ground-truthing fieldwork.

Offset site contacts often reported that requested information had already been provided to the Department. The second request could have impacted the reputation of the Department. Some approvals, mostly for Queensland offset sites, required that OMPs and annual reporting were published on developer's websites and, as such, information was sourced from websites where possible. However, in some instances information meant to be published on websites was either difficult or not possible to locate through web searches. In other instances, cross-checking web-listed documentation identified that OMPs and associated documents provided by the Department were sometimes not the latest version.

A lack of consistency in documentation naming (refer to Section 2.2) could confound communication with offset site contacts and make information sourcing difficult. Ground-truthing undertaken was based on information available at the time and therefore all relevant information may not have been assessed for some sites (Table 3-2). Furthermore, documentation may have been provided but did not necessarily contain all required information as discussed in greater detail Sections 4.1.3 and 4.1.4 below.

4.1.3 Availability of data

Availability of data, as required by the OMP, varied across sites with all required data sourced provided to Jacobs for only eight of the 20 sites (40%; refer to Table 3-2).; this included six sites that had all documentation but were missing spatial data. Instances of missing data created limitations for ground-truthing as limited or outdated information was often utilised in the assessment (e.g. Jacobs was provided versions of documents by the Department such as OMP and monitoring reports that had been superseded (e.g. site 19)).

GIS data and monitoring reports were the most commonly missing data sources. A lack of GIS data created notable challenges in undertaking ground-truthing as locations of key features were often unknown. This was particularly apparent for Queensland sites with seven sites (sites 11, 14, 15, 16, 17, 18 and 20) missing GIS data, compared to only three (sites 2, 3 and 6) in Victoria. At each of these Queensland sites, the missing data comprised boundaries of the REs and subsequent AUs and as such, ground-truthing these was difficult. Additionally, maps made from the associated data (e.g. showing REs and AUs) provided in the relevant OMPs were often difficult to interpret due to incomplete or poorly represented data (refer to Section 4.1.4). Furthermore, mapping of vegetation or key features

was not provided at all for sites 15 and 16 meaning considerable assumptions had to be made about the RE and AU boundaries during ground-truthing.

Monitoring reports as required by OMPs were not available for several sites which resulted in ground-truthing data only being able to be compared to baseline data or earlier monitoring. As such, differences in ground-truthing data could have been due to environmental changes resulting from management of the sites and climatic conditions and ground-truthing may not have detected other variation or discrepancies in the original data. Similarly, the lack of detail in management reports at various sites limited the ability to identify progress against management actions and improvement of the sites. A list of all missing data compared to what was required under the OMPs is provided in Table 3-2.

It could not be determined if missing reports were a result of monitoring and/or management activities (or reporting) having not yet been undertaken, or if the information had just not been provided to the Department at the time of the ground-truthing assessment. Additionally, due to the challenges in the document and data collection (as discussed in Section 4.1.2), it is possible some documents have been received by the Department, but not shared with Jacobs.

4.1.4 Completeness of information and data

A comprehensive and clear OMP is essential in achieving biodiversity objectives at an offset site. Each of the consultants have prepared OMPs with different structures, focus, and inclusion/exclusion of details (Section 4.1.5). Common information and/or data that was missing or lacking across the OMPs included details on weed species, weed densities and mapping, monitoring locations, data and methods from vegetation and habitat assessment and clear definitions (e.g. with regard to habitat determinations and monitoring methods). These factors are particularly important as they provide essential baseline data (thus a point of repeatable comparison) to assess the improvement of a site over the life of the OMP as management actions are undertaken.

4.1.4.1 Weed inventories

Listing weed species and densities/cover is essential for targeting particular species, planning management (i.e. seasonal timing of weed management) and selecting suitable management methods (i.e. chemical treatment, burning, mechanical management, herbivory, etc). Many OMPs did not have weed species inventories and some did not specify key weeds present. Additionally, some have requirements for managing weeds, however, do not have baseline data to provide a comparison. For example, at site 2, the OMP provided a list of only 13 herbaceous weeds, however, also requires management of woody weeds but none are listed. Another requirement of the OMP is that any new and emerging weeds are eradicated, however as there has been no inventory of weed species recorded in the OMP or monitoring reports (aside from the selected herbaceous weeds), it is not possible to determine whether a weed has been newly recorded.

4.1.4.2 Weed densities and mapping

Recording of weed densities/cover and mapping of their locations is also essential in practical management. It provides land managers with an understanding of where to focus efforts and risks for particular locations (e.g. riparian areas may be subject to high water flows and erosion following weed removal). Few OMPs included mapping of weed densities and locations. Site 2 is the only site that had an OMP that included specific mapping of weed species (herbaceous weeds) and densities (as a percentage range) with further detail included in descriptive text.

Most OMPs are missing this important information, which results in a lack of baseline data to measure success of management actions. For example, the OMP for Site 20 requires several management actions relating to weeds including requirements to “observe evidence of significant reductions in the presence of other exotic species”, “remove extensive weed infestations (namely shrubs and taller grasses)”, and “collect a range of data including but not limited to… percentage weed cover within the rehabilitation areas”. However, the OMP does not provide a list of exotic species present, or details of baseline weed percentage cover. As such, these actions have no baseline data against which the requirements could be assessed. Similarly, the Site 9 OMP contains a requirement to achieve a 50% reduction in cover of introduced perennial grasses from the baseline by Year 10 through a continuous decline of such species. However, monitoring methods included in the OMP contain no requirement to collect data on introduced perennial grass cover and as such there is no data by which the monitoring can assess progress towards the target.

4.1.4.3 Monitoring locations

The identification of monitoring locations is important in collecting repeatable and scientifically rigorous data to show change over time. Different types of monitoring location are required across sites depending on the biodiversity values being monitored (e.g. vegetation condition, threatened species surveys, weed densities etc). Generally,

sufficient spatial data to allow repeatable monitoring was provided for more Victorian sites than Queensland sites. Spatial information provided for several of the Queensland sites was insufficient to undertake replicate BioCondition assessments. For example, at sites 19 and 20, some data (coordinates and/or bearings) identifying the locations of the BioCondition plots is missing in the raw data (although there is a space for this data in the pro-forma as shown in the appendices), provided spatial data, and not shown in figures. As such, the location of the BioCondition plot cannot be replicated as the start point and/or direction of the plot is unknown. Due to the nature of the BioCondition method, the positioning of a plot, even if nearby to the original, can result in considerably different results.

Differences between the Victorian and Queensland sites may be attributed to the different methods used, as the Victorian VQA method does not require plot-based assessment. Monitoring plot spatial data was generally provided for Victorian sites, although unless plots were physically marked on the ground, errors inherent in the collection of spatial data potentially confounded ground-truthing as no data on the accuracy of collected GIS data was provided.

4.1.4.4 Vegetation assessment data and mapping

Accuracy and completeness of vegetation assessment data (baseline and operational monitoring) is important in providing robust information that is repeatable over monitoring periods and allows for an accurate assessment of whether vegetation condition changes over time.

For the Victorian sites raw data/field values associated with Habitat Hectare assessment were rarely provided and instead only included scores. For example, a score of 7 for the weed category in the method can encompass a range of percentage weed covers. Mapping of HZs and TECs was usually provided and clear.

The field values/raw data associated with BioCondition assessments for the Queensland sites were usually provided (e.g. as appendices in OMPs). However, the mapping of AUs, REs and assessment sites was often unclear. All Queensland sites had missing data, errors, or discrepancies in the vegetation assessment data (Table 3-6). During review of the BioCondition data it became clear that the process of determining a score from the field values often resulted in errors. This was often due to inconsistencies in the benchmark data used, which was also hard to assesses as all sites failed to reference the benchmark version or source. The errors resulted in miscalculations of vegetation condition scores, which were often directly related to OMP or approval targets for offset sites. However, the errors were generally minor. To provide a better comparison with ground-truthing results, previously collected field data often needed to be re-scored against the current (v3.4) benchmarks (Queensland Herbarium 2023).

Mapping errors and misrepresentation were also common across Queensland sites. The mapping provided at several sites appeared to be directly downloaded from state resources and was not amended to on-ground validation of key features such as REs and AUs. For example, the only vegetation mapping at site 14 shows Queensland Government resource, the ‘regulated vegetation management map’. This shows classification of the vegetation as ‘remnant vegetation’ but provides no representation of boundaries of the five REs discussed in report text.

Several sites also had discrepancies between maps in reports and other data sources (including spatial data). For example, for Site 19, AUs were difficult to decipher due to discrepancies in the description of their boundaries between the OMP, the baseline report and the spatial files. This included polygons being assigned different REs and AUs, inconsistent areas provided to AUs and tables in the body of the report that do not match data presented in appendices. Similarly, at site 20, the mapping only shows the condition state classification of the vegetation (i.e. remnant, non-remnant) and not the name or an identifier of the RE or AU. As such, the locations of the REs and AUs had to be interpreted by the associated BioCondition plot identifiers in the raw data during ground-truthing. However, as there were two ‘site 4’ plots, this approach required considerable assumptions and thus was prone to error. Additionally, site 20 has five management units which also indicates the location of the REs but do not appear to match the six AUs.

4.1.4.5 MNES and MNES habitat determination

Determining the suitability of an offset site in supporting an MNES is critical to ensuring benefits for the targeted MNES are recognised. This is often considered during the approvals process and incorporated into approval requirements. For instance, at site 20 the approval conditions stated “baseline surveys must be conducted by a suitably qualified field ecologist in accordance with a scientifically valid, robust, and repeatable methodology and determine in detail the: …extent, location, condition and quality of Koala (*Phascolarctos cinereus*) habitat and GHFF foraging habitat”. However, the method for determining habitat for these species was not explicitly detailed in offset site documentation. In fact, the provided offset site documentation did not include an area or describe the extent, location, condition, and quality of GHFF foraging habitat within the site at all.

