Ecological Assessment Report

Tahbilk Winery

APPROVALS

Rev	Date	Description
0	19 February 2020	Final issued to client

	Name	Position	Date
ORIGINATORS	Dr Jarrad Cousin Andrew Dawson Christopher Ewing	Senior Ecologist Ecologist Senior Project Manager	19 February 2020
APPROVER	Rebecca Enright	Senior Manager	19 February 2020

Commercial in Confidence

This advice is for the sole benefit of the Client. The information and opinions contained in this document are strictly confidential. Accordingly, the contents of this document or opinions subsequently supplied will constitute confidential information and may not, without the written consent of CO2 Australia, be published, reproduced, copied or disclosed to any person (other than your advisors having a need to know and who are aware that it is confidential), nor used for any purpose other than in connection with its intended use.

Disclaimer

The information in this document has not been independently verified as to its accuracy or completeness. This document is based on the information available at the time of preparation as well as certain assumptions. No representation or warranty, express or implied, is given by CO2 Australia or any of its directors, officers, affiliates, employees, advisers or agents (and any warranty expressed or implied by statute is hereby excluded (to the extent permitted by law)) as to the accuracy or completeness of the contents of this document or any other information supplied, or which may be supplied at any time or any opinions or projections expressed herein or therein, nor is any such party under any obligation to update this document or correct any inaccuracies or omissions in it which may exist or become apparent.

To the extent permitted by law, CO2 Australia limits its liability in accordance with the terms of the Engagement Agreement. Subject to the terms of the Engagement Agreement, no responsibility or liability is accepted for any loss or damage howsoever arising that you may suffer as a result of this document or reliance on the contents of this document and any and all responsibility and liability is expressly disclaimed (to the extent permitted by law) by CO2 Australia and any of its respective directors, partners, officers, affiliates, employees, advisers or agents.

Marketing

If, in any document or other communication to be made public or disclosed to a government agency, the Client wishes to make reference to the use of CO2 Australia's services, CO2 Australia's consent must first be obtained, and this will not unreasonably be withheld.

Maps

The maps in this document are based on or contain data that has been provided by the State which gives no warranty in relation to the data (including accuracy, reliability, completeness or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data.

EXECUTIVE SUMMARY

Tahbilk Winery is one of Australia's oldest and most respected family-owned wineries, and is an industry leader, demonstrating a commitment to environmental sustainability. Tahbilk have spent nearly three decades rehabilitating parts of the winery, including many parts of the Tahbilk Wetlands and Wildlife Reserve. In 2012, Tahbilk extended this commitment to environmental sustainability in achieving its objective of becoming carbon neutral through the carboNZero accreditation process with Toitu Envirocare.

As part of CO2 Australia's 2018 carbon audit surveys on the Tahbilk Winery estate, Tahbilk expressed an interest to not only understand the carbon sequestration volume and forecasts required to maintain their carbon neutral status, but to understand the biodiversity co-benefits afforded by those efforts. This was in large part driven by demand from customers whom also wanted to know the biodiversity co-benefits of Tahbilk's revegetation and carbon neutrality initiatives.

CO2 Australia were engaged by Tahbilk in 2019 to undertake a field-based assessment of the biodiversity values of the Tahbilk estate, specifically the revegetation estate. This included the calculation of the ecological condition (ECOND) of biodiversity under the Accounting for Nature™ model; namely calculation of a Native Vegetation ECOND and a Native Fauna ECOND based on methodologies developed by CO2 Australia. The biodiversity assessment was undertaken across six days in November 2019, and can be summarised as follows:

- 126 species of fauna were observed or heard over the six days on site, including 12 species of mammal, 105 species of birds, 3 species of reptiles and 6 species of frogs
- 4 species of fauna and 1 species of flora observed on site are listed as threatened species under the *Flora and Fauna Guarantee Act 1988* (Victoria)
- Bird species richness and bird communities differed with revegetation site age, with younger sites typically characterised by greater abundance and species richness of small birds, with older sites supporting greater abundance of larger birds
- Vegetation compositional and structural attributes differed between reference sites and different revegetation age sites, with no difference in functional attributes
- An ECOND of 48 (/100) was calculated for Native Vegetation, with an ECOND of 82 calculated for Native Fauna.

The results of the biodiversity assessment demonstrate the significant biodiversity value of the Tahbilk Winery estate. Of particular significance is the calculation of ECOND scores for native vegetation and native fauna. Opportunities are discussed to target biodiversity management to improve ECOND scores on Tahbilk, including weed control and retention of woody debris. In order to realise the biodiversity co-benefit of revegetation efforts, and to identify targeted biodiversity management, it is recommended that ECOND scores are calculated at the same time as future carbon audits.

With the ever-increasing recognition (domestically and internationally) of the importance of biodiversity co-benefits in the winegrowing industry, and consumer research showing a willingness of consumers to pay a premium price for wine certification that considers biodiversity, ECONDS provide a significant opportunity to further differentiate product and brand through the calculation of an objective metric quantifying biodiversity co-benefits.

CONTENTS

1 INTRODUCTION

1.1 INDUSTRY LEADING ENVIRONMENTAL SUSTAINABILITY

Tahbilk Winery is one of Australia's oldest and most respected family-owned wineries; established in 1860 in the Nagambie Lakes region of central Victoria. The winery is located on ~1,200 ha of alluvial flats, with ~11 km of frontage to the Goulburn River and ~8 km of backwaters comprising anabranchs of the Goulburn River and associated ox-bow lakes.

Aside from operating an award-winning winery, Tahbilk is an industry leader, demonstrating a commitment to environmental sustainability, having spent the better part of three decades rehabilitating and revegetating ~160 ha of the property, including many parts of the Tahbilk Wetlands and Wildlife Reserve. In 2008, Tahbilk extended this commitment to understanding its Greenhouse Gas (GHG) profile with the objective of becoming carbon neutral by establishing:

- baselines to calculate carbon stored onsite by revegetation activities
- 100 kwh solar system
- organic waste treatment facilities
- recycling initiatives
- investment in verified carbon credit schemes to offset residual emissions

Through these efforts, Tahbilk achieved its objective of becoming carbon neutral for the first time in the 2012 financial year through the carboNZero accreditation process with Toitu Envirocare.

CO2 Australia and Tahbilk Winery have a long-standing relationship, developed in 2012 when CO2 Australia assisted with the establishment of the baselines and forecasts of carbon storage of the revegetation activities on the property. As part of CO2 Australia's 2018 carbon audit surveys, Tahbilk expressed an interest to not only understand the carbon sequestration volume and forecasts required to maintain their carbon neutral status, but to understand the biodiversity co-benefits afforded by those efforts; expanding the previous Biodiversity Benefits Index assessments first undertaken by CO2 Australia for Tahbilk in 2012.

With that in mind, CO2 Australia prepared a scope of work in June 2018 with the aim of assessing the biodiversity of Tahbilk Winery and providing information for communicating with their customers.

1.2 BIODIVERSITY CO-BENEFITS

Tahbilk Winery represents one of the pioneers in the winemaking industry in recognising the importance of environmental sustainability in their operations; having engaged with consultants, contractors and other experts to push for carbon neutrality of their operations and products since the 2000s. In recent years, Tahbilk Winery noted that there had been a shift driven primarily by Tahbilk customers wanting to understand the biodiversity co-benefits afforded by revegetation works. It is understood that while customers were receptive and appreciative of Tahbilk's efforts to operate and produce products that are carbon neutral, customers also wanted to know the biodiversity co-benefits of those revegetation and carbon neutrality initiatives.

This shift in awareness of environmental issues associated with agro-food systems has increased in recent years, leading to an ever-increasing number of consumers shifting toward environmentally sustainable consumption habits. Although the scientific and public debate has recognised the issue of environmental

sustainability of agro-food production practices, this is not always the case for the conservation of biodiversity, despite the recognised benefits that biodiversity plays in providing necessary ecosystem services to maintain agricultural productivity (e.g. soil health, natural pest control, pollination etc).

Notwithstanding, there appears to be traction in the winemaking industry in particular, for operators to demonstrate sustainability in their processes and products. Specifically, consumer research show that consumers are willing to pay a premium price for wine certification that considers biodiversity (Mazzocchi et al. 2019); offering wine producers opportunities for product differentiation (Pomarici et al. 2018).

For example, Gemtree Vineyards in the McLaren Vale winegrowing region of South Australia have partnered with Greening Australia to establish the "Gemtree Wetlands Eco Trail" through 10 ha of constructed wetlands and bushland regeneration work, comprising over 50,000 native plants (Figure 1). The incentive for this appears to be driven by a desire to:

- improve the quality of the soil by cycling nutrients
- control wind and water erosion and rising ground water
- provide habitat for useful predators of pest insects within the property and a safe haven for vineyard pollinators
- facilitate water cycling through the wetland to provide a natural filter breaking down agricultural wastes from upstream

While the activities and incentives outlined above are beneficial to the operation of the vineyard in their own right, they afford Gemtree Vineyards additional commercial benefits through product differentiation and demonstrable environmental sustainability that consumers demand.

Figure 1: The entrance to the Gemtree Wetlands Eco Trail at the Gemtree Vineyards in the McLaren Vale winegrowing region of SA. The trail meanders for 1 km through constructed wetlands and rehabilitated woodland.

Given the ever-increasing recognition (domestically and internationally) of the importance of biodiversity co-benefits in the winegrowing industry, efforts to further differentiate product and brand require an objective metric to quantify biodiversity co-benefits. Recognising the emerging importance of biodiversity co-benefits, in late 2018, CO2 Australia engaged with Accounting for Nature Limited; an independent not-for-profit organisation licensed by the Wentworth Group of Concerned Scientists to operationalise the Account for Nature™ model in Australia and internationally. This model, developed between 2008 and 2018 sought to:

> *"…establish a practical, affordable and scientifically robust methodology for creating a common unit of measurement to the describe the condition of environmental assets and measure any change in the condition of those assets over a period of time."*

CO2 Australia ecologists have since continued to consult with AfN to prepare of a number of methodologies for the express purpose of developing a transparent, quantifiable biodiversity metric. These methodologies centre around a common unit of measurement of ecological condition, named an ECOND, to assess the condition of an environmental asset against established reference condition benchmarks. The implementation of these methodologies, and the calculation of the ECOND of an estate like Tahbilk Winery provides opportunities to facilitate an objective metric quantifying biodiversity co-benefits.

In September 2019, CO2 Australia discussed with Tahbilk the opportunity for their organisation to contribute to a trial of the proposed Accounting for Nature™ ECOND methodologies developed by CO2 Australia.

1.3 PURPOSE AND SCOPE

The current report presents the results of the various assessments of biodiversity undertaken in November 2019, as discussed with Tahbilk Winery between 2018 and 2019. This report presents:

- an overview of Tahbilk and the landscape within which it is located (e.g. geology, hydrology etc)
- an overview of ecological assessment methods undertaken, including survey site locations and the various vegetation and fauna survey methodologies and analysis techniques
- results of vegetation surveys, including analysis of differences between different aged revegetation sites compared to intact woodland sites
- results of fauna surveys, collating all species observed from bird surveys, fauna camera sites and incidentally. Includes specific analysis on the differences in bird communities as a function of revegetation age, compared to results from intact woodland sites and open country (vineyard) sites
- calculations of two ECONDs for the revegetation sites of the Tahbilk Winery Estate based on methodologies prepared by CO2 Australia, namely a Native Vegetation ECOND and Native Fauna ECOND
- a summary of the biodiversity values of Tahbilk.

2 THE ENVIRONMENT OF TAHBILK WINERY

2.1 VICTORIAN RIVERINA IBRA SUB-BIOREGION

Tahbilk Winery is located in the very south of the Victorian Riverina sub-bioregion of the Riverina IBRA[1] region, with the Goldfields sub-region of the Victorian Midlands IBRA region located immediately to the west of the Goulburn River which bounds Tahbilk Winery.

Historically, the open grassland plains and grassy woodlands of the Victoria Riverina subregion were settled and developed early by Europeans. The fertile soils and secure water supply made much of the area suitable for extensive agriculture, which remains the dominant land-use today. Large-scale irrigation schemes for the production of fodder crops, cereals and fruits were established within the fertile valleys of the sub-region, including the Goulburn Valley within which the Tahbilk Winery is located.

As a consequence of this agricultural development, much of the sub-region is heavily fragmented, with ~81% of the sub-region cleared of native vegetation (VEAC 2010), with retained patches considered regionally significant given the paucity of large patches within the sub-region, with only 0.6% within the conservation reserve system. Remnant vegetation associated with riparian and roadside reserves is a disproportionately dominant feature of the sub-region, with significant areas of riparian vegetation and wetlands including that within riparian zones of the Goulburn River, the banks of which Tahbilk Winery is located (VEAC 2010).

2.2 GEOLOGY

The geology of the Tahbilk Winery estate is dominated by old and new alluvial sediments (DJPR 2018), delineated into the following:

- alluvial sediment deposits associated with present river channels, lower floodplain terraces and Tahbilk wetland extent. Characterised by unconsolidated silt, sand and gravel; up to 2.3 million years in age (Pleistocene to Holocene age)
- older alluvial sediments (Shepparton formation), located on higher river terraces and floodplains adjacent to Goulburn Wetlands and Tahbilk Wetlands. Characterised by clay, sand, silt and gravel, often developing into soil 2-3 m thick; up to 5.3 million years in age (Pliocene to Holocene age).

[1] Interim Biogeographical Region of Australia

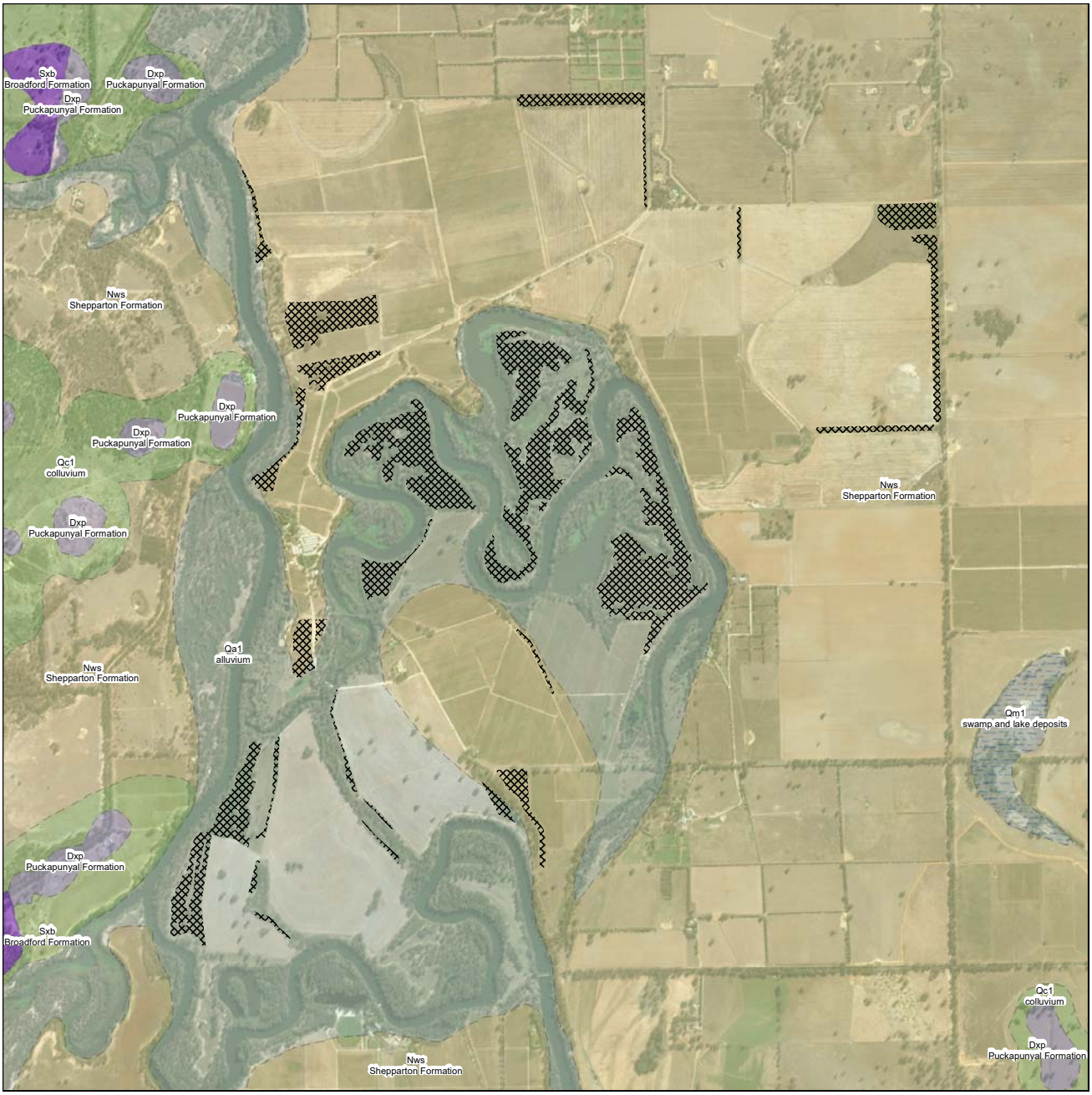

Figure 2: Geology of the Tahbilk Winery (DJPR 2018). Revegetation areas shown in black crosshatch.

2.3 GOULBURN RIVER AND TAHBILK WETLANDS

The Goulburn River is fed by Victoria's largest catchment, covering 1.6 million ha of the state. Sourced in the forests of the Great Dividing Range to the north of Woods Point (~130 km south-east of Nagambie), the Goulburn River flows 570 km through central Victoria before joining with the River Murray east of Echuca. While the construction and operation of numerous weirs along the Goulburn River (e.g. Lake Eildon and Goulburn Weir) have altered the natural flow regime of the river, it still provides significant environmental, Aboriginal cultural heritage and recreational values. Water-harvesting along the Goulburn River during wet periods and regulated releases to meet irrigation and other consumptive demands during dry periods mean that flow downstream of these structures is typically low in winter and spring and high in summer and autumn. Consequently, while this has resulted in a reversal of the natural seasonal flow pattern, it means that stretches of the river are infrequently without water.

In addition to the Goulburn River supporting significant environmental values, wetland systems along the river such as the Tahbilk Wetlands are recognised as biological hotspots of regional importance (Cottingham et al. 2014). The Tahbilk Wetlands comprise a series of interconnected ox-bow lakes (colloquially referred to as billabongs) spawned from historical anabranches of the Goulburn River. While ox-bow lakes are typically subject to seasonal fluctuations in water level (e.g. often complete drying out followed by inundation during rain seasons), the construction and operation of the Goulburn weir in 1889 has prevented this cycle. Instead, the ox-bow lakes that make up the Tahbilk Wetlands are inundated year-round, characterised as a series of interconnected channels and oxbow lakes with more than > 10 km of shoreline.

Figure 3: Aerial photo showing part of the Tahbilk wetlands, with revegetation areas in the centre-top of the photo, anabranch of the Goulburn River on the right and the vineyard and sorghum fields in the distance.

Given the year-round availability of water and the extent of remnant vegetation throughout the greater Tahbilk Wetlands area, the site plays a significant role in providing habitat for large number a number of woodland-dependent and wetland-dependent species. This includes species threatened in Victoria under Section 10 of the *Flora and Fauna Guarantee Act 1988* (Vic) that have been confirmed utilising or occupying Tahbilk Wetlands, including, *inter alia*:

- water shield lily (*Brasenia schreberi*) (Figure 4)
- freshwater catfish (*Tandanus tandanus*)
- eastern great egret and intermediate egret (*Ardea alba* and *Ardea intermedia*, respectively)
- white-bellied sea-eagle (*Haliaeetus leucogaster*)
- brush-tailed phascogale (*Phascogale tapoatafa*).

Figure 4: Tahbilk Wetland showing extensive fringing cover of the threatened water shield lily (*Brasenia schreberi*).

3 ECOLOGICAL ASSESSMENT METHODS

3.1 TAXONOMY

Taxonomy of fauna documented in this report refers to the following:

- Reptiles and amphibians – Cogger (2018)
- Birds – BirdLife Australia (2019)
- Mammals – Jackson and Groves (2015)

3.2 SURVEY SITE LOCATIONS

In addition to incidental observations throughout the Tahbilk Winery estate, detailed ecological assessments were undertaken at 31 sites between Tuesday 13 November and Sunday 17 November 2019, including:

- 21 vegetation and fauna (bird) survey sites
  - 4 reference sites – comprising areas of largely intact (structurally and compositionally) native vegetation
  - 15 revegetation sites
    - 5 sites established in the early 1990s
    - 4 sites established in the mid 2000s
    - 6 sites established post 2010
  - 2 vineyard sites (bird surveys only)
- 10 fauna camera sites

Figure 5 shows the location of all the vegetation and fauna survey sites.

145°5'0"E 145°6'0"E 145°7'0"E

36°4'0"S 36°5'0"S 36°5'10"S

Site 05 Site 11 Site 08 Site 07 Site 06 Cam 01 Site 10 Cam 06 Ref 02 Cam 08 Site 03 Site 13 Cam 07 Cam 09 Site 12 Cam 04 Site 09 Cam 05 Ref 04 Ref 03 Cam 10 Site 14 Site 04 Cam 03 Site 15 Vine 02 Vine 01 Cam 02 Site 02 Site 01 Ref 01

Tahbilk Winery

Figure 5
Location of vegetation and fauna survey sites

Monitoring sites
- Reference sites
- Revegetation sites
- Vineyard sites
- Fauna camera sites

Revegetation site type
- Early 1990s
- Mid 2000s
- Post 2010

0 250 500 750 1,000
Metres

N

CO2 Australia

Location diagram

New South Wales
Victoria
Melbourne

Date: 2/14/2020 Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator Datum: GDA 1994 Scale: 1:15,000@A3

Path: P:\GIS\Data\Projects\Tahbilk Winery\3_20191202_Fieldwork_results\200214 - Map template.mxd

© CO2 Australia. All Rights Reserved 2020. CO2 Australia gives no warranty about information recorded in this map and accepts no liability to any user for any loss, damage or costs (including consequential damage) relating to any use of this map, except as otherwise agreed between CO2 Australia and a user.

3.3 FAUNA SURVEY TECHNIQUES

Fauna surveys were undertaken using a combination of bird surveys, spotlighting, fauna camera surveys and incidental searches:

- Bird surveys – comprising 2 ha searches over 20 minutes, centred on 21 sites including four intact woodland sites, 15 revegetation sites (of differing ages) and two vineyard sites (refer to Section 3.2).
- Spotlighting – comprising traversing of key fauna habitat areas (e.g. Tahbilk wetlands, Goulburn River bank) opportunistically spotlighting using headtorches. Spotlighting also provided opportunities to aurally detect nocturnal fauna.
- Fauna camera surveys – undertaken at 10 sites, comprising the use of 10 motion-triggered fauna cameras (set to capture movement throughout the day to ensure the opportunity to collect an inventory of diurnal and nocturnal fauna.
- Incidental observations – undertaken throughout Tahbilk while traversing the site over the six days of surveys, confirming the presence of species either seen or heard independent of those observed at each of the monitoring sites.