As there is no standard way to determine habitat for MNES fauna, each approval provided their own approach, and often no definition or criteria of habitat requirements was provided. Where criteria were provided in the existing

offset site documentation, it was used during ground-truthing. Conversely, where it was lacking, existing information provided in MNES listing advice or other credible sources was utilised to assess MNES habitat extent. Explicit standardised criteria would help ensure consistency in determining habitat for MNES offset sites.

Several sites provided descriptions of MNES habitat which included evidence for the extent reported. For example, site 3 provided descriptions of habitat for SLL and GSM (in table form) and compared that to the features present on the offset site. This provided justification for the spatial extent of the MNES habitat at the site and identified some features that are specifically included/ excluded (e.g. the lack of Chilean Needle Grass within the GSM habitat). Similarly, site 15 provides a description of GHFF foraging habitat within the site by specifically identifying feed trees that are winter and spring flowering. Such detail aids in providing a point of reference for repeatable assessments of habitat extent.

Determining the extent and presence of TECs was generally more structured than determining fauna habitat, given that the TECs assessed have diagnostic characteristics and condition thresholds within the listing advice. However, some inconsistency in the interpretation of these criteria was evident, such as at site 3 and site 10, where assessment of these criteria in the site ground-truthing report was debated by offset providers in provided feedback. Clear and concise assessment criteria are critical to their consistent application, however, encapsulating environmental variation in such criteria can be very challenging and can result in varied interpretations by ecological assessors.

4.1.4.6 Definitions, monitoring methods and assessing targets

Definitions and explanation of key environmental features are important in ensuring repeatable monitoring and enabling measurement of actions. As all offset sites generally utilised state-based systems for vegetation assessments (Habitat Hectares and BioCondition), most attributes are defined within the standardised methods. However, in situations where monitoring assessed attributes outside of the standard methods, definitions are required within the OMP. Similarly, where targets are set for particular attributes (standard and OMP specific ones) there was often a lack of detail in determining how they are assessed (Table 3-8).

With regard to the lack of definition in assessing particular attributes, an example is the use of 'inter-tussock space'. This is a critical component for GSM habitat as specified in the conservation advice for the species (DAWE 2021) and was an attribute where monitoring was required in OMPs for this MNES. However, very few OMPs defined what it was and ow to measure it. For instance, did it refer to any area that is not vascular vegetation and comprise rocks, bryophytes, litter and bare ground, or was it the area not covered by tussock-grasses, or only bare-ground excluding rocks, bryophytes and litter? As such it was often unclear if changes observed in inter-tussock space during ground-truthing and those in previous data were due to increased vegetation cover, or assessor variation in the definition of inter-tussock space. For instance, Site 4 stakeholder feedback comments on the OMP state:

> ….. *the measures for vegetation height and bare ground are also poorly defined. Bare ground is often interchanged with inter tussock space. These two terms are not the same.*

Inter-tussock space was set as a target for many GSM OMPs. For example, "an inter-tussock space of 20-40% to be maintained". However, the method of assessment was rarely detailed and often it appeared that one visual assessment was made across the site. The risk with this approach is, if just one assessment is made to encapsulate variation across the site, the larger the area, the higher the likely variation amongst assessors. With GSM offset sites ranging from 33 to 155 ha, there is potential for significant dispute.

Some sites looked to specifically address this risk using monitoring plots. The monitoring plots were much smaller areas (e.g. ranging from 1m x 1m to 20 m x 20m), meaning assessments of vegetation conditions, including inter-tussock space, could be undertaken more accurately. The site 9 OMP provides an example (although with slightly confusing language) of how the monitoring plots are connected to OMP targets:

> *The average level of open inter-tussock spaces (as determined by the 15 monitoring plots) will be taken as the average open space available across the offset site unless the broad observations taken during the annual vegetation monitoring indicate this result is atypical.*

Unfortunately, being explicit in defining attributes and how associated targets are to be assessed was very uncommon across OMPs. This lack of detail resulted in uncertainty during the ground-truthing assessment and likely across other parties attempting to understand and implement the OMP.

4.1.5 Offset Management Plan requirement differences

Across the sites, there was considerable variation in the types and frequency of ongoing management and monitoring reporting required by the OMPs even when similar MNES were involved. This appeared to differ between consultancies and the MNES being assessed.

4.1.5.1 Reporting frequency

Regarding management (compliance) reporting, annual reporting over the life of the OMP is the most common approach, with 18 (90%) of the sites requiring annual reporting (Table 3-2). The two outliers, sites 2 and 14, require less frequent reporting at years 1, 2, 5 & 10, and every second year, respectively.

The frequency of monitoring activities also varied considerably across sites. Some form of vegetation monitoring (VQA, MHQA, monitoring plots) is required at 18 (90%) of the sites and is required at varying frequencies, from annually to 5-year intervals. The two sites that do not describe the frequency or requirements for monitoring (sites 15 & 20) both provide offsetting habitat for Koala and GHFF, and require regeneration of woodland communities. As such, it is difficult to understand how the objective of the OMP would be assessed and recorded. Additionally, without the need for regular monitoring throughout the operational life of the OMP, no adaptive changes can be made to meet the goals by the end of the OMP.

4.1.5.2 Management action details and types

Most OMPs do not provide enough detail in management actions to ensure they are easily implemented and measurable. A well written action should be 'SMART': specific, measurable, achievable, realistic, and timely. Additionally, sites that have incomplete data (particularly baseline data) do not have the required information to compare with future monitoring, and thus demonstrate change over time. Further discussion regarding how OMPs could be improved, including in this aspect, is provided in Section 4.5.

Management actions require specific timeframes to ensure that actions are commenced and completed at a suitable time to support the meeting of site-wide goals by the end of the OMP (e.g. 10-20 years). The OMPs for sites 11 and 17 (both prepared by Consultant D) include 'milestones' to support progress of the management actions over time. These OMPs include up to three milestones with staged criteria leading to the final completion criteria by the end of the OMP (after 20 years). The consultant also provides management triggers and corrective actions if milestones are not met. This is a good example of adaptive management actions being included in an OMP. It provides guidance to the land manager in the event that management of the site is not on-track to meet the final obligations and goals. It also considerably increases confidence that the final goals of the site are achievable.

Most OMPs address similar environmental risks/ issues (e.g. weeds, pests, etc). However, detail or consideration of more challenging actions differed across sites. For example, the consideration of bushfire and/or ecological burn management was raised in several OMPs but at sites where it was not included, justification for its absence was often not provided. Moreover, OMPs generally do not consider the expenses required to manage the site or undertake specific actions. The cost of management may vary considerably depending on the type of management action, the approach taken (e.g. weed management via herbicides vs grazing), and the location (e.g. undertaking an ecological burn may have jurisdictional requirements (i.e. permits) and accessibility issues (i.e. access to water sources, fire breaks).

Reporting on the completion of management actions was varied. As a general trend Victorian sites tended to provide more detail and some included logs of activity undertaken and detailed consideration of issues and challenges the land manager was addressing. In comparison, other sites may have only had a brief sentence to say some work addressing the requirement had been completed with very little detail.

4.1.5.3 Offset Management Plan time frames

There is variation in the duration of OMPs across the sites. The majority, 10 sites (50%), have 10-year OMPs, 8 sites (40%) have 20-year OMPs, and one site each have12-year (site 12) and 21-year OMPs (site 16). The differences are largely state-driven with all except one of the Victorian OMPs spanning ten 10 years and eight of the Queensland OMPs spanning 20. In Victoria, OMPs required by state-based legislation (i.e. *Planning and Environment Act* 1987) are 10 years (followed by in perpetuity obligations) and this has likely influenced the EPBC Act OMPs. Queensland offset policy, under the *Environmental Offsets Act 2014* (DES 2023), like the EPBC Act requirements, does not include a standard timeframe.

None-the-less, as the Queensland sites with 12 to 20-year OMPs require replanting and/or regeneration of woodland vegetation, longer time periods are required to ensure that vegetation grows to the required maturity. Comparatively, as the 10-year OMPs are generally supporting grasslands and/or species habitats that comprise grasslands (e.g. GSM, SLL) and the vegetation can reach maturity in shorter timeframes, management actions, depending on the condition of the site, can potentially be realised sooner.

However, achieving management goals before the end of the plan is still considered ambitious given the length of some OMPs. For example, the OMP for Site 20 includes management actions for vegetation across the site to reach

remnant vegetation status (70% of height and 50% of cover of benchmark) by the end of year 15 which seems an optimistic target given the considerable area of cleared paddock present within offset boundaries and the limited work completed to date.

Many sites appeared to have delays in commencing management actions (refer to Section 0), however contingencies or consideration of extending OMPs were not included within the OMPs reviewed. Additionally, the defined start date of OMPs is often unclear; for many sites it was difficult to determine if the OMP started with commencement of the controlled action or at some later date. Some OMPs go through a lengthy drafting process after the controlled action has begun. For instance, at site 13 the action commenced in March 2019 however the OMP was not finalised until December 2021. Consequently, offset targets outlined in the approval that are to be achieved during this timeframe were not met and other offset targets, such as those to be achieved within five years of commencement of the action, have a significantly reduced timeframe making them less likely to be achieved. Having OMP finalisation and associated start dates align with the commencement of the action would improve the likelihood of targets also aligned with the commencement of the action being achieved. Some approvals do require this, e.g.

Compliance reporting and monitoring reports are often aligned with the anniversary of the commencement of the action. However, this may not be the most suitable timing given that offset monitoring is linked to seasonal requirements. It may be better to have a predetermined time that ensures monitoring or other critical actions can be completed within a reporting cycle. For instance, the ACR date for site 1 was amended from November to May, this enabled the annual spring-summer monitoring to be completed and reported on in one report that was submitted in autumn rather than midway through the monitoring period.

4.1.6 Data collation

The data collation process took considerable time due to the lack of standardised data collection and presentation in OMPs and associated information. Data was also often located within PDFs, rather than more accessible formats such as Excel or GIS, and therefore took additional time to extract and reformat. Although state systems were generally utilised, consultants collected and presented the data in various ways. This resulted in inefficiencies and difficulties in assessing and comparing data within and between sites. Additionally, numerous errors were noted in many consultants' data which may be partially associated with data collation methods (refer to Section 4.1.4.4).