3.4 VEGETATION SURVEY TECHNIQUES

Vegetation surveys were undertaken using plot and transect-based methodologies from 19 sites, represented by four different broad community types. These included four reference sites and 15 revegetation sites outlined in Section 3.2. The purpose of the vegetation surveys was to ascertain differences in composition, structure and function of the vegetation communities as a function of their age, relative to the reference state.

At each of the 19 sites, a total of 11 vegetation attributes were surveyed within a 50 m x 20 m survey plot, comprising vegetation composition, vegetation structure and vegetation function. Table 1 outlines the categories, measurable attributes and their corresponding survey areas at each survey site.

Table 1: Vegetation attributes and corresponding survey area

Vegetation attribute category	Vegetation attribute	Unit of measure	Survey area
Vegetation composition	Tree species richness	Species count	20 m x 20 m plot
	Shrub species richness	Species count	
Vegetation structure	Tree canopy height	m	20 m x 50 m plot
	Tree canopy cover	%	50 m transect
	Shrub canopy cover	%	
Vegetation function	Tree species regeneration	Count	20 m x 50 m plot
	Woody debris	Length of logs (m)	
	Organic litter cover	%	5 x 1 m² plots
	Native perennial grass cover	%	
	Bare ground cover	%	
	Non-native plant cover	%	10 m x 20 m plot

3.4.1 Vegetation composition

Assessment of vegetation composition was based on a measurement of number of native tree species and shrub species within the 20 m x 20 m plot of each survey site. The definition of a tree and shrub is as follows:

- Tree – woody plants, more than 2 m tall with a single stem or branching at least 200 mm from ground level.
- Shrub – woody plant multi-stemmed from the base (or within 200 mm from ground level) or if single stemmed, less than 2 m.

3.4.2 Vegetation structure

Assessment of vegetation structure is based on a measurement of tree canopy height (m) within the 20 m x 50 m plot and crown cover (%) of native trees and shrubs along a 50 m transect. Tree canopy height was measured as the median canopy height of the ecologically dominant layer (EDL) within the 20 m x 50 m plot. The EDL refers to the layer containing the greatest amount of above-ground vegetation biomass of the vegetation community at the site. Canopy cover is assessed by calculating the projected canopy cover (i.e. crown) of all living, native trees and native shrubs along the 50 m transect.

3.4.3 Vegetation function

Assessment of vegetation function was based on a measurement of various functional attributes including tree species regeneration, woody debris volume, organic litter cover, native perennial grass cover, bare ground cover, and non-native plant cover:

Tree species regeneration

Tree species regeneration was assessed in the 20 m x 50 m plot by counting native tree species recruits. Tree species recruits are defined as living native trees with stems <5 cm DBH[2]. Individual trees known or assumed to have been planted (i.e. are positioned and/or spaced consistent with known planted specimens) are excluded from the count. Tree species regeneration was not possible to assess from the post 2010 sites on account of many of the sites having evidently been supporting by direct seeding in addition to planting. Consequently, it was too difficult to ascertain whether those trees were the result of regeneration or direct seeding.

Woody debris attribute

Woody debris was assessed by measuring the length (in metres) of fallen logs on the ground within the 20 x 50 m plot. Logs were only considered where they were greater than 10 cm diameter, dead, and at least 50% in contact with the ground. Where logs extend outside of the plot, the length of the fallen log that is contained only within the plot was recorded.

Organic litter cover attribute

Organic litter cover was assessed by recording the average percentage cover of organic litter from five 1 m x 1 m plots positioned every 10 m along the 50 m transect. Organic litter cover refers to all fine and coarse organic material such as fallen leaves, twigs and branches <10 cm diameter.

Native perennial grass cover attribute

Native perennial grass cover was assessed by recording the average percentage projected cover of native perennial grasses from the five abovementioned 1 m x 1 m plots.

[2] DBH – diameter at breast height, taken to be 1.3 m

Bare ground cover attribute

Bare ground cover was assessed by recording the average percentage projected cover of bare ground from the five abovementioned 1 m x 1 m plots.

Non-native plant cover attribute

Non-native plant cover was assessed by recording the average percentage projected cover of non-native plant species across all vegetation strata within the 10 m x 20 m plot. Non-native plants refer to exotic (introduced) species or non-endemic species (i.e. native species outside of their natural range).

3.5 ANALYSIS

3.5.1 Statistical analysis

For the purposes of statistical analyses mentioned below, statistical significance is reported as a probability value or 'p-value' between 0 (0%) and 1 (100%):

- values approaching 1 imply the observed pattern is almost certainly (i.e. 100%) due to chance and therefore the results of the analysis indicates no difference, or the data is not robust enough to determine a statistical difference
- values approaching 0 imply a very small probability (i.e. 0%) that the observed pattern is due to chance, and the analysis outcome is therefore a true reflection of statistical difference.

Unless noted otherwise, the below-mentioned statistical analysis utilised a p-value of 0.05 (5%), reflecting the threshold below which any observed patterns have such a low probability of being due to chance that it is considered likely a true reflection of statistical difference. This is the widely accepted level of probability utilised in statistical analysis.

3.5.2 Bird community analysis

The results of the bird species plot survey data were used to assess differences in species richness and species abundance across the three revegetation site types, the forest references sites and the vineyard sites. Differences in species richness and abundance across the different vegetation types was analysed using one-way analysis of variance (ANOVA) assuming unequal variances. ANOVA is a statistical technique that is used to check if the means of three or more independent groups are significantly different from each other. As part of the ANOVA, an F-value is generated that is interrogated in order to assign the statistical significance of the test.

For those ANOVA tests identifying a significant difference ($p < 0.05$), additional tests (Student's t-test) were undertaken between all pairs of vegetation site types to determine which combination of site types were contributing/driving the statistical significance result of the ANOVA. As part of the Student's t-test, a t-value is generated that is interrogated in order to assign the statistical significance of the test.

Bird species plot survey data were analysed using the multivariate nonparametric randomisation-based technique of non-metric multidimensional scaling (MDS), using Bray– Curtis inter-site similarities. MDS was undertaken for bird species survey data, generating a two-dimensional plot (ordination) to graphically represent the pattern of similarity between all surveyed sites. Sites that are close together in the ordination plot represent those with a similar bird species group composition, whereas sites far from each other reflect their relative dissimilarity. To assist with interpretation of the spacing of sites, biplot vectors were added to each of the ordinations, representing individual bird species that were significantly associated with the spatial arrangement of sites in the MDS ordination. Only those bird species with at least five records were

considered. In addition to individual bird species, bi-plot vectors were also produced for total abundance and species richness of large and small birds, with large birds considered anything greater than ~59 g, representing the approximate weight of a noisy miner – *Manorina melanocephala*. A 1% level of significance ($p < 0.01$) was used to select the significant bird species given the exploratory purpose of the biplot vector analysis. Coordinates specifying the end of each vector were obtained by calculating a Pearson product-moment correlation coefficient across all sites based on square-root transformed bird species abundance for the x- and y-axis values of each site from the respective MDS ordinations. MDS analysis was undertaken using the Ordination procedure in the SYN-TAX 2000 statistical package (Podani, 2001).

3.5.3 Vegetation survey analysis

The results of the vegetation survey were used to assess differences in vegetation composition, vegetation structure and vegetation function attributes across the three revegetation site types and the forest references sites. Differences in these attributes across the different vegetation types was analysed using the same one-way analysis of variance (ANOVA) method used for the bird community analysis.

As with the bird community analysis, for those ANOVA tests identifying a significant difference ($p < 0.05$) in vegetation attributes across the vegetation site types, additional tests (Student's t-test) were undertaken between all pairs of vegetation site types to determine which combination of site types were contributing/driving the statistical significance result of the ANOVA.

3.6 WEATHER

All surveys were conducted between Tuesday 13 November and Sunday 17 November 2019. Weather conditions immediately prior to and during the survey were derived from Mangalore Airport (Station Number 088109), representing the closest meteorological station to Tahbilk Winery (~11 km south-east; BOM, 2019). Long-term average data was derived from the same meteorological station. The weather during the survey period could be characterised as milder than average, with maximum temperatures during the survey period averaging 21.2°C, approximately 2.3°C lower than the long-term average for November (Figure 6). The minimum temperature during the same period averaged 8.0°C, approximately 2.0°C below the long-term average. No rainfall was recorded during the survey period, with just over 20 mm recorded in the nine days prior to the survey period, including 15.4 mm on 3 November (Figure 6). The survey period was also characterised by persistent windy conditions, with wind gusts up to 65 km/hr (12 November).

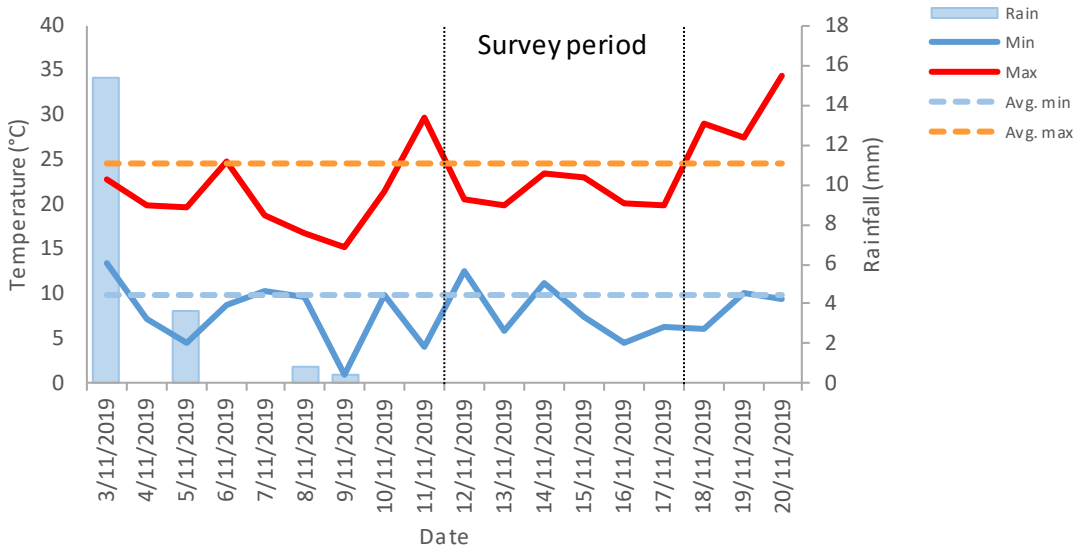

Figure 6: Weather data during and immediately prior to the Tahbilk winery survey.

4 FAUNA SURVEY RESULTS

A total of 126 fauna species were confirmed on the Tahbilk Winery property between Tuesday 13 November and Sunday 17 November 2019, either as part of systematic surveys (bird surveys and fauna camera surveys), or incidentally while traversing the site. The 126 species include:

- 12 species of mammal
  - 1 threatened species – Tuan (brush-tailed phascogale) (*Phascogale tapoatafa*); listed as threatened under the *Flora and Fauna Guarantee Act 1988* (Victoria); captured on one of the fauna cameras (C10)
  - 9 native species and 3 non-native (introduced) species (black rat, mouse and red fox)
  - 10 species captured from the fauna camera sites
  - 2 species observed incidentally (sugar glider and koala)
- 105 species of birds
  - 3 threatened species – intermediate egret (*Ardea intermedia*), eastern great egret (*Ardea alba*) and white-bellied sea-eagle (*Haliaeetus leucogaster*); all observed within the Tahbilk wetlands
  - 98 native species and 7 introduced species
  - 64 species observed from the bird survey sites
  - 41 species observed incidentally
- 3 species of reptiles
- 6 species of frogs

Of the 126 fauna species, 116 (92%) are native, endemic species with the remaining 10 (8%) introduced species.

4.1 BIRD SURVEY RESULTS

A total of 1,106 birds were recorded (observed or heard) across the 21 survey sites during the systematic bird species, representing 64 species (Appendix A). An additional 41 species of birds were confirmed incidentally outside of the bird survey plots or while traversing the Tahbilk site. Of the 64 species recorded across the 21 survey sites, the most numerous by abundance was the superb fairy-wren, representing 135 (13%) of the 1,006 birds recorded, with the next most abundant species being the white-browed woodswallow, represented by 99 individuals (10%). Of the 64 species, nine (14%) were represented by a single individual, including the white-eared honeyeater, white-bellied sea-eagle, Horsfield's bronze-cuckoo and shining bronze-cuckoo. Of the 105 species of birds observed throughout Tahbilk, none are listed as threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, Cwlth), with three species (great egret, intermediate egret and white-bellied sea-eagle) listed as threatened species under the *Flora and Fauna Guarantee Act 1988* (Vic).

Appendix A outlines the abundance and bird species richness observed from each of the 21 sites during the bird surveys. A complete list of fauna species, including the 64 bird species recorded during the bird surveys and 41 species of birds confirmed incidentally outside of the bird survey plots is also presented in Appendix A.

4.1.1 Bird community analysis

Species richness of birds recorded during the bird surveys varied across sites (Table 4), with between three and 22 species per site, with species abundance similarly varying with between eight and 90 records per site. In addition to variability in species richness and species abundance within each of the three revegetation treatments (early 1990s, mid 2000s and post 2010), reference sites and vineyard sites, there was a significant difference in species richness ($F = 10.43$, $df = 4$, $p < 0.001$) across the five site types, although there was no significant difference in species abundance ($F = 2.32$, $df = 4$, $p = 0.101$). Reference sites supported a higher species richness (18.3 ± 2.1 species) compared with the two vineyard sites (4.0 ± 1.0 species), but also compared with all revegetation treatments: early 1990s (13.0 ± 1.1 species), mid 2000s (9.8 ± 1.4 species) and post 2010 (14.8 ± 0.9 species; Figure 7). Post-comparison tests revealed that species richness at reference sites was similar only to that in post 2010 sites, while vineyard sites supported significantly lower species richness than any other site type with the exception of mid-2000s sites (Figure 7).

The general pattern of species richness and abundance shown in Figure 7 is expected. Reference sites would generally be expected to support the highest richness and abundance of birds, largely as a consequence of an intact and diverse vegetation community compared with revegetation sites that often lack structural heterogeneity. The high abundance and species richness observed in post 2010 revegetation sites is likely a reflection of the comparatively dense structure typical of younger sites (refer to Section 5.1) compared with older revegetation site types and references sites. The subsequent drop in species richness and abundance of bird between post 2010 sites and mid 2000s sites likely reflects the natural thinning of these revegetation sites, that no longer support the dense understorey favoured by small species. Species richness and abundance then rebound in early 1990s sites; approaching that of reference sites as these mature revegetation sites begin to develop multiple strata, including a more open midstorey and canopy that permits understorey development, favouring a diversity of birds from ground-foraging insectivores to midstorey honeyeaters and canopy feeding insectivores.

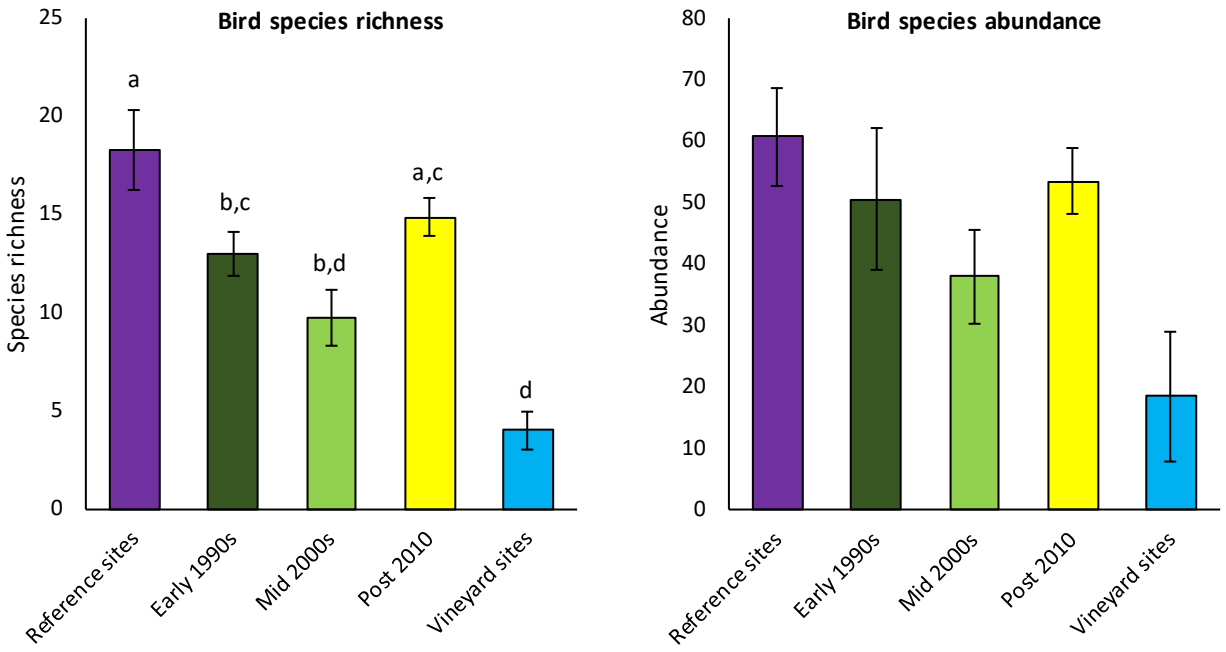

Figure 7: Average species richness and average species abundance for references sites, revegetation treatment sites and vineyard sites. Columns show average ± standard error. In the average species richness graph, columns labelled with different letters reflect significantly different average species richness, and vice versa. e.g. average species richness in post 2010 sites is significantly different from mid 2000s and vineyard sites, but no different to reference sites and early 1990s sites.

The results of the MDS ordination analysis on the abundance of bird species across all 21 survey sites indicate loose grouping of the revegetation treatment sites, four reference sites and two vineyard sites (Figure 8). The bird communities representing the two vineyard sites are shown on the ordination to be dissimilar to all other sites. Three of the four reference sites are grouped closely, reflecting their similar species composition, with the remaining reference site (Ref 01) positioned amongst a grouping of mid 2000s and post 2010 sites. Of the five early 1990s revegetation sites, four were positioned so as to suggest greater similarity to vineyard sites than reference or mid 2000s or post 2010 revegetation sites, with their wide separation from each other indicative of varying species composition. All remaining revegetation sites were loosely grouped with one or more reference sites, indicating their relatively similar species composition.

The biplot vectors in Figure 8 indicate that species driving the bird community pattern across the Tahbilk estate. Specifically, it indicates that the early 1990s sites and vineyard sites are characterised by those with greater abundance of large-sized bird species, specifically little raven. Conversely, a number of the younger sites (mid 2000s and post 2010 sites) are characterised by a higher abundance and species richness of small-sized bird species; including superb fairy-wren, weebill and silvereye. The results of the bi-plot vectors also indicate that three of the four reference sites are characterised by a higher abundance of striated pardalote, white-plumed honeyeater and rufous songlark.

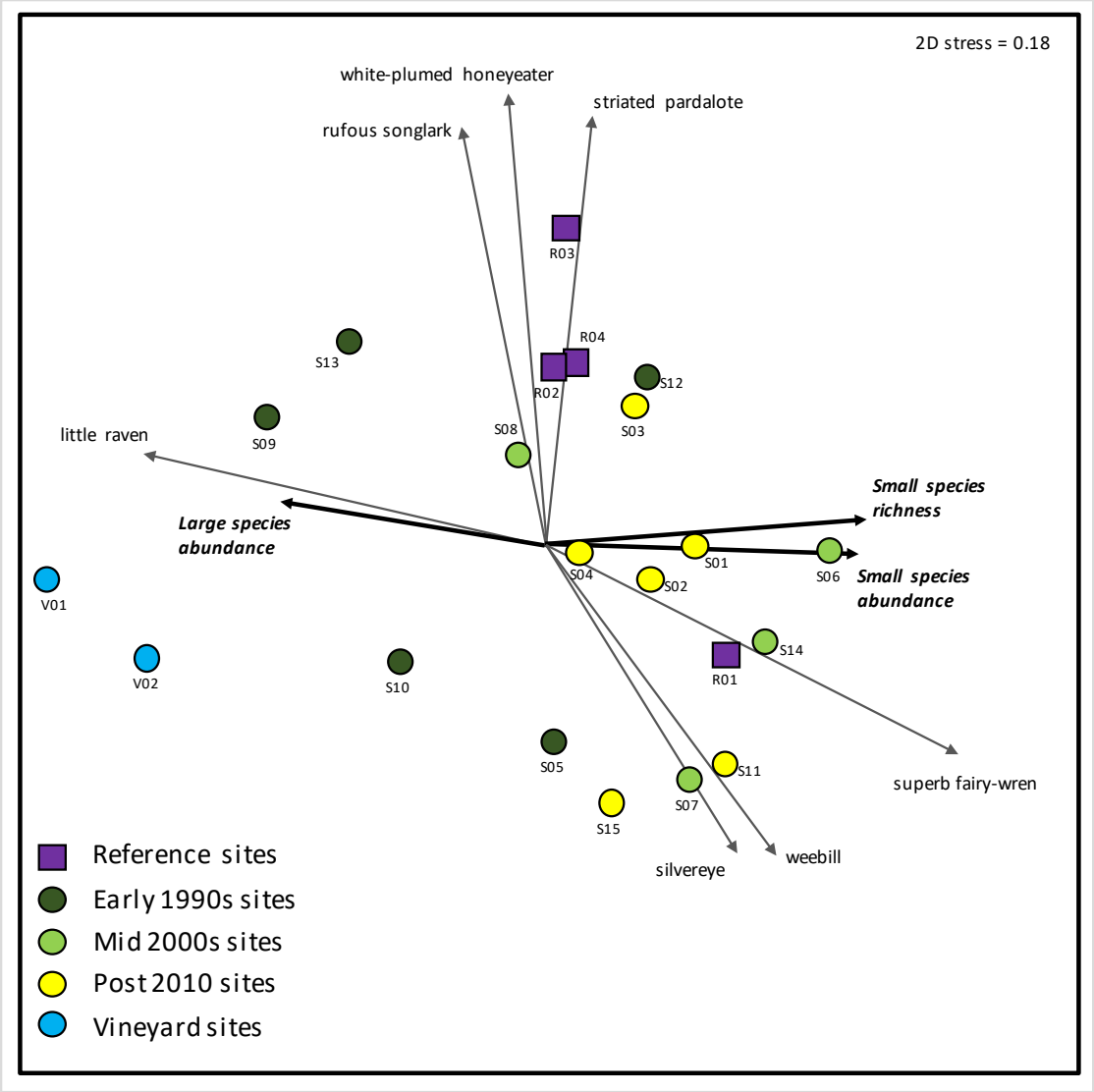

Figure 8: Multidimensional scaling ordination (MDS) of similarity in bird community composition between the survey sites. Biplot vectors show bird species and species groupings significantly driving the spatial arrangement of sites in the MDS; vector origins correspond with intersection of ordination axes.