In circumstances where monitoring plots did not align with state standard methods it was uncommon for OMPs to accurately explain how survey methods were undertaken (refer to Section 4.1.4.6).

These challenges led to delays in shortlisting sites and finalising a ground-truthing method and further created difficulties in replicating the methods during the ground-truthing process.

4.1.7 Confidence in data and information provided

A key objective of the ground-truthing assessment was to gain an understanding of the level of confidence that can be given to the data and information provided for offset sites. As discussed in the above sections, there are several key issues in the reliability and confidence in the documentation and data provided in OMPs and subsequent operational reports. Two main factors reduced confidence in the data and information provided, namely:

1. missing or unavailable information and data, and
2. erroneous or contradictory information and data.

There was considerable missing or unavailable data across the 20 ground-truthed offset sites, and as such, various methods could not be easily replicated during ground-truthing. Results and conclusions were often difficult to compare to existing reports. Additionally, absent or poor quality of mapping and spatial data made the process of 'connecting-the-dots' difficult. For example, at several sites where location data for monitoring or management activities (e.g. weed management) was not provided (e.g. as coordinates, spatial data or a map), it was impossible to replicate the assessment in the same location. Consequently, some assumptions were made to compare ground-truthing results with existing site information.

Errors or discrepancies in data were often difficult to rectify as the source of information was not referenced (e.g. confirming benchmark data for Queensland sites (refer to Section 4.1.4.4)). Contradictory information also confounded ground-truthing. For example, at site 5, there is a discrepancy in the canopy cover score target and the canopy cover within the OMP. The OMP states the canopy target is to remain at a score of zero however the OMP also states that that canopy cover was 5% across the site, which cannot result in a score of zero.

However, in most instances the errors or discrepancies were relatively minor and did not have large consequences for the offset. In more limited circumstances some documents appear to have a misrepresentation of data in order to meet obligations. For instance, at site 2, one of the approval conditions is for a 10% increase in the area considered a native vegetation patch from the area at commencement of the site. The OMP outlines only 80.3 ha of the total offset site (93.1 ha) is considered a patch of native vegetation (i.e. >25% of the perennial vegetation cover is native). The year 2 monitoring report states that the whole site (93.1 ha) is now considered native vegetation, due to improvement in vegetation condition in an area in the south of the offset. However, the accompanying weed data in the same monitoring report shows no decrease in the weed species (Toowoomba Canary-grass (*Phalaris aquatica*)) purported to have decreased to facilitate the improvement. Discussions with the landowner also touched on the difficulty in reducing herbaceous weed cover. When the new area of native vegetation within the offset area was assessed for ground-truthing in year 3 of the OMP, this area of grassland recorded the highest VQA score at the site with the highest perennial tussock cover and greatest diversity of floral species. These findings bring into question the validity of the area not originally being considered native vegetation in the OMP, especially given similar improvements are not purported to have occurred elsewhere within the site.

Similarly, very large differences between ground-truthing and previous VQA scores are difficult to understand, such as at site 3, were ground-truthing scores were approximately half the value of the previous year's scores; and at site 6 ground-truthing scores were around 20% the value of the baseline (13 v 60). Accordingly, both these sites had reduced extent of NTGVVP compared with the extent detailed in the OMP. Other instances of significant consequences associated with the data include at Site 10, where Bulbous Meadow-grass (**Poa bulbosa*) appears to have been mistaken for a native species such that large areas of offset site do not meet the condition thresholds to qualify as NTGVVP. At site 4, the most significant weed on site, and arguably the dominant species at the site, Brown-top Bent (**Agrostis capillaris*) was misidentified in the OMP, which appears to have led to the development of unrealistic OMP weed targets.

Discrepancies between documents include instances where ACR reporting does not appear to align with other information provided. For example, the Year 1 ACR for site 20 states that that Approval Condition 7 relating to baseline survey requirements is provided in the OMP. The compliance report does not specify where in the OMP these conditions have been addressed, it appears the following baseline data/information is not provided:

- the extent, location, condition and quality of GHFF foraging habitat (Conditions 7b);
- the OMP provides a HQA for Koala which implicitly implies the extent, location, condition, and quality of Koala habitat (as required by Condition 7b); no definition is provided in the OMP for what tree species are suitable Koala feed trees nor specific consideration of their extent across the offset site;
- the extent of weed cover (Conditions 7c); and
- the abundance of non-native predators and non-native herbivores (Condition 7d).

The ACR also states that "follow up MHQA Surveys have been completed yearly since 2019". These were not provided to Jacobs and the compliance report does not provide references or any other details on these surveys, consequently this information could not be ground-truthed.

4.2 Approval and offset requirement considerations

Approval requirements for each site, as detailed within the site-specific approval decisions, varied from site to site (see Section 3.1; Table 3-1). The requirements outline specific actions, plans and targets for each offset site to assist in the appropriate management of the site and its environment. Aspects consistent across all approvals included legal securing of offsets, preparation of an OMP (or similar offset strategy framework) as well as compliance and non-compliance reporting. There were also site specific actions which varied in detail, such as several approval requirements in response to current land use, surrounding environment, and MNES of concern. These included livestock guidelines and management plans, revegetation and/or tree planting targets, and environmental condition targets and plans.

For example, Site 16 which is located within large bushland area, had an explicit condition for a Bush Fire Management Plan (BFMP) with associated fire management works. Whilst these requests certainly contribute to native fauna and flora management and maintenance of site conditions, a large portion of sites located in similarly vegetated areas did not specifically clarify the requirement for a BFMP. As such, whilst the approval requirements undoubtedly require flexibility and reactiveness to offset site conditions, a level of standardisation in approval conditions for specific species, environments and MNES of concern would allow for greater comparison between site needs and help to create baselines for the future development of management plans and guidelines.

Additionally, the layout, structure and formatting of each approval decision varied significantly between sites. Several approvals provided in-depth detail on factors to be included in OMPs, including specific topics for consideration (e.g. weeds, pest animals, bushfire, livestock management), targets to be achieved (e.g. restoration of RE benchmarks) and specific details of surveys and timing of ecological and environmental monitoring. Conversely, several OMP approval requirement listings were very brief, only outlining the need for an OMP and leaving the contents and specifics of future management actions and strategies largely interpretive (see Section 3.1; Table 3-1). For example, the approval decision for Site 6 is very brief, detailing the requirements for legal securing of land, notice requirements and implementation of an OMP, without any further site-specific factors described. In contrast, the conditions of approval detailed for Site 12 and even more so in Site 18 are extensive, detailing requirements under each management plan, including survey effort, monitoring requirements, environmental and ecological targets, and offset area specifications.

The reasoning behind these discrepancies between both approval requirements and approval decision structure does not appear to occur because of site condition, offset site size, or MNES of concern. Rather the difference seems to be state driven, with Victorian approvals generally being less detailed than Queensland ones. The date of the approval also appears to have an influence with earlier decisions typically providing greater detail, and more recent notices seemingly more streamlined.

Differences between approval decision requirements for offset sites and associated offsets approvals process could potentially be a factor leading to the inconsistencies between the OMPs generated for the offset sites. With clear expectations, guidelines, and requirements for each site, either through more detailed and generally more consistently formatted decisions, consistent naming of requirements and plans, and available guidelines and templates for OMPs and other management plans, the outcomes for these offset sites would be increasingly comparable, reliable, and likely more successful from year to year.

4.2.1 Unrealistic Offset Management Plan targets

Some offset management plan targets were considered to be unrealistic given existing site conditions, particularly some herbaceous weed control targets, biomass and associated vegetation cover targets at Victorian sites. For instance, Site 4 stakeholder feedback comments on the OMP include:

> *Targets that are not seemingly based what is achievable, especially when implementing actions in the OMP have resulted in moving further away from the targets described (grazing, burning and weed control have all increased weeds in some manner).*
>
> *The OMP can be an impenetrable document and internally inconsistent. Targets that don't make sense such as ensuring at least 30% bare ground and at least 70% vegetation cover (which hasn't considered litter cover) are not useful for management, condition monitoring or compliance. When these cover requirements are combined with a non-seasonally specified minimum vegetation height of 10 cm and a late spring monitoring, the requirement to meet the target is almost impossible, especially in a year of higher rainfall and growth.*

Site 10 stakeholder feedback suggests that:

> *As part of the EPBC referral/approval process that involve third party offset sites, DCCEEW should explicitly question whether the landowner or land manager has been adequately consulted during development of the OMP and that the owners/managers have reviewed, understood, and approve the OMP requirements and targets.*
> *Third party offset providers are essential for a functioning offset system and yet they don't have a clear role in the approval process. The owner's/manager's knowledge of what's realistic and feasible at the site helps to avoid (1) site assessments that do not reflect the true weediness of a site, and (2) OMP targets that are idealistic and overly ambitious.*

Another area of challenging targets is the setting of stocking rate targets for fauna. This was more common for Queensland offset sites than Victorian ones (see Section 3.1; Table 3-1 for sites with these targets). For instance Site 2 is required to achieve a Golden Sun Moth abundance of greater than 20 moths/hectare and site 12 is required to achieve an increase in Koala density above [benchmark] average Koala density by the end of year 15. While increasing the population of threatened fauna at offset sites is the ultimate aim of offsetting there are many complex factors at play that may be outside of a land managers ability to control. These targets may prevent landowners from engaging with offsetting given the risk that they cannot be achieved due to external factors (e.g. climate, disease) or landscape scale threats (e.g. bushfire, habitat loss, predators) and the consequential liability with not achieving these targets.

4.3 Offset site ground-truthing findings

4.3.1 Offset site location and extent

Generally, offset sites were found to be in suitable locations for the relevant MNES and aligned with their spatial data and mapping. Offset sites occurred in the location given (e.g. provided address) and were generally managed to support the MNES (or its habitat) identified in the EPBC Act approvals. However, it is more difficult to determine if the exact extent and location of the offset site was consistent with approval requirements due to inaccurate, contradictory and incomplete data (Section 4.1.3). Table 3-3 shows that fourteen of the twenty sites (70%) had inconsistencies with the offset area across information sources (Approval decision, OMP and spatial data).