4.2 FAUNA CAMERA RESULTS

Across the 10 camera sites over 5 nights (i.e. 50 camera nights), a total of 437 photos were taken triggered by fauna. The 437 photos captured a total of 21 fauna species, including 11 species of bird and 10 species of mammal. Of the 21 fauna species, three are introduced species (black rat, mouse and red fox). The most commonly encountered species from fauna cameras was the common brushtail possum and swamp wallaby; each species being captured at five of the 10 sites. While a number of additional common mammal species were encountered (e.g. eastern grey kangaroo), the fauna cameras confirmed the presence of two significant species:

- Tuan – confirmed from one of the camera sites (C10). The tuan (brush-tailed phascogale) is a small, nocturnal, arboreal, carnivorous marsupial. Numbers of this species have decreased significantly throughout its range due to loss of habitat and clearing of bushland areas, predation by introduced foxes and cats, and loss of hollow bearing trees. Consequently, it is listed as a vulnerable species under the Victorian *Flora and Fauna Guarantee Act 1988*.

- Rakali – confirmed from three of the sites (C01, C06 and C08). The rakali (water rat) is one of Australia's largest rodents and is a nocturnal species specially adapted to live in waterways. Usually found near permanent bodies of water, rakali are considered semi-aquatic, and have webbed feet and soft water-resistant fur. Consequently, there impressive fur once supported a thriving fur industry in Australia, during which time their numbers crashed.

Appendix B lists the fauna species confirmed from the ten fauna camera sites.

Figure 9: Tuan (brush-tailed phascogale) confirmed at C10.

Figure 10: Rakali (water rat) confirmed at C08 (also confirmed at C01 and C06).

4.3 INCIDENTAL OBSERVATIONS

Aside from the 74 fauna species identified from the 21 bird survey sites and captured on camera from the 10 fauna camera sites, an additional 52 fauna species were confirmed incidentally throughout Tahbilk between Tuesday 13 November and Sunday 17 November 2019 while traversing the site, including:

- 2 species of mammals
  - koala (*Phascolarctos cinereus*) – a single individual observed on multiple occasions in the same large *Eucalyptus camaldulensis* adjacent Tahbilk wetland
  - sugar glider (*Petaurus breviceps*) – a single individual observed during spotlighting in a grove of regrowth *E. camaldulensis* adjacent Tahbilk wetland
- 41 species of birds (previously mentioned in Section 4.1 and shown in Appendix A)
- 3 species of reptiles
  - pale-flecked garden sunskink (*Lampropholis guichenoti*) – numerous individuals seen throughout the site, typically in areas of leaf litter and on woody debris
  - red-bellied black snake (*Pseudechis porphyriacus*) – a single individual observed basking at Site 14
  - Macquarie turtle (*Emydura macquarii*) – numerous individuals observed throughout the waterways of Tahbilk
- 6 species of frogs
  - peron's tree frog (*Litoria peronii*), eastern banjo frog (*Limnodynastes dumerilii*), Spotted grass frog (*L. tasmaniensis*), eastern sign-bearing froglet (*Crinia parinsignifera*) and common eastern froglet (*C. signifera*) heard throughout the ox-bow lakes of Tahbilk wetlands, with very few along the Goulburn River and its anabranch tributaries making up Tahbilk wetlands (Figure 11)
  - long-thumbed frog (Limnodynastes fletcheri) only heard from near the wooden causeway bridge just to the south of the Tahbilk café.

Appendix C lists the fauna species confirmed from the ten fauna camera sites.

As previously noted, the results of the fauna survey reflect those species confirmed during the six days on site in November 2019. Many more species are known from the property, including the secretive platypus (*Ornithorhynchus anatinus*), the threatened growling grass frog (*Litoria raniformis*), as well as a myriad of other species present at other times of the year including the migrant crescent honeyeater (*Phylidonyris pyrrhopterus*) and the altitudinal migrant: flame robin (*Petroica phoenicea*). The extent of woodland habitat on Tahbilk Winery also provides known habitat for other threatened species, including the swift parrot (*Lathamus discolor*), a critically endangered species recorded nearby to Tahbilk that breeds in Tasmania prior to migrating to eucalypt woodland foraging habitat in Victoria and New South Wales for winter.

Figure 11: Peron's tree frog (*Litoria peronii*) observed along the banks of the Goulburn River at Tahbilk Winery.

5 VEGETATION SURVEY RESULTS

The results of the vegetation survey identified variability in the response of the different vegetation attributes as a function of age and in relation to reference sites.

5.1 VEGETATION COMPOSITIONAL ATTRIBUTES

Species richness of trees tended to increase between the early 1990s sites and the post 2010 sites (Figure 12), likely as a consequence of differing revegetation methods. However, statistically, there was no significant difference between the different revegetation treatments and the reference sites ($F = 2.31$, $df = 3$, $p = 0.12$) likely attributable to the variability between sites within the different groups.

In contrast, shrub species richness was significantly different between the different groups ($F = 4.43$, $df = 3$, $p = 0.02$), driven by statistically higher species richness of shrubs in the mid 2000s sites compared with reference sites ($t = 3.87$, $df = 3$, $p = 0.03$); refer to Figure 12.

Differences in the vegetation composition attributes are likely driven by differences in species mixes and methodologies across the various revegetation/regeneration efforts over the years. Figure 13 shows an aerial photo of one of the post 2010 monitoring sites (Site 11) from which monitoring identified nine species of trees; the most of any of the other 18 vegetation monitoring sites.

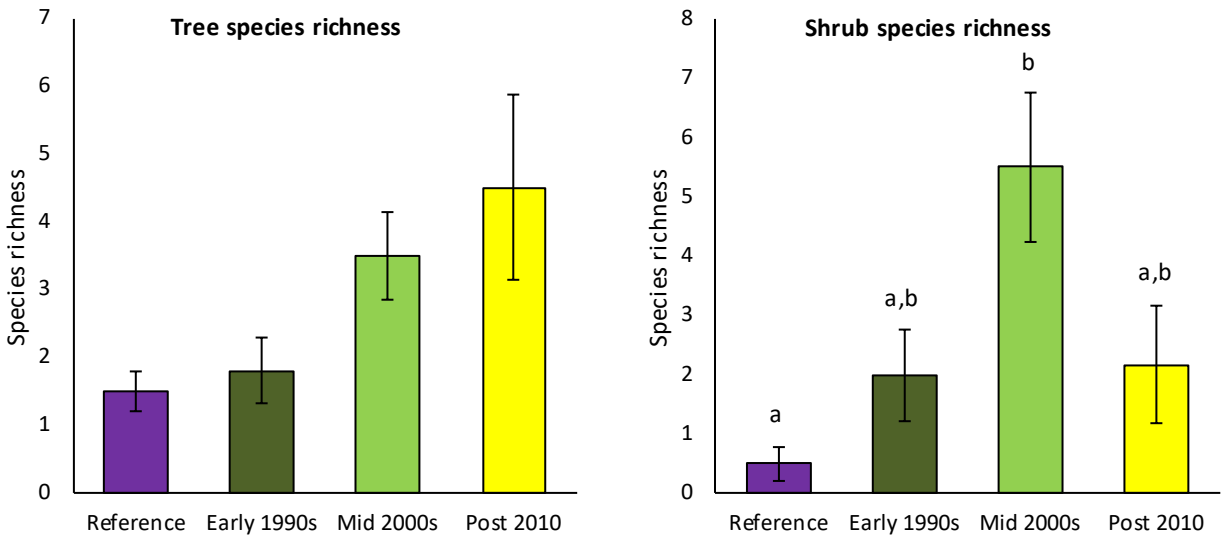

Figure 12: Differences in species composition attributes (tree species richness – left graph, shrub species richness – right graph) between reference sites and the three revegetation treatments. Columns show average ± standard error. In the shrub species richness graph, columns labelled with different letters reflect significantly different average species richness, and vice versa. e.g. average species richness in mid 2000s sites is significantly different from reference sites, but no different to early 1990s sites and post 2010 sites.

Figure 13: Aerial image of a patch of post 2010 revegetation (looking west). Site 11, located within the middle of this patch, supported the greatest tree species richness out of any of the other 18 vegetation monitoring sites across Tahbilk Winery.

5.2 VEGETATION STRUCTURAL ATTRIBUTES

Of the three species structural attributes, only tree canopy height showed significant differences between the four treatments ($F = 17.8$, $df = 3$, $p < 0.001$; Figure 14). Tree canopy heights of post 2010 sites significantly smaller than all other treatments, including the closest aged mid 2000s sites ($t = 2.75$, $df = 3$, $p = 0.03$) which were themselves significantly smaller that early 1990s sites ($t = 2.88$, $df = 3$, $p = 0.03$). Interestingly, the canopy tree heights of early 1990s revegetation sites were no different to intact reference sites ($t = 2.27$, $df = 3$, $p = 0.09$).

While tree canopy cover was highest in the references site, this was no different to canopy cover across the three revegetation treatments ($F = 2.01$, $df = 3$, $p = 0.16$), with even greater variability across sites in shrub canopy cover ($F = 0.65$, $df = 3$, $p = 0.59$; Figure 14).

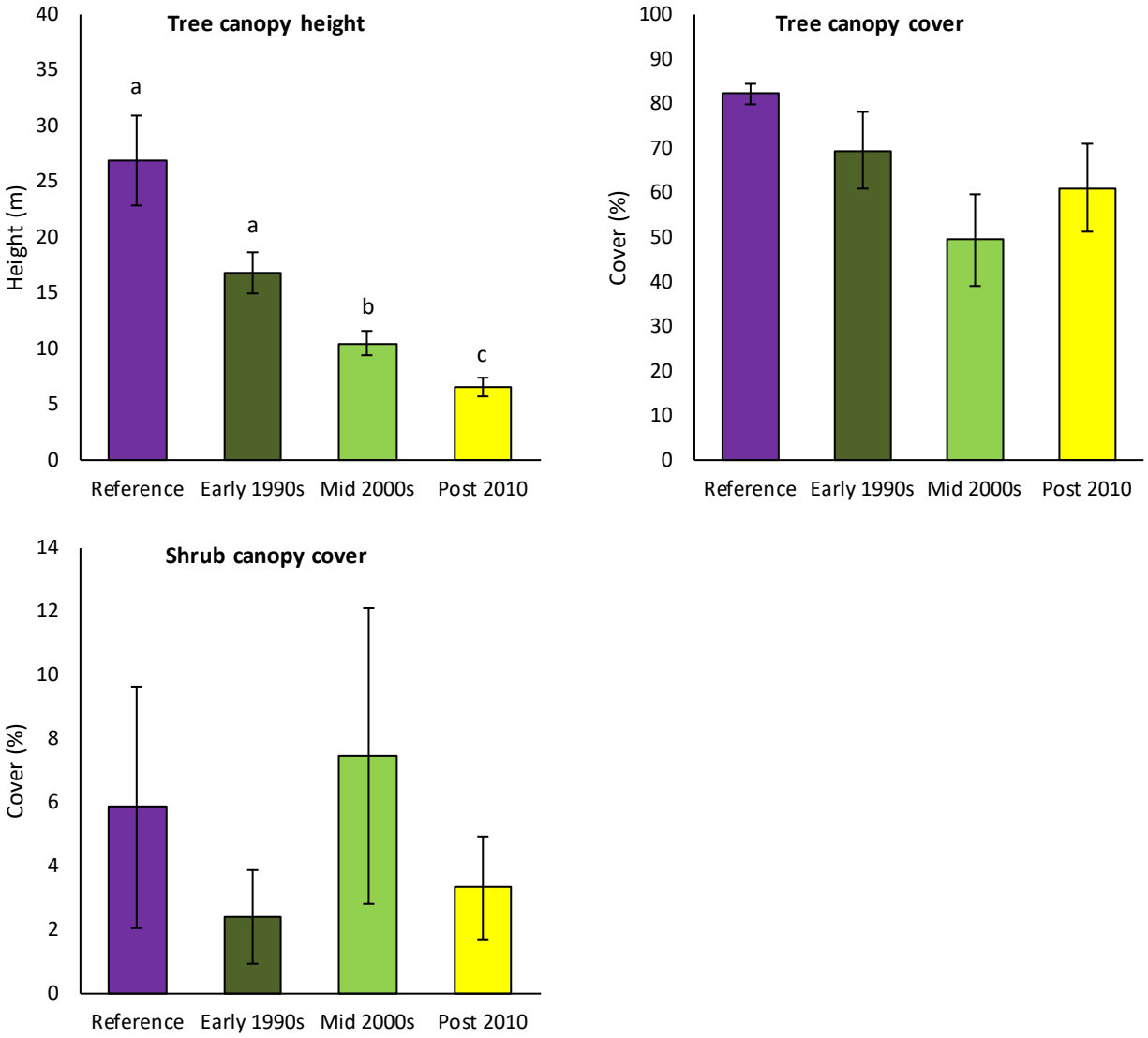

Figure 14: Differences in species structural attributes between reference sites and the three revegetation treatments. Columns show average ± standard error. In the tree canopy graph, columns labelled with different letters reflect significantly different average tree canopy heights, and vice versa. e.g. average tree canopy height in reference sites is significantly different from mid 2000s and post 2010 sites, but no different to early 1990s sites.

The observed patterns of vegetation structural attributes demonstrate that early 1990s revegetation sites are approaching the height of the reference sites, with the different revegetation ages varying in their % cover of tree and shrub canopy cover, likely a reflection of the species mixes used as part of those revegetation efforts.

5.3 VEGETATION FUNCTIONAL ATTRIBUTES

All vegetation functional attributes were each highly variable across the four vegetation treatments (Figure 15). Statistically, there were no differences between the vegetation treatments for any of the vegetation functional attributes. Notwithstanding, of all the six vegetation functional attributes, there was a clear tendency for reference sites to support a greater volume of woody debris than all of the revegetation sites. This is not unexpected given unless coarse woody debris is present at the time of revegetation efforts, it would take many decades for it to become available through the senescence of maturing vegetation.

The analysis indicated that leaf litter cover was similar in revegetation sites as reference sites, although the analysis also showed the extent of non-native vegetation within all vegetation treatments including reference sites; largely a consequence of the extent of non-native pasture grasses.

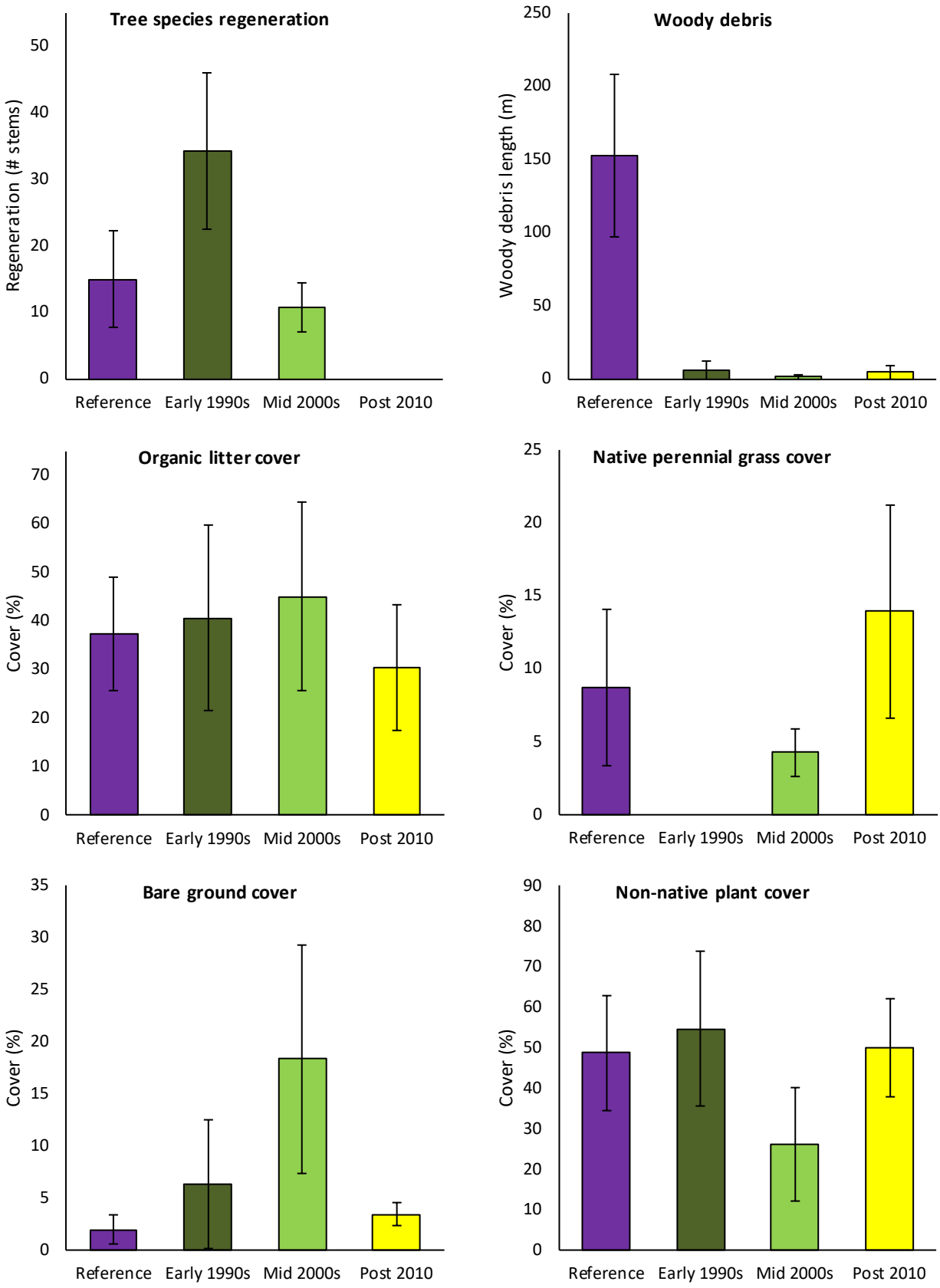

Figure 15: Differences in species functional attributes between reference sites and the three revegetation treatments. Columns show average ± standard error.

6 ACCOUNTING FOR NATURE™ FRAMEWORK

In 2008, the Wentworth Group of Concerned Scientists and other industry experts in the fields of science, statistics and economics, proposed a conceptual framework known as Accounting for Nature (Wentworth Group 2016), to create a robust and practical method to measure changes in the biophysical condition of environmental assets at any scale.

The Accounting for Nature™ Framework sets the overarching Standard and Technical Protocols for measuring ecological health and trends in ecological health for different environmental asset classes, such as native vegetation and fauna, in a cost-effective, scientifically robust, fully transparent and verifiable way.

6.1 ECOND METHODOLOGY

The Accounting for Nature™ model centres around a common unit of measurement of ecological condition, named an ECOND, to assess the condition of an environmental asset against established reference condition benchmarks. More specifically, an ECOND represents an index between 0 and 100, where 100 refers to an asset in an undegraded (reference) state.

CO2 Australia is currently engaged with Accounting for Nature Limited to assist with piloting an independent, credible and cost-effective accreditation and environment accounting certification system. As part of that engagement, CO2 Australia has developed a number of ECOND methodologies; two of which have been used as part of the current engagement with Tahbilk.

6.1.1 Native Vegetation ECOND

A Native Vegetation ECOND was calculated separately for each of the 15 survey sites used as part of the vegetation assessments (refer to Section 3.2), utilising the results from the same 11 vegetation attributes outlined in Section 3.4. Under the ECOND model, contributing attributes to calculation of an ECOND are referred to as indicators, so are herein referred as such. In addition to the 11 vegetation indicators, the Native Vegetation ECOND includes a site context indicator, which is calculated from the combined percentage cover of remnant vegetation and non-remnant vegetation (e.g. regrowth vegetation, environmental planting estate) within a 1 km buffer of each site.

The Native Vegetation ECOND was calculated for each of the 15 revegetation sites, with eight of the 11 measurable vegetation indicators at each site scored against relevant benchmark values derived by vegetation community benchmark documents corresponding to the specific pre-European vegetation communities known, likely or observed at each of the 15 sites. In the case of the current survey, benchmark conditions were derived from the Ecological Vegetation Class (EVC) benchmarks for the Victorian Riverina bioregion, developed by the Victorian Government. The remaining three measurable vegetation indicators (tree species regeneration, bare ground cover and non-native plant cover) were scored as a function of actual cover, rather than any comparison to an EVC benchmark. This is the same for the site context indicator, which is scored against a set of threshold values.

Once all measurable indicator scores for each site had been determined, the final Native Vegetation ECOND was calculated (out of 100), combining weighted scores from vegetation composition, vegetation structure, vegetation function and site context indicators. Table 2 summarises the scoring for each measurable indicator and their contributions to the final Native Vegetation ECOND (out of 100). In addition to a combined Native Vegetation ECOND across all 15 revegetation sites, separate Native Vegetation ECOND scores were generated for each of the three revegetation treatments.

Table 2: Summary of indicators surveyed and their contribution to the final Native Vegetation ECOND.

Indicator		Indicator score
Vegetation composition	Tree species richness	5
	Shrub species richness	5
Vegetation structure	Tree canopy height	5
	Tree canopy cover	10
	Shrub canopy cover	5
Vegetation function	Tree species regeneration	5
	Woody debris	10
	Organic litter cover	10
	Native perennial grass cover	10
	Bare ground cover	5
	Non-native plant cover	10
Site context	Native remnant vegetation and native non-remnant vegetation within 1 km buffer	20
	Final Native Vegetation ECOND	**100**

6.1.2 Native Fauna ECOND

A Native Fauna ECOND was calculated separately for each of the same 15 survey sites used as part of the vegetation assessments (refer to Section 3.2). The Native Fauna ECOND uses birds as a surrogate taxon for measuring biodiversity values and changes over time. Specifically, the method incorporates three indicators recorded over 20 minutes within 80 m (~2 ha) of the centre of each of the survey sites:

- Bird species richness – the number of bird species observed or heard within the 2 ha area, including all birds observed flying <50 m above the site. Sites with species richness approaching that of reference sites richness score higher than those with fewer species fitted to a 4-variable logistic regression model; with the score discounted as a function of revegetation age.
- Miner presence/absence – the presence and abundance of miner species within the 2 ha area, including one or both of noisy miner (*Manorina melanocephala*) or yellow-throated miner (*Manorina flavigula*). Sites with greater abundance of either or both miner species score lower than those with no miner species
- Bird size class – a measure reflecting the proportion of birds larger than or smaller than miner species. Sites with greater proportional abundance of species smaller than miners score higher than those dominated by greater proportional abundance of larger birds.