EPBC Act approvals normally define an extent of impact and an extent of offset required in hectares. GIS data (e.g. shapefiles) are sometimes requested in approvals to support this. It was common for the GIS data provided for ground-truthing to not entirely match maps provided in OMPs or approvals, either regarding the shape, location or area of the offset site. With regard to the shape, this was generally due to offset areas being refined since approvals and OMPs were finalised.

Regarding the location and area, the variations were often small but could be substantial across an entire offset site. For instance, at site 9, when ground-truthed, the GIS data showed the offset area extended approximately 5-10m past the property boundary fence and into the neighbouring property. As such, over the length of hundreds of metres this can amount to a substantial area. At site 1, the GIS data provided indicated the offset area occurred about 10m short of the northern fenced boundary and overlapped with another offset site to the south. In response, the offset provider produced a new map showing how the original boundaries (as per the approval and OMP) of the offset site were aligned with the Digital Cadastral Database (DCDB) and in the updated map they had been aligned to the property boundaries determined by a land surveyor. However, as a consequence it appears this 'moving' of the offset site results in it including areas of disturbance (e.g. dams) that were originally intended to be excluded.

At present there are no standards for how the extent of offset areas are measured. If DCDB boundaries are used, this can result in inconsistencies with property ownership and on-ground conditions. If the area is calculated using GIS data and an associated projected coordinate system (as done in this ground-truthing project) this can result in variations depending on the coordinate system used. This may differ from instances where on-ground measurements taken by a land surveyor (as is the practice for legal documents) are used to determine the area. Furthermore, historical positions of fences often follow natural elements (e.g. slopes, vegetation, or waterways) and may be different again. This points to the need for a standardised system of measurement including data capture and data format standards so the area can be consistently determined. Land surveyors can provide the best assurance that offset sites fall within property boundaries and match the actual on-ground area.

4.3.2 Offset site support of relevant MNES

The extent of the MNES (i.e. for TECs) or habitat for the MNES (i.e. habitat for threatened species) varied across the sites. Only 9 sites (45%) were observed to have the same extent for all the MNES as stated in the OMPs (Table 3-4). Five were considered to have a major difference. Nine of the 10 Victorian sites had inconsistent extents with at least one of the MNES (all but site 5), compared to only two of the Queensland sites (sites 14 & 20). This was primarily due to Victorian sites comprising MNES with more specific requirements (i.e. NTGVVP, SHWLTP, GSM), compared to MNES for Queensland sites (i.e. GHFF, Koala) which have broader habitat requirements that are more easily met. It should be noted that three sites (sites 1, 3 & 4) have multiple MNES present, but were not considered inconsistent in extent for all MNES. For example, site 3 contains four MNES (NTGVVP, SHWLTP, GSM & SLL), however only the two TECs (NTGVVP & SHWLTP) were identified as having an inconsistent extent.

Common inconsistencies observed across the Victorian sites were predominantly related to the extents of NTGVVP and GSM habitat. Issues with the extent of NTGVVP generally related to the condition thresholds against the EPBC Act listing (TSSC 2008). At sites 3, 4 and 6, the extent of NTGVVP appeared to be smaller than reported in the OMP due to much of the site being dominated by exotic vegetation (i.e. the listing requires a minimum of 50% of the ground layer cover comprising native grasses and/or other herbs). However, it is noted the ground-truthing was undertaken outside of the optimal survey period, and as such, determination of the presence of NTGVVP reflects this seasonal limitation (Section 4.6). Similarly, at sites 7 & 10, wet depressions in areas mapped as NTGVVP appeared more representative of Plains Grassy Wetland (EVC: 125) (often associated with SHWLTP), and as such the proportion of habitat representative of NTGVVP at the site may be lower than described within the OMP. The preceding three years of high rainfall may have prompted a shift between these communities that was only evident under such conditions, however this was not identified in the most recent monitoring report for the site.

Similar issues were identified for the extent of GSM habitat regarding specific habitat requirements. The extent of GSM habitat may be lower than reported in some OMPs due to limited presence of native vegetation and inter-tussock space being below the required target for breeding habitat. For example, at site 6, the entire site was mapped as suitable habitat for GSM, however ground-truthing identified that the site was often dominated by exotic Toowoomba Canary-grass (*Phalaris aquatica*) with occasional scattered native tussock grass species. Therefore, GSM habitat may be of reduced extent and/or lower quality than described within the OMP.

The MNES at Queensland sites comprise habitat for threatened species that have more general habitat requirements and larger home ranges (i.e. GHFF & Koala). Sites comprise suitable habitat for the species but, the species may not actually have been previously recorded on site (Victorian taxa have smaller home ranges and have been previously recorded at offset sites). Meeting habitat conditions for GHFF and Koala is relatively easy, as only suitable geographic conditions and foraging resources are generally required. However, at site 20, about a third of the site currently contains open paddock areas or predominantly exotic vegetation that do not provide habitat for either species. The OMP assumes that the entire offset site would provide suitable Koala and GHFF foraging habitat upon reaching 'Remnant vegetation' status at Year 15. However, given little work has been undertaken, the target seems optimistic.

Other issues relating to the inconsistencies of extent relate to scale and accuracy of mapping, as well as the extent of the site boundaries. For example, at site 1, boundaries for excluded sections surrounding a windmill and dam appear not to accurately distinguish sections of NTGVVP from sections of weed dominated habitat thus impacting the exact quantity of NTGVVP considered present. Similarly, at site 2 fence boundaries did not align with the cadastral property boundaries, and therefore the extent of GSM habitat present is likely slightly different (Section 4.3.1) the documented in the OMP.

4.3.3 Consistency of offset site vegetation condition and available information

Ground-truthing of vegetation conditions found considerable variation across the sites in comparison with previous data (refer to Table 3-5). In some instances, considerable time had passed between ground-truthing and collection of previous data available for the site, such that change in vegetation conditions over time could not be ruled out from accounting for differences in the results. Similarly, seasonal variation, particularly for Victorian sites likely contributed to differences in ground-truthing data and other previous data provided. Table 3-6 provides discrepancies in OMP documentation that also accounts for difference between the data. Other differences can be attributed to what appear to be errors in identification, such as misidentification of Bulbous Meadow-grass at site 10 and Brown-top Bent in the OMP for site 4 and site 9. Some larger differences in scores such as those at site 3 and site 6, appear to be beyond what is expected with seasonal variation and are difficult to account for with the information available.

The location of assessment sites (i.e. site sampling) likely accounts for a significant amount of variation from previously recorded Queensland data. Ground-truthing did not just replicate previous BioCondition assessments but also aimed to ensure previously chosen assessment sites were reflective of the broader AU through use of a rapid assessment method across a broader area (Section 2.3.2.2). This was intended to be a rapid method for accounting for variation within AUs such that where a previous BioCondition score, or the average of multiple BioCondition scores for an AU, were highly different from the results of rapid assessment, it indicated the previous data did not reflect current conditions across the AU. Aside from the considerations identified above, this could be driven by the selection of sampling sites in the AU not reflecting average conditions across the AU or due to changes in vegetation condition since the previous assessment, the former being easier to detect when comparing against more recent data. For instance, at site 15 there is a high level of variation in results across several attributes assessed in 2021 including large trees which are unlikely to have changed much in this time frame. This indicates a high degree of variation within the AUs and the location of the sampling plots is a contributing factor to the variation observed. Site 19 is potentially another instance where this has occurred. In contrast, it was noted that site 20 has a high degree of variation in RE12.3.11 – Cleared Paddock (Site 5 & 6), but when the two BioCondition scores for this AU are averaged the discrepancy with the rapid assessment is somewhat balanced out.

Given the whole zone is assessed in Habitat Hectare assessments, variation in site sampling was not an issue for the Victorian VQA data. However, without the use of sampling, assessment of broad areas can be much more difficult and have a much higher level of assessor variation. To account for this 5 out of the 10 Victorian sites contained monitoring plots tending to have a higher level of replication (e.g. 15-20 across an offset site) than the BioCondition plots. This was helped by the Victorian plots being in grassland with less attributes and could therefore be assessed quicker. Ground-truthing these plots could still result in a high level of variation, such as that seen at site 10 due to previous misidentification of weeds. Where replication was lower, evidence for site sampling influencing results was evident. For example, at Site 4 where ground-truthing replicated seven plots established by the land manager and nine plots established by an ecological consultancy both producing quite different averages. These plots were only $1m^2$ representing a very small area of the offset site and therefore it is difficult to extrapolate the results to the entire offset site with confidence. The landowner plots were physically marked with stakes and ground-truthing results were

more similar to these plots than the consultancy plots that were not physically marked but located by GIS. Stakeholder feedback revealed the latter plots were intentionally not marked as they were not designed to be replicated at the exact same spot each time, rather the sampling strategy was intended to give a spatially representative average of condition across the offset.

The BioCondition score often feeds into site targets associated with OMP approvals such that the score for one BioCondition plot can be extrapolated over tens of hectares and have a significant influence for assessing OMP targets. Similarly, monitoring plots in Victoria may relate directly to an assessment of OMP targets. Standardisation of sampling and ensuring there are sufficient samples across an offset site to accurately capture variation is thus critical in ensuring offsets are achieving their intended purpose.

4.3.4 Offset site condition trends

An assessment was made of the general trend in vegetation condition at offset sites in comparison to baseline documentation. Overall, vegetation conditions were maintained at 11 of the 20 offset sites (55%) with implementation of the OMP, six were worse (30%), one mixed (5%) and only two (10%) resulted in a clear improvement (see Table 3-7). Noting that these results are fairly conservative with only larger increases or decreases in VQA scores (e.g. 10 points) and weed cover (e.g. >10%) since baseline (or earliest available data) considered to be a significant change. This is intended to reflect the numerous limitations associated with the project including seasonal and assessor variation and difficulty in replicating methods and comparing with previous data (see Table 3-6).