Once each of the three indicator scores for each site had been determined, the final Native Fauna ECOND was calculated (out of 100), combining weighted scores the bird species richness, miner presence/absence and bird size class indicators. Table 3 summarises the scoring for each measurable indicator and their contributions to the final Native Fauna ECOND (out of 100). In addition to a combined Native Fauna ECOND across all 15 revegetation sites, separate Native Fauna ECOND scores were generated for each of the three revegetation treatments.

Table 3: Summary of indicators surveyed and their contribution to the final Native Fauna ECOND.

Indicator	Indicator score
Bird species richness	50
Miner presence/absence	30
Bird size class	20
Final Native Fauna ECOND	**100**

6.2 RESULTS

6.2.1 Native Vegetation ECOND

Across all 15 revegetation sites, the average Native Vegetation ECOND (/100) equated to 48. For each of the three revegetation treatments, the Native Vegetation ECOND ranged between 44 (early 1990s reveg sites) and 56 (mid 2000s sites).

Of the four indicators contributing to the native Vegetation ECOND score, the vegetation composition indicator varied the most across the three revegetation treatments, ranging from 44 in the early 1990s reveg sites up to 90 in the mid 2000s reveg sites. Vegetation function attributes varied little across the revegetation treatments (40, 40 and 47).

Refer to Appendix B for ECOND account, including results of the Native Vegetation Asset ECOND.

6.2.2 Native Fauna ECOND

Across all 15 revegetation sites, the average Native Fauna ECOND equated to 82. For each of the three revegetation treatments, the Native Vegetation ECOND ranged between 70 (mid 2000s sites) and 92 (post 2010 reveg sites). Refer to Appendix B for ECOND account, including results of the Fauna Vegetation Asset ECOND.

Of the three indicators contributing to the Native Fauna ECOND score, bird species richness showed the highest degree of variability, ranging between 42 (mid 2000s sites) and 87 (post 2010 sites), with miner presence/absence varying little (96, 97 and 100) reflecting the low abundance of noisy miners at Tahbilk.

Refer to Appendix B for ECOND account, including results of the Native Fauna Asset ECOND.

6.2.3 ECOND implications for biodiversity management at Tahbilk Winery

The aim of any ECOND assessment is to calculate a representative measure of the ecological condition of a given environmental asset compared to that asset in its intact and natural state – in effect it calculates a value reflecting a system's naturalness. In the case of the Native Vegetation and Native Fauna ECOND method utilised at Tahbilk, this has incorporated the measure of many vegetation and fauna indicators contributing to those ECOND. By interrogating the indicators contributing to an ECOND, there is the opportunity to track indicator change over time and understand how land management activities can be tailored to assist with improving these ECOND indicator scores. For example, active weed control has the potential to impact a significant direct change on the non-native plant cover indicator. While only contributing 10% to the Native Vegetation ECOND score, active management that maximises the non-native plant cover score would simultaneously, albeit indirectly afford opportunities for native perennial grass cover and organic litter cover to increase; each contributing an additional 10% to the Native Vegetation ECOND score.

Often, seemingly insignificant management decisions can significantly influence ECOND scores. For example, ensuring the retention of woody debris when establishing environmental planting projects, or reintroduction of woody debris into established project areas has the potential to directly and indirectly improve Native Vegetation ECOND scores as well as provide foraging habitat for ground-foraging birds, thus assisting with improving the Native Vegetation ECOND score and Native Fauna ECOND score. The same is true to incorporating shrub species in environmental plantings – whether when establishing or retrospectively. Shrub species richness and shrub cover indicators which not only contribute to the Native Vegetation ECOND, but provide important habitat for fauna that would assist with improving the Native Fauna ECOND scores.

Figure 16 shows a stylised representation of how active management interventions (e.g. weed control, woody debris retention) can influence ECOND scores over time compared with business as usual scenario. In order to effectively manage and monitor changes to ECOND scores, it is recommended that ECOND scores are calculated at the same time as carbon audits.

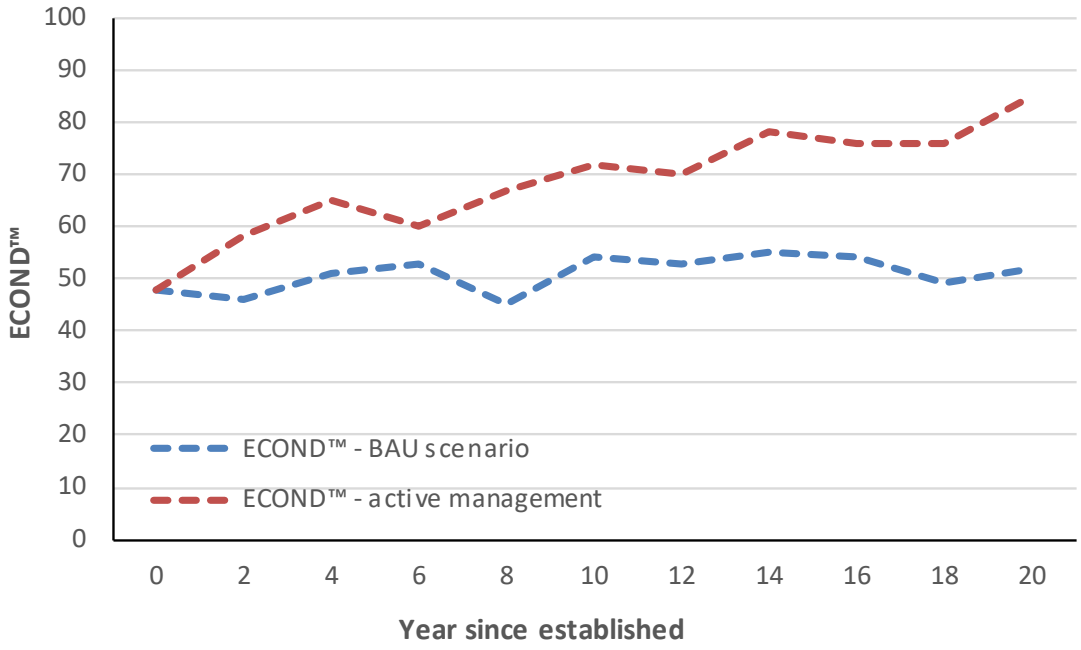

Figure 16: Example of ECOND score trajectory over 20 year period, conditional on whether 'business as usual' (BAU) scenario or active management intervention.

7 SUMMARY OF BIODIVERSITY VALUE OF TAHBILK

The results of the biodiversity assessment, undertaken in November 2019 identified considerable biodiversity value throughout the Tahbilk Winery estate, summarised as follows:

- 126 species of fauna were observed or heard over the six days on site, including 12 species of mammal, 105 species of birds, 3 species of reptiles and 6 species of frogs
- 4 species of fauna and 1 species of flora observed on site are listed as threatened species under the *Flora and Fauna Guarantee Act 1988* (Victoria)

- tuan (brush-tailed phascogale) (*Phascogale tapoatafa*) – captured on one of the fauna cameras (C10)
- intermediate egret (*Ardea intermedia*), eastern great egret (*Ardea alba*) and white-bellied sea-eagle (*Haliaeetus leucogaster*); all observed within the Tahbilk wetlands
- water shield lily (*Brasenia schreberi*) observed fringing parts of the Tahbilk wetlands

- Bird species richness varied with site type, with vineyards supported lowest species richness while youngest reveg sites (post 2010) had a similarly high species richness to intact woodland (reference) sites
- Bird community analysis suggested older sites (early 1990s) and vineyard sites were characterised by a higher abundance of large bird species (e.g. little raven), whereas younger sites were characterised by a higher abundance and species richness of small species (e.g. silvereye, weebill and superb fairy-wren)
- Fauna cameras confirmed a number of cryptic, native species not otherwise observed, including tuan (brush-tailed phascogale) (*Phascogale tapoatafa*), rakali (water rat) (*Hydromys chrysogaster*) and bush rat (*Rattus fuscipes*)
- Vegetation compositional and structural attributes differed between reference sites and different revegetation age sites, with no difference in functional attributes
  - younger revegetation sites tended to have higher tree species richness than older sites and reference sites, with all revegetation age sites supporting greater species richness than reference sites
  - tree canopy height increased with age of revegetation, with similar tree and shrub canopy cover across revegetation site types
  - functional attributes varied greatly across all sites, with very few patterns delineating revegetation age, with the only exception being the trend for reference sites to support a greater volume of woody debris than revegetation sites
- Accounting for Nature™ model used to calculate ECONDs (/100) for the Tahbilk Estate:
  - Native Vegetation ECOND = 48
    - Early 1990s reveg sites = 44
    - Mid 2000s reveg sites = 56
    - Post 2000s reveg sites = 45
  - Native Fauna ECOND = 82
    - Early 1990s reveg sites = 79
    - Mid 2000s reveg sites = 70
    - Post 2000s reveg sites = 92
- Targeted biodiversity management affords opportunities to improve Native Vegetation ECOND and Native Fauna ECOND. For example, managing weeds and retaining woody debris provides direct and indirect opportunities to improve ECOND scores
- In order to effectively manage and monitor changes to ECOND scores, it is recommended that ECOND scores are calculated at the same time as future carbon audits

8 REFERENCES

Birdlife Australia (2019). *The BirdLife Australia Working List of Australian Birds; Version 3*. Retrieved from BirdLife Australia at http://www.birdlife.org.au/conservation/science/taxonomy

Bureau of Meteorology (BoM)(2019). *Mangalore Airport, Queensland November 2019 Daily Weather Observations (Station Number 088109)*. Retrieved from Climate Data Online available at http://www.bom.gov.au

Cogger, H. G. (2018). *Reptiles and Amphibians of Australia*. CSIRO Publishing, Melbourne.

Cottingham, P., Brown, P., Lyon, J., Pettigrove, V., Roberts, J., Vieta, G and Woodman, A. (2014). *Mid Goulburn River FLOWS study – final report: flow recommendations.* Report prepared for the Goulburn Broken Catchment Management Authority. Peter Cottingham & Associates, Melbourne.

Department of Jobs, Precincts and Regions (DJPR) (2018). *Seamless Geology Earth Resources Spatial Data Collection for the Datamart*. <GIS dataset>. Available at https://data.vic.gov.au/

Jackson, S. and Groves, C. (2015). *Taxonomy of Australian Mammals.* CSIRO Publishing, Melbourne.

Mazzocchi, C., Ruggeri, G. and Corsi, S. (2019). Consumers' preferences for biodiversity in vineyards: A choice experiment on wine. *Wine Economics and Policy* **8:** 155 – 164.

Podani, J. (2001). *SYN-TAX 2000 – Computer Programs for Data Analysis in Ecology and Systematics*. Scientia Publishing, Budapest. Available from: http://ramet.elte.hu/~podani/SYN2000.html

Pomarici, E. Asioli, D. Vecchio, R. and Næs, T. (2018). Young consumers' preferences for water-saving wines: An experimental study. *Wine Economics and Policy* **7:** 65-76

Victorian Environmental Assessment Council (VEAC) (2010). *Discussion Paper – Chapter 5: Findings by Bioregion*. IN: Remnant Native Vegetation Investigation Discussion Paper. Victorian Environmental Assessment Council, Melbourne. Available at http://www.veac.vic.gov.au/documents/Chapter%205%20-%20Findings%20by%20Bioregion.pdf

Wentworth Group of Concerned Scientists (2016). *Accounting for Nature – a scientific method for constructing environmental asset condition accounts*. Wentworth Group, Sydney, NSW.