When compared between states, Victorian sites were generally more likely to be trending to worse condition than Queensland sites. This trend is potentially associated with the types of habitats dominating offset sites assessed in each state; Victorian sites assessed were grasslands, compared with the predominantly wooded Queensland sites. Grassland sites can be highly variable across seasons, with weedy species often more evident in the winter months which was when ground-truthing fieldwork took place. At this time there is also some reduced native species richness as observations are skewed towards species visible at the time of survey, rather than cryptic species only observed during a certain time of the year (generally spring-early summer). However, reduced species richness was considered to have a very limited impact for the sites assessed. It also appears that recent years of high rainfall have facilitated a high amount of weed growth due to better growing conditions for many weedy taxa than would occur in drier years.

Comparatively, the wooded Queensland sites tend to be less dynamic, and weed cover generally lower and mostly associated with woody weeds which have limited seasonal fluctuation, take longer time to grow and are generally easy to manage. In areas of lower quality, its generally easier to restore woody ecosystems and be more effective in achieving gains than in grasslands; and detection of condition gains are most evident in restoration of lower quality areas. Restoring previously cleared areas, devoid of native vegetation to native woodland communities is generally a highly effective and easily measurable and detectable offset gain.

Of the ten Victorian sites, six sites (60%) were found to be in a worse condition, with VQA scores lower compared to baseline and weed cover results consistently higher compared to baseline cover percentages. The remaining four sites in Victoria reported a maintained vegetation condition, with VQA scores and weed cover similar when compared against baseline. There were several notable reasons behind a degrading vegetation condition that likely contributed to these results, including discrepancies in vegetation assessment methods and overall inconsistencies in scoring results and data reporting styles. For example, for Site 2 and Site 7, which both resulted in a ‘maintained’ vegetation condition, reported weed cover scores equated to greater than 100% in previous data, highlighting potential flaws in their assessment and reporting such that comparison was difficult.

Of the ten Queensland sites, seven (70%) were found to be in a maintained condition, one (Site 19) to be in a mixed condition and two sites (20%) resulting in an improved vegetation condition. Of the sites reporting a maintained condition, the BioCondition scores determined during ground-truthing were similar (e.g. within 10 points of) to reported baseline scores. However, largely noted across the sites was the occurrence of discrepancies in vegetation assessment methods and BioCondition scoring errors such that the data obtained did not correspond with the methods implemented, and the lack of properly referenced benchmark values and versions.

At Site 19, where a mixed vegetation condition result was seen and ground-truthing VQA scores indicated that some areas declined in quality and others improved, there were irregularities with AU mapping and small differences across a range of attributes so that differences may be associated with assessor variation and differences in sampling locations. The two sites which showed an improvement in vegetation condition (Site 16 and Site 18), saw again, a similar lack of benchmark data stated and associated concerns with scoring, however there was evidence of improved condition with higher BioCondition scores. At site 16, weed management was considered to be the main factor driving the improvement and at site 18 revegetation provided the largest increase and in other areas where this had not occurred, weed cover and perennial native grass cover improvements were observed. Perennial native grass cover

and woody regeneration were two attributes that showed improvement across a number of Queensland sites and these are both potentially linked to the recent years of high rainfall.

The trends observed across Victorian and Queensland sites appear associated with a number of factors. These include recent climate driving vegetation responses (i.e. 2-3 years of high rainfall), seasonal variation, errors and discrepancies during data collection previously completed at the site and the extent of implementation of management actions.

4.3.5 Management action implementation and targets achieved

While not the main focus of ground-truthing, observations on management actions undertaken were made during the assessment and where ground-truthing revealed discrepancies in reported information and OMPs it was noted and a summary of those findings is presented in Table 3-8 and discussed further in the following sections.

4.3.5.1 On-ground actions

Management actions not implemented to levels as described within the OMP were commonly observed (see Table 3-8). From the information available, it is understood that 'most' actions required by the OMP had commenced at five sites (25%), 'some' actions had commenced at 10 sites (50%), no management actions commenced at one site and for four sites that had not completed the first year of the OMP it was considered too soon to determine. It should however be noted, that this is not an extensive review of all actions across all sites, and only those actions and targets assessable during ground-truthing are considered. It is also worth noting that for offset sites in early stages of the OMP often fewer management actions are required to have commenced than for those sites at later stages.

Common management actions that had not commenced included implementation of physical items such as perimeter fencing or monitoring point markers, active management such as ecological burning, pest and weed management and revegetation, this includes not achieving targets in outlined time-scales. Compliance reporting on management activities was also often incomplete or not provided for ground-truthing.

Physical items were easier to assess during ground-truthing than activities that often do not leave evidence on-ground such as ecological monitoring or pest control. One of the clearest examples common to most sites was implementation, removal or maintenance of fencing which often acted as a structural measure to assist in the management of other factors (e.g. exclusion of livestock, native fauna movement). The presence of fencing varied across sites in consistency with OMP requirements although perimeter fencing had been implemented or updated as described in most cases.

In the Victorian sites, management actions appeared to generally be implemented but not to the degree necessary to achieve the required targets. In particular, achieving weed cover targets were seen as a major challenge by offset providers, as evidenced during on-site discussions and in stakeholder feedback to draft site ground-truthing reports. While the recent years of high rainfall, favouring weed growth were identified as a significantly contributing factor there was also some acknowledgement around the difficulty in controlling weeds in grassland environments without impacting native flora. Most sites appeared to have applied significant resources and effort towards weed control but were often having limited success. In fact, stake holder feedback from site 4 noted that "it appears that wet seasons have a more dramatic effect on success of targets than management actions."

Perennial mat-forming grasses, particularly Brown-top Bent, commonly had a higher cover than OMP target. This species was misidentified in some OMPs but also is likely to be less evident during the summer months which was often when most survey effort was spent at GSM offset sites. There is potential that assessing the site in late spring or summer in association with OMP development has led to the creation of unrealistic weed control targets for some Victorian sites. There is a general feeling amongst offset providers that there is some disconnect in the setting of OMP targets, particularly with regard to herbaceous weed control and what can be realistically achieved.

Inter-tussock space was another attribute regularly not at target levels. Partially this may be due to the lack of definition around how and when it is assessed in almost all OMPs but potentially also due to how targets are set. Often inter-tussock space was equated to bare ground, however due to high levels of non-tussock forming species, including exotic grasses bare-ground was limited and required considerably high grazing pressure. In more intact grasslands with a better tussock structure and lower cover of exotics, bare ground targets were easier to achieve. The measurement of inter-tussock space is also likely to vary greatly between seasons, being higher in summer when cover of exotic non-tussock forming species is reduced, therefore the timing of assessment requires consideration when assessing this attribute.

There appeared to be more evidence for a lack of effort in OMP implementation across Queensland sites, with more sites not undertaking what appeared to be achievable OMP activities. For instance, woody weed targets were achieved across Victorian offsets sites however further effort was required in Queensland offsets and some sites

showed no evidence of weed management at all. Other activities such as fencing and revegetation efforts were more often behind plan the actions required in the OMP at Queensland sites. Another clear example was the exclusion of livestock. Livestock was still present within several Queensland sites, despite not being permitted by the OMPs. Reasoning for the persistence of livestock on sites was not provided, however could be resultant from poor fence management or uncertainties of land managers regarding OMP requirements.

It was often difficult to identify if management activities had commenced or the degree to which they had been undertaken. In many annual reports, some actions were not mentioned or discussed or did not provide time-based actions thus producing no urgency in land managers undertaking the action. This contrasted with some Victorian management reports where detailed logs of management activities were provided. Lack of standardisation across OMP documentation and associated data also often caused difficulties in interpreting management actions; OMPs for multiple sites, for example sites 15, 19 and 20, provided insufficient detail on management and monitoring actions to allow review of success.

Most assessed offset sites were within the first three years of implementation and as such it was difficult to interpret establishment or efficacy of management actions. Early-stage actions often focused on installing boundary fencing, designing monitoring methods/weed and predator plans, and recording baseline information rather than subsequent management or monitoring. Delays and constraints in undertaking management were common in early stages of offset sites. As such, discussion regarding potential issues and future actions (i.e. adaptive management) in OMPs and annual reporting can support achieving of delayed actions.

4.3.5.2 Effective management actions - association with improved vegetation conditions

The effectiveness of management actions across sites were variable. However, due to differences in the time since the OMP had been in place, specific site constraints, the type of and detail included in management actions, as well as the data collected during ground-truthing, the results of this project cannot comment in detail on their effectiveness. Nevertheless, some association was observed between instances where described management actions had been implemented, and offset sites where vegetation conditions had improved. This was most clearly observed in the Queensland sites where woody weed control (e.g. Site 16) or revegetation efforts (e.g. site 18) was correlated with improvements in BioCondition scores.

Management of woodland communities located in Queensland, can produce more impactful results than Victorian grassland sites due to individual plant scale; i.e. removing a large woody species is generally easier and can have greater impact than removal of a small grassland species. Herbaceous weed management can require treatment of extreme numbers of plants that are complexly arranged amongst native plants that weed management should not impact. Hence, the challenges in managing the herbaceous weeds associated with grassland communities rather than a lack of implementation of management actions at Victorian sites has likely significantly influenced site outcomes.

Comparatively, where woody weeds are much larger and where they (notably Lantana **Lantana camara* in Queensland sites) created an infestation, no distinction between native and exotic species is required as native species are rarely present whereas herbaceous weed management can require treatment of exotics in a complex mosaic with native species. Primary management of woody weeds also usually occurs in the first few years of an OMP, as such observations on efficacy are usually quickly and clearly evident. Furthermore, the past following two-three years of high rainfall associated with La Nina weather conditions, are likely to have supported weed growth of both herbaceous and woody species.

Management actions in Queensland also incorporated revegetation for woodland restoration, which is much easier than grassland community revegetation and subsequently was not a management action in the Victorian OMPs. Revegetation with woody species can result in rapid and effective improvements to a site as it can quickly change the composition (i.e. diversity of native species), structure (i.e. ground-layer, shrub-layer, canopy) and function (i.e. ground litter cover, natural regeneration, diversity of tree sizes) of the community. For example, at sites 18 and 19, in degraded AUs that included regeneration as a management action, notable increases in vegetation scores were attributed to revegetation (see Table 3-5).

Although short-term effectiveness of some management actions can be observed more quickly, effective management and overall success of the OMP should be measured at key milestones (relevant to the timing of the specific management action) and the end of the plan. For example, although management of woodland sites has generally resulted in increases to vegetation scores (i.e. notably from woody weed management and revegetation), these actions have been recently undertaken, and therefore short-term effectiveness can be observed. However, ongoing management is required to maintain this improvement and support the site to become self-sufficient. In areas of revegetation, the plantings must be maintained to ensure survival, in-fill plantings may be required where plants are lost, and ongoing herbaceous and woody weed management may be required until the new canopy is

sufficiently developed to naturally mange weeds. As such, comparing overall effectiveness of management between sites in this project cannot be commented on due to the early stages of the OMPs.

It is also worth noting that although detail in management actions is important in creating measurable and achievable goals (i.e. SMART actions; see Sections 4.1.5.2 and 4.5), the specifics of 'how' measures are undertaken may not necessarily result in more effective management. By leaving the specifics of the method to the land managers, adaptive changes and site-specific knowledge may be utilised, which was not available to the consultants that prepared the OMP. For example, land managers may be able to couple suitable weed management with a planned ecological burn, or change weed management approaches (e.g. change the type of herbicide, or change from herbicides to grazing if a herbicide is outlawed in the future).

Site 20 provides an example of effective adaptive management by a land manager. The OMP does not specify the presence of Giant Parramatta-grass (**Sporobolus fertilis*), a dominant weed across the site but on-site discussions with the land manager revealed it as a known key issue. The land manager further noted his experience with the weed and identified several approaches considered for its future management (e.g. grazing, herbicides). However, the OMP includes a management action requiring removal of all stock from the site. The inclusion of this action may restrict an effective and sustainable method for weed management proposed by the land manager. Challenges like this could be avoided with greater standardisation of management actions and consultation with land mangers during preparation of the OMPs (see Section 4.5).

Some management actions and associated targets can result in unintended outcomes. For instance, removal of weeds may encourage recruitment of other weeds rather than native species as was discussed in stakeholder feedback for site 4. At site 5, the offset site was once a woodland, but has been cleared for sheep farming and is now a grazed grassland that supports Golden Sun Moth. It is likely that Golden Sun Moth have colonised or increased in abundance from nearby areas that are naturally treeless or low in tree cover. Erosion is a significant challenge across the site., however the OMP hampers the effective treatment of this as it requires limiting recruitment of eucalypts and other biomass to maintain habitat for Golden Sun Moth.

4.3.5.3 Interpreting of OMPs

Variation in structure and content across OMPs (also refer to Section 4.1.5) often resulted in difficulties in sourcing key information. Important information such as baseline data and management actions were often in appendices or written in text and difficult to locate or decipher. At times information in tables contradicted information provided in text elsewhere. As those implementing OMPs are often landowners and land managers and without a technical background (i.e. not ecologists, consultants, scientists), the task of finding and implementing management actions from a complicated document or from multiple documents, may be more difficult, and often appeared more difficult to decipher than necessary. For example stakeholder feedback for site 4 stated "*The OMP can be an impenetrable document and internally inconsistent. "*As such, OMPs should be concise and well-structured for ease of interpretation. Increased consultation with land managers during the development of the OMP may also enhance understanding and identification of land management issues, effective actions, and achievable targets.

4.3.6 Monitoring being undertaken

Requirements and associated descriptions for offset site monitoring were outlined within OMPs. Generally monitoring included repeat assessments of baseline surveys such as VQA or MHQA or other targeted surveys for MNES. Other additional requirements were often outlined in contribution to general site condition such as weed cover assessments, pest monitoring, fire fuel hazard and fauna monitoring for target MNES. Most monitoring was in relation to progression to offset site targets as outlined within OMPs to varying levels of detail.

Table 3-8 provides a summary of monitoring not undertaken as per approval or OMP requirements. Two offset sites, Site 4 and 14, had undertaken all described monitoring as per the requirements of the OMP. Of the remaining sites, fourteen had outstanding monitoring requirements including two that did not clearly describe the monitoring requirements within the OMP; and four were in Year 1 of the OMP and thus it was too early to assess progress of monitoring requirements. Although also in the first year of the OMP, Site 18 was missing key elements of baseline monitoring required to successfully inform future monitoring targets and is included within the twelve sites with incomplete monitoring.

Explanation for incomplete monitoring was not evident within provided documentation. It is also likely that variation from original project timescales is likely to have impacted the apparent lack of monitoring observed during the ground-truthing assessment. Where for some sites, subsequent documentation clearly demonstrated gaps in monitoring, for other sites a lack of clarity on progress or offset timeline might have falsely led to monitoring being

considered incomplete. Greater consistency in monitoring requirements across offset sites in addition to improved document control would allow for easier interpretation of missing monitoring documentation.

4.4 Offset stakeholder engagement

Draft site reports were shared with offset stakeholders upon request. Pending their review of the draft report and intention to meet with the department, discussions were held to discuss draft report findings and the ground-truthing exercise. Seventeen draft reports were requested and issued by the Department. This resulted in nine follow-up meetings where draft findings were discussed (six Victorian sites and three Queensland sites). In addition to the nine meetings held, one stakeholder group opted to send consolidated comments in lieu of meeting with the department. Ten individual site reports contain stakeholder feedback.

Key points raised by stakeholders in relation to draft reports and the ground-truthing exercise include:

- Draft reports lacked additional context that could potentially explain differences in ground-truthed information. Stakeholders were provided the opportunity to substantiate their claims and provide further context. Where this has occurred, it was attached as an appendix in final site reports.
- Some ground-truthing reports lacked scale and focused on negative findings rather than neutral or positive findings. This meant that stake holders perceived ground-truthing as an audit or compliance.
- Some offset managers found the findings useful, particularly where Jacobs identified additional sub-components/variables that were missing from OMPs but instrumental for comprehensive annual monitoring.
- Additional points were raised about departmental engagement with offset land managers, who are a proxy regulated community:
  - Limited engagement and communication channels with the department outside of compliance action;
  - Limited consultation on management actions and obligations during the environmental assessment process.
  - Bearing compliance action despite Commonwealth compliance action being directed towards proponents.

Stakeholders, particularly offset managers, indicated their willingness to engage in continued conversations with the Department about managing offsets under EPBC Act approvals.

4.5 Potential improvements to offset management

As discussed throughout Section 4.1, key challenges in reviewing the OMPs in the ground-truthing project related to the availability and completeness of documents and data, as well as the considerable differences between OMPs. As such, Table 4-1 summarises key issues raised in the above sections and identifies possible improvements that could be implemented to increase the quality of OMPs. These improvements may further support the ability to successfully implement management actions in future OMPs.

Table 4-1 Potential improvement opportunities for future OMPs

Challenge	Opportunity
Out of date or inaccurate contact information of approval holders, consultants, and offset land managers (Section 4.1.1). Out of date or superseded documents and data (Section 4.1.2). OMP initiation and timing of targets and reporting inconsistencies (Section 4.1.5).	**Data and document management systems** A more comprehensive and monitored document and data management system would support the sourcing and organisation of up-to date documents and contacts. This may include document filing and management, notifications for report due dates and past correspondences with stakeholders. This could include key dates including commencement of action and ensuring OMPs are finalised prior to this date so that OMP targets and reporting is aligned with other compliance reporting associated with the action. Ensuring contact details are up-to date could be required in annual compliance monitoring. However, it is noted that issues with confidentiality may arise if documents are to be made public.

Challenge	Opportunity
Inconsistency in document naming (Section 4.1.2). Inconsistency in format and provision of data (Section 4.1.2). Discrepancies in on-ground location of offsets site boundaries (Section 4.3.1). Lack of availability and completeness of GIS data (Sections 4.1.3 and 4.1.4). Lack of detail or absence of information such as weed inventories, weed densities, monitoring locations, vegetation data and mapping (Section 4.1.4). Lack of detail or inaccurate mapping (Section 4.1.4.4). Lack of definitions or lack of required detail in monitoring and assessing targets (Section 4.1.4.6). Long and convoluted reports that are difficult to interpret and identify key information (Section 4.1.5). Inconsistencies in frequency of compliance reporting (Section 4.1.5.1). Inconsistencies and unknown effort and frequency of monitoring (Section 4.1.5.1).	**Standardisation of OMP documentation and data** An OMP guideline document would minimise inconsistencies and ensure inclusion of required information and data. This could provide further detail on requirements that are not specified in approvals and enable changes in response to policy over time. It would ensure consistency between OMPs and that they are written and displayed in a manner that all land managers can easily interpret and successfully undertake management actions. As state jurisdictional requirements differ through impact assessment stages, and offset calculations often mirror these state methods, a guideline may be preferable over a standardised template; accounting for the requirements of all states may be challenging and prone to error. Additionally, a standardised structure and set requirements would provide the Department with a more coordinated system for review of OMPs and their associated documents and data. The structure and detail provided in an OMP should be provided in a manner that any person (with no prior knowledge of the site or technical expertise) could understand and implement. As such, high quality maps and key information provided in tables is valuable in simplifying the communication of detailed data. Additionally, the OMP should be concise and focus on the management of the site. As such, detailed and complex information not specifically required to implement the plan (i.e. baseline data) should be restricted to a specific section or appendix (with reference to the location to the information) in the OMP. The requirement to prepare an OMP should also include a requirement to provide at minimum the accurate (e.g. within 1m) location of the offset area in GIS format. This information should conform to a defined standard set by the Department and include information on the data projection used and key attributes required to be recorded.
Ensuring that land managers understand the OMP and are able to successfully implement the actions (Section 4.3.5.3). Difficulty in measuring change/ improvement of management actions over time (Section 4.1.5.2).	**Consultation with land managers** During the preparation of the OMP, consultation with the landholder/land managers could be undertaken to ensure the requirements of the OMP are understood and considered achievable prior to approval. This should take into consideration who the land manager is and their requirements for understanding the OMP requirements. For example, land managers may have little access to GIS technologies. As such, mapping should be adequate to explain all relevant features without GIS and on-site visits may be required. Standardisation of OMP documentation including reporting and data requirements would further support the clear and concise preparation and delivery of OMPs.
Lack of details in management actions (Section 4.1.5). Lack of consistency in types of management actions (Section 4.1.5.2). Overly optimistic management action targets (Section 4.1.5 and 4.3.2). OMPs that do not have a long enough duration to meet management action targets (Section 4.1.5.3).	**Standardisation of management action requirements** This may be included in an OMP guideline document and could provide a framework of requirements for each management action. It may identify management actions that should be considered for all sites, where relevant (e.g. boundaries, waste, grazing, weeds, pests, native vegetation, threatened species, fire, adaptive management). Each management action should be 'SMART', including, but not limited to actions that are: '**Specific'**: including details of 'what' is to be measured (e.g. weed inventories, species, and planting densities for revegetation, etc) and 'who' is responsible for it. '**Measurable**': includes complete and reliable baseline data with repeatable methods.