APPENDIX A BIRD SPECIES OBSERVED AT TAHBILK WINERY

This list includes the 105 species confirmed on site during the November 2019 surveys, including 98 native species and seven non-native (introduced) species. The abundance of the 64 species identified from the 15 revegetation sites, four reference sites and two vineyard sites are presented; summarised as total species richness and species abundance at the base of the table. The presence of species not confirmed at any survey sites is denoted in the incidental column as '●'. Species confirmed from fauna cameras is denoted with '§'. Additional bird species have been confirmed at Tahbilk by CO2 Australia ecologists and others outside of the November 2019 surveys, although have not been included here.

Status refers to whether species is Native or Introduced, and whether 'Threatened' under Section 10 of the *Flora and Fauna Guarantee Act 1988* (Victoria).

Family	Common name	Scientific name	Status	Site 01 (Post 2010)	Site 02 (Post 2010)	Site 03 (Post 2010)	Site 04 (Post 2010)	Site 05 (Early 1990s)	Site 06 (Mid 2000s)	Site 07 (Mid 2000s)	Site 08 (Mid 2000s)	Site 09 (Early 1990s)	Site 10 (Early 1990s)	Site 11 (Post 2010)	Site 12 (Early 1990s)	Site 13 (Early 1990s)	Site 14 (Mid 2000s)	Site 15 (Post 2010)	Reference 01	Reference 02	Reference 03	Reference 04	Vineyard 01	Vineyard 02	Incidental
Phasianidae	Indian peafowl	*Pavo cristatus*	Introduced																						●
Anatidae	Black swan	*Cygnus atratus*	Native																						●
Anatidae	Australian wood duck	*Chenonetta jubata*	Native																						●
Anatidae	Pacific black duck	*Anas superciliosa*	Native																						●,§
Anatidae	Grey teal	*Anas gracilis*	Native																						●
Anatidae	Chestnut teal	*Anas castanea*	Native																						●
Podicipedidae	Australasian grebe	*Tachybaptus novaehollandiae*	Native																						●
Columbidae	Rock dove	*Columba livia*	Introduced																						●
Columbidae	Common bronzewing	*Phaps chalcoptera*	Native				1	1		1	1	1		2				2							
Columbidae	Peaceful dove	*Geopelia placida*	Native																	1	1				
Cuculidae	Horsfield's bronze-cuckoo	*Chalcites basalis*	Native										1												
Cuculidae	Shining bronze-cuckoo	*Chalcites lucidus*	Native																			1			
Rallidae	Purple swamphen	*Porphyrio porphyrio*	Native		1																				§
Rallidae	Dusky moorhen	*Gallinula tenebrosa*	Native																						●
Rallidae	Black-tailed native-hen	*Tribonyx ventralis*	Native																						●
Threskiornithidae	Straw-necked ibis	*Threskiornis spinicollis*	Native																						●
Threskiornithidae	Australian white ibis	*Threskiornis moluccus*	Native																						●
Ardeidae	White-necked heron	*Ardea pacifica*	Native																						●
Ardeidae	Eastern great egret	*Ardea alba*	Native, Threatened																						●
Ardeidae	Intermediate egret	*Ardea intermedia*	Native, Threatened																						●
Ardeidae	White-faced heron	*Egretta novaehollandiae*	Native																						●
Pelicanidae	Australian pelican	*Pelecanus conspicillatus*	Native																						●
Phalacrocoracidae	Great cormorant	*Phalacrocorax carbo*	Native																						●
Phalacrocoracidae	Little black cormorant	*Phalacrocorax sulcirostris*	Native																						●
Anhingidae	Australasian darter	*Anhinga novaehollandiae*	Native																						●
Charadriidae	Black-fronted dotterel	*Elseyornis melanops*	Native																						●

Family	Common name	Scientific name	Status	Site 01 (Post 2010)	Site 02 (Post 2010)	Site 03 (Post 2010)	Site 04 (Post 2010)	Site 05 (Early 1990s)	Site 06 (Mid 2000s)	Site 07 (Mid 2000s)	Site 08 (Mid 2000s)	Site 09 (Early 1990s)	Site 10 (Early 1990s)	Site 11 (Post 2010)	Site 12 (Early 1990s)	Site 13 (Early 1990s)	Site 14 (Mid 2000s)	Site 15 (Post 2010)	Reference 01	Reference 02	Reference 03	Reference 04	Vineyard 01	Vineyard 02	Incidental
Charadriidae	Masked lapwing	*Vanellus miles*	Native																						●
Strigidae	Southern boobook	*Ninox boobook*	Native																						●
Podargidae	Tawny frogmouth	*Podargus strigoides*	Native																						●
Accipitridae	Wedge-tailed eagle	*Aquila audax*	Native									1													
Accipitridae	Collared sparrowhawk	*Accipiter cirrocephalus*	Native																						●
Accipitridae	White-bellied sea-eagle	*Haliaeetus leucogaster*	Native, Threatened									1													
Accipitridae	Whistling kite	*Haliastur sphenurus*	Native				1		1		1											1			
Accipitridae	Black kite	*Milvus migrans*	Native																						●
Coraciidae	Oriental dollarbird	*Eurystomus orientalis*	Native	1																		1			
Alcedinidae	Azure kingfisher	*Ceyx azureus*	Native																						●
Alcedinidae	Sacred kingfisher	*Todiramphus sanctus*	Native			2					3		1			2			1	1	2	2			
Alcedinidae	Laughing kookaburra	*Dacelo novaeguineae*	Native									2				2	2					2			
Cacatuidae	Cockatiel	*Nymphicus hollandicus*	Native																						●
Cacatuidae	Galah	*Eolophus roseicapilla*	Native		4											1	2	1				3		8	
Cacatuidae	Long-billed corella	*Cacatua tenuirostris*	Native																						●
Cacatuidae	Little corella	*Cacatua sanguinea*	Native					3			1				1				1						
Cacatuidae	Sulphur-crested cockatoo	*Cacatua galerita*	Native										4									1			
Psittaculidae	Red-rumped parrot	*Psephotus haematonotus*	Native															4		5				2	§
Psittaculidae	Crimson rosella	*Platycercus elegans*	Native																	1		2			
Psittaculidae	Eastern rosella	*Platycercus eximius*	Native			1		4				2			2					2	2	4			
Psittaculidae	Musk lorikeet	*Glossopsitta concinna*	Native			2						6			2										
Climacteridae	White-throated treecreeper	*Cormobates leucophaea*	Native		1														1						
Climacteridae	Brown treecreeper	*Climacteris picumnus*	Native			2													2	2	1				
Maluridae	Superb fairy-wren	*Malurus cyaneus*	Native	13	10	7	8	5	4	20	7			20	5		8	6	9	4		9			
Meliphagidae	New holland honeyeater	*Phylidonyris novaehollandiae*	Native																						●
Meliphagidae	Blue-faced honeyeater	*Entomyzon cyanotis*	Native																						●
Meliphagidae	Brown-headed honeyeater	*Melithreptus brevirostris*	Native					2		2				2				2			2				
Meliphagidae	White-eared honeyeater	*Nesoptilotis leucotis*	Native		1																				
Meliphagidae	Little friarbird	*Philemon citreogularis*	Native									5	1					2		2					
Meliphagidae	Noisy friarbird	*Philemon corniculatus*	Native																						●
Meliphagidae	Red wattlebird	*Anthochaera carunculata*	Native					8		1		5	2			1			1	1	1	2			
Meliphagidae	White-plumed honeyeater	*Ptilotula penicillata*	Native		1	1					5	3			4	3				3	14	9			
Meliphagidae	Yellow-faced honeyeater	*Caligavis chrysops*	Native	3	5			1						2			1	1	2						

Family	Common name	Scientific name	Status	Site 01 (Post 2010)	Site 02 (Post 2010)	Site 03 (Post 2010)	Site 04 (Post 2010)	Site 05 (Early 1990s)	Site 06 (Mid 2000s)	Site 07 (Mid 2000s)	Site 08 (Mid 2000s)	Site 09 (Early 1990s)	Site 10 (Early 1990s)	Site 11 (Post 2010)	Site 12 (Early 1990s)	Site 13 (Early 1990s)	Site 14 (Mid 2000s)	Site 15 (Post 2010)	Reference 01	Reference 02	Reference 03	Reference 04	Vineyard 01	Vineyard 02	Incidental
Meliphagidae	Noisy miner	*Manorina melanocephala*	Native			2			2																
Pardalotidae	Spotted pardalote	*Pardalotus punctatus*	Native				3												5						
Pardalotidae	Striated pardalote	*Pardalotus striatus*	Native	2	1	2			3			5			5	5			1	2	6	3			
Acanthizidae	Western gerygone	*Gerygone fusca*	Native	3	2								5						2						
Acanthizidae	Weebill	*Smicrornis brevirostris*	Native	5	5		5	15	7				7	4			4	3	3						
Acanthizidae	White-browed scrubwren	*Sericornis frontalis*	Native		2	2					25			5	2	2						2			§
Acanthizidae	Yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Native					8	4	5								3							
Acanthizidae	Striated thornbill	*Acanthiza lineata*	Native							2				10											
Acanthizidae	Brown thornbill	*Acanthiza pusilla*	Native		2					3			7	7					10						
Acanthizidae	Buff-rumped thornbill	*Acanthiza reguloides*	Native							4															
Pomatostomidae	White-browed babbler	*Pomatostomus superciliosus*	Native							5															
Oriolidae	Olive-backed oriole	*Oriolus sagittatus*	Native																2	1					
Pachycephalidae	Rufous whistler	*Pachycephala rufiventris*	Native	2						2				6			1		1						§
Pachycephalidae	Grey shrike-thrush	*Colluricincla harmonica*	Native	2	2	1					1	2		1	2				1		2	2			
Campephagidae	Black-faced cuckoo-shrike	*Coracina novaehollandiae*	Native			1	1									2					1	1			
Campephagidae	White-winged triller	*Lalage tricolor*	Native				3					2	7							2		3			
Artamidae	Pied currawong	*Strepera graculina*	Native			1																			
Artamidae	Grey currawong	*Strepera versicolor*	Native		1														2						
Artamidae	Australian magpie	*Cracticus tibicen*	Native				1	2		4	3	21	2	2						2				10	§
Artamidae	Grey butcherbird	*Cracticus torquatus*	Native																						●
Artamidae	White-browed woodswallow	*Artamus superciliosus*	Native	15	5	10	10						3		2		2	1		10	18	23			
Artamidae	Dusky woodswallow	*Artamus cyanopterus*	Native																						●
Artamidae	Black-faced woodswallow	*Artamus cinereus*	Native																						●
Artamidae	White-breasted woodswallow	*Artamus leucorynchus*	Native											3											
Rhipiduridae	Willie wagtail	*Rhipidura leucophrys*	Native			1		1						1											
Rhipiduridae	Grey fantail	*Rhipidura albiscapa*	Native	3	8					1			1	9			3	1	2						
Monarchidae	Restless flycatcher	*Myiagra inquieta*	Native																						●
Monarchidae	Magpie-lark