Challenge	Opportunity
	'**Achievable**': includes sensible targets that can be met within the timeframes proposed (e.g. achievable weed management targets, enough time in the OMP to achieve targets). The money and resources that are required to complete the actions should also be considered. '**Relevant**': All actions should reflect on what the MNES are and how the actions will improve the MNES and/or its habitat. Adaptive management should be included in annual reporting to reflect on how relevant actions are for current and future conditions (e.g. monitoring requirements may change over the life of the OMP based on the environmental conditions and known presence/ density of MNES). '**Time-based'**: include specific timeframes in which actions need to be commenced or completed. This ensures that actions are commenced early enough to meet end-of-OMP goals and adaptive management can be considered if actions are not on track. Adaptive management can assist in changing/ updating time-based goals when unexpected events occur (e.g. global pandemic, extreme weather events). SMART management actions and standardised requirements for annual reporting would support clear data and commentary on the challenges in implementing management actions. It would further support the implementation of adaptive management. Information and education of offset providers as to what happens if the targets are not met within the timeframe of the OMP will help set expectations for the management of offset sites. This may include considerations of extending OMPs until the targets are met or other penalties for non-compliance with the targets.
Lack of detail in management actions (Section 4.1.5). No justification provided for management actions that are not started or incomplete (Section 4.3.5.1). Late or delayed commencement of management actions (Section 4.3.5.1). Difficulty in measuring change/ improvement of management actions over time (Section 4.1.5.2).	**Triggers for adaptive management** Triggers are required at OMP milestones to identify if management actions are being successfully implemented and if they are on track to meet end-of-OMP goals. The inclusion of triggers (i.e. meeting of a performance indicator by a particular time) associated with management actions enables land managers to identity 'when' alternative measures need to be considered. Additionally, the inclusion of possible corrective actions provides direction of 'what' kind of changes could be made. Required ongoing reporting on management action progress and justification for changing approaches would assist in documenting what worked and what didn't and help to identify issues for future management and reviews of the OMP. Monitoring is complementary to adaptive management as it provides the data for evaluating the effectiveness of management actions and the impact of any adaptive changes made.
Consideration regarding funding of management actions (Section 4.1.5.2).	**Budgets and funding** Consideration of what an OMP would cost to implement should be undertaken during its preparation. The estimation of costs can assist in identifying risk (e.g. contingency costs for unexpected bushfire damage to fences) and help plan the staging of management actions over time. Budgets should be broken down into estimated yearly or staged (e.g. Years 1-5) spending to help allocated resources to key actions. For example, most funding for the management of woody weeds would be required in early stages. The reporting of spending in annual reports can also assist in identifying operational risk and triggering adaptive management.
Lack of clarity in what management has been undertaken (Section 4.3.5). Inconsistent monitoring (Section 4.3.6).	**Standardised management and monitoring reporting** Consistency in the standard of documentation for management and monitoring reporting would help provide clarity on what is expected of

Challenge	Opportunity
	offset managers, improve consistency on offset reporting and integrity of the offset system. This would not be limited to increased standardisation of the methods and frequency of monitoring achievement of targets as should be detailed in OMPs, but also the level of detail provided on management actions undertaken, including logging of activity as was provided for some of the offset sites assessed in this project.

4.6 Potential offset monitoring improvements

Section 4.3.6 outlines the extent to which monitoring is being undertaken across the sites. The key challenge in identifying the success of monitoring include the adequacy of reporting and detail in monitoring methods. Increasing consistency in the requirements of annual reports would support the awareness of when monitoring should be undertaken. Annual reports should clearly outline which monitoring activities have occurred in the past year, and ideally set out what is to occur in the year ahead. This would avoid confusion of what 'Year' number particular activities should be undertaken in, particularly if there are delays in the commencement of the OMP.

At present every OMP has its own approach to monitoring and nuance on the methods used. For instance, stakeholder feedback for site 9 stated:

> *Jacobs notes that the OMP and subsequent monitoring reports were not explicit regarding methods used to assess monitoring plots. We concur with this conclusion and suggest clarity on this would have been helpful. The detail listed in Jacobs report is helpful. It reflects some of the methods used and clarity to others.*

More standardised monitoring approaches and methods would improve consistency between monitoring events and improve the replication of data. This would include both standardisation on the methods used and level of monitoring (and sampling) effort to be applied, varying primarily on the MNES being targeted by the monitoring. Monitoring not only informs management but is a measurement of the success of the OMP and provides assurances that the targets have been achieved. Standardisation around how monitoring is undertaken will improve consistency in the assessment of offsets and confidence that benefits for the relevant MNES are realised across approvals. This will help improve the integrity of the system as a whole.

Furthermore, if management goals are not being met or are behind OMP timescales, increases in monitoring may be required to develop a greater understanding of the issues and better inform potential changes to management approaches. This approach of adaptive management (regarding monitoring activities) may require more flexibility in OMP authoring and more detail in the annual reporting.

Similarly, improvements in data and document management systems (as detailed in Section 4.3.5) would avoid challenges relating to the availability and completeness of information and data. As discussed in Sections 4.1.3 and 4.1.4, some data was not available during the ground-truthing (e.g. monitoring locations). Although the consultants undertaking the monitoring may know these locations, since they are missing from the available/ reported data, the monitoring cannot be replicated by other parties if the consultants undertaking the work change.

4.6.1 Out of season monitoring

Monitoring of the Victorian offset sites typically occurs during Spring and early-Summer. This is generally the best time to observe floral diversity in temperate areas, including temperate grasslands, as geophytes have typically emerged and flowers and fruits are most likely to be available to help observe and identify taxa. Golden Sun Moth also emerge from underground at this time of year so above ground habitat conditions, including inter-tussock space are most critical through this period for this species. Similarly, Striped Legless Lizard becomes active at this time.

In Queensland, the timing of monitoring of offset sites is generally more variable. BioCondition assessment south of the Tropic of Capricorn is recommended to occur in May or June following the wetter summer months, or sampling in spring following an unseasonably wet winter, when many plants are flowering (Eyre et al. 2015). While this is most critical to inform species diversity, reasonable results can be achieved outside this period and a number of the offset sites are monitored outside of this period, including some that were being monitored during the ground-truthing field survey period (July-August).

The Department expects that offsets (under EPBC Act approvals) provide habitat for MNES year-round; although for some MNES some attributes are more critical at certain times of year. For instance, inter-tussock space does not affect

Golden Sun Moth outside of the spring-summer breeding. Given ecological monitoring (i.e. monitoring undertaken by an ecologist and not the land manager) of offset sites often only occurs once per year at most, the associated reporting only provides insight into the state of the offset at that time. As ground-truthing was conducted during July-August and outside of this window, out of season monitoring provided insight into the state of offsets outside of this time. For example, weed coverage in grassland sites was higher than typically described in annual reporting, suggesting that intensive management would be required to meet thresholds. Therefore, out of season monitoring has the potential to provided predictive capability on the progress of offsets.

The timing of the ground-truthing was a key criticism from offset stakeholders involved in the exercise. This is partly due to the dynamic nature of temperate grasslands and scheduled management activities such as burns (in Queensland) and weed spraying. Ground-truthing was not intended to impact planned management activities, and fieldwork was organised around this.

Assessing the grassland sites is more difficult in winter, particularly with the high grazing pressure that was evident at most Victorian sites during ground-truthing making floral species identification more difficult. However, it could still be undertaken as identification to species level was not critical and identification of taxa to genus level was sufficient for the purposes of the assessment. The NTGVVP diagnostic criteria and condition thresholds generally are based on features which apply all year round, with the exception of the ground cover of native forbs (TSSC 2008); however none of the NTGVVP offset sites relied on that criterion.

Out of season monitoring, highlighted that assessments throughout the year help to inform site conditions and management challenges that may not be as evident at other times of the year. For instance, with the release of grazing pressure during spring, growth of native species is potentially favoured over winter growing exotics such that with higher biomass exotic cover looks lower than during winter periods. This is likely the case for Brown-top Bent, which is a low-growing mat forming exotic grass, that was highly visible in the grazed grasslands at the time of ground-truthing, but may be less visible as biomass increases with the removal of grazing during spring. This additional data may inform the management approaches or intensity required to meet management goals. These assessments should still be accompanied by monitoring during optimal times for the target MNES. The existing advice on monitoring/ assessment of MNES (i.e. in Conservation Advices and listings) is important to validate other aspects such as species diversity.

Out of season monitoring may only be relevant to particular sites or during particular stages of an OMP. For example, at an offset site that aims to restore woodland communities, the out of season monitoring of annual grasses may only be required in early stages of management, until the woodland canopy develops to a degree in which these grasses are naturally managed (i.e. limits grass growth due to canopy shade).

Some management issues that would be identified by out of season monitoring may not be relevant to improving habitat for a particular MNES. For example, the monitoring of annual herbaceous grasses is unlikely to improve habitat values for Grey-headed Flying-fox which relies on winter and spring flowering shrubs and trees. Similarly, Golden Sun Moth are a summer emergent species only, therefore, monitoring of some criteria/habitat features are only critical during the period when they are emerged (e.g. the presence of weeds when they are not emerged may not impact their lifecycle). Nevertheless, these issues should be justified on a site-specific basis. For example, if the presence of exotic herbaceous weeds are impacting the natural regeneration of shrubs/trees or native tussock grasses, regarding the above examples, respectively, additional out of season monitoring and additional management may be justified.

The increase of monitoring in and out of season would add survey effort (and expense) to the management of sites. This additional expense should be considered in the overall budget of the site and not redirect funds away from other important management actions. Availability of consultants to undertake out of season monitoring is not expected to be challenging, as many have lesser fieldwork obligations during autumn/ winter months.

4.7 Lessons for future offset information and integrity activities

Several challenges arose when undertaking the ground-truthing project that are likely to also pose a challenge to future activity to improve confidence in offset information and integrity. These mostly related to issues in the documentation and data available at the time of the ground-truthing field work. Table 4-2 summarises key challenges or factors experienced during the project and discusses the resulting lessons learnt to help inform similar future projects.

Table 4-2 Lessons learned from ground-truthing for future activities

Challenge/ factor	Lesson learnt
Engagement with DCCEEW	Engagement between Jacobs and DCCEEW throughout the project was useful and productive. Due to the project being a pilot, ongoing engagement ensured decisions made throughout the process were in line with project objectives.
Site contacts	Contact details provided by DCCEEW where often associated with the approval holder and it could often take time to identify the right contact for management of the offset site and arranging access. A site register that includes approval holders, offset site manager and other relevant parties such as ecologist undertaking site monitoring would help streamline the compilation of information and organise access to offset sites.
Missing and/or unavailable documents and data	This was a key challenge of the project, particularly in the earlier stages. In future, additional time and personnel could be assigned to document review stages, prior to fieldwork. Additionally, better document and data management and stakeholder contact information would have increased efficiency and progression of the project. It was also the case that some information sourced from offset managers and consultants superseded or was not included in data provided by the Department. Where important documentation or data was unavailable at the time of the field surveys, delaying the fieldwork until information is available would be preferable, to minimise limitations in the ground-truthing data collected.
OMP progression	The offset sites were at varying stages of completion with five sites still within the first year of the OMP, although this was often not revealed until later in the project once sufficient data had been collected from offset providers. This is because the time between approval of actions under the EPBC Act and commencement of controlled actions and implementation of OMPs varies for each action. While it is worthwhile to ground-truth offset sites in the early stages of implementing OMPs, understanding what stage of the OMP a site is at early in the ground-truthing process, will help with efficiency implementing the project and understanding the limitations of what can be completed during ground-truthing.
New/ updated documents becoming available later in the project	Re-work was required at sites in which new or updated documents became available later in the project, particularly after fieldwork was completed. This resulted in inefficiencies and delays in reporting and increased limitations in data comparison.
Differing baseline data collection methods created limitations in comparing with ground-truthing data	Ground-truthing methods were developed in an attempt to assess all 20 sites in as standardised manner as possible. However, as Victorian and Queensland sites differed in data collection methods (i.e. VQA, BioCondition) and there was further variation between sites in the same state, limitations in the comparison of ground-truthing results were apparent. For example, VQA of Victorian sites generally encountered fewer limitations as the method was more closely aligned with the previous Habitat Hectare assessments at offset sites. As the Queensland BioCondition method is plot-based (and there was often issues with identifying specific plot locations), the general assessment of vegetation was not as directly comparable to existing data. Nevertheless, it provided a useful overview of the site condition on a higher level, that would not have been achieved by only undertaking plot replication.
Ground-truthing vs compliance auditing	The process of ground-truthing existing data in this project is closely related to a compliance review of offset site management actions (i.e. the process of document review and visiting the site). However, as the project did not include scope for reviewing compliance, this was not included in the assessment. There was opportunity to undertake a compliance review simultaneously. Additionally, information that may have been gained from further investigation into the compliance and progression of management actions would likely have provided feedback to further inform the ground-truthing. Undertaking these two activities simultaneously would provide an opportunity for efficiency in future projects.
Multiple authors and field staff	Due to the scale of the project and widespread geographic locations, various Jacobs staff undertook fieldwork and prepared reports simultaneously. This was intentionally planned so that suitably skilled ecologists for that location were undertaking the work and project timeframes could be achieved. However, this resulted in some variation in field survey (particularly in association with incomplete existing data) and in the style and structure of individual reports.
Not all data was ground-truthed	Determination of offset sites and ground-truthing methods was made following awarding of the project, as such a standard time allocation was provided to each site. However, as sites differed in size, baseline and monitoring survey data and assessment methods, not all features were ground-truthed. Furthermore, some sites required site inductions which also reduced effective field time. Flexibility, in responding to these factors and allowing for more time at complex sites may help improve comparability of ground-truthing data.

5. Conclusions

The purpose of the project was to compare the current state of selected offset sites with reported information contained within offset management plans and annual reporting to ensure that information published about offsets is accurate and reflective of the sites' current condition. Along with information in offset reporting and compliance activities, ground-truthing results add to the Department's effort towards maintaining accurate information on the condition of approved offsets. Findings will inform longer-term activity to improve confidence in offset information and integrity.

Ground-truthing found that 55% of sites sampled had maintained the site conditions, 30% of the sites have worse site conditions, 10% have improved and remaining sites having a mixed outcome.

Offset sites were generally in-place and supporting the MNES or habitat for the MNES, however minor discrepancies in the actual extent were common and major inconsistencies identified at five of the 20 sites. The five major inconsistencies included four Victorian sites, that had weed covers above thresholds for NTGVVP and one Queensland site that had completed limited activity to establish Grey-headed Flying-fox and Koala habitat. Minor discrepancies related to smaller areas of offset sites not supporting the relevant MNES for a range of reasons including poor quality site conditions and offset areas not matching the extent listed in approvals.

Ground-truthing identified a number of improvements to offset site management that approval holders and land managers can now implement and feed into subsequent OMP reporting. Offset management was generally occurring and being implemented across offset sites, with most reported information broadly consistent with site conditions. However, erroneous and incomplete information led to discrepancies being common throughout the associated information. In some limited instances, site conditions as assessed were significantly different from those reported in the provided documentation, bringing into question the credibility of the information provided.

Offset site managers are generally implementing management actions although some targets are difficult to achieve and appear to set unrealistic expectations on land managers. This is most relevant for herbaceous weeds across grasslands in Victoria, which are difficult to manage and influenced heavily by season and climate (e.g. recent years of high rainfall). Management actions for Queensland sites appear more likely not to be implemented however when they are, usually have a higher degree of success. This is likely associated with it being easier to manage woody weeds and revegetation of woody ecosystems being more effective in achieving gains than restoring grasslands. Restoring previously cleared areas, devoid of native vegetation to native woodland communities is generally a highly effective and easily measurable and detectable offset gain.

Monitoring of offset sites was often incomplete or missing information to accurately assess progress towards targets. Incomplete information and lack of detail in methods often made ground-truthing monitoring data difficult.

Ground-truthing has identified a number of lessons for the Department to improve its processes and procedures that support effective approved offset management and monitoring. The high amount of variation, incompleteness, and errors among provided documents and information was a considerable challenge in undertaking ground-truthing and affected consistency in provision of offsets. Ground-truthing also identified opportunities for the Department to improve its processes and procedures that support effective offset management and monitoring. Increased consistency in approval requirements, improved information management, and standardisation and guidelines around the implementation of offsets and associated documentation is recommended. This would extend to guidance on baseline site assessments, associated GIS data, management actions and required monitoring. Consultation with offset providers/ managers when developing OMPs will also likely influence success in offset implementation.

As a trial, ground-truthing of offset sites was successful in identifying inconsistencies and challenges with offset provision and ongoing management and monitoring. To enable consistency throughout the project and improved comparison of results, future activities may benefit from more detailed initial stakeholder consultations to ensure all existing documentation and information is collated and understood prior to fieldwork commencing.

6. References

DAWE (2021). *Conservation Advice for Synemon plana (Golden Sun Moth)*. Department of Agriculture, Water and the Environment, Australian Govenment, Canberra.

DES (2023). *Queensland Environmental Offsets Policy, Version 1.14*. Environment and Conservation Policy and Legislation, Department of Environment and Science, State of Queensland.

DSE (2004). *Vegetation quality assessment manual: Guidelines for applying the Habitat Hectares scoring method. Version 1.3*. Victorian Department of Sustainability and Environment, Melbourne.

Eyre, T. J., A. L. Kelly, V. J. Neldner, B. A. Wilson, D. J. Ferguson, M. J. Laidlaw and A. J. Franks (2015). *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2.* Queensland Herbarium, The State of Queensland: Department of Science, Information Technology, Innovation and Arts.

Queensland Government (2014). *Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy Version 1.1*. Department of Environment and Heritage Protection, State of Queensland.

Queensland Government (2017). *Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy Version 1.2*. Department of Environment and Heritage Protection, State of Queensland.

Queensland Government (2020). *Guide to determining terrestrial habitat quality. Methods for assessing habitat quality under the Queensland Environmental Offsets Policy, Version 1.3*. Q. Department of Environment and Science, State of Queensland.

Queensland Herbarium (2023). *BioCondition Benchmark Database. Version 3.4 (April 2023).* Department of Environment and Science, Queensland

TSSC (2008). *Commonwealth Listing Advice on Natural Temperate Grassland of the Victorian Volcanic Plain*. Threatened Species Scientific Committee, Department of the Environment, Water, Heritage and the Arts, Government of Australia, Canberra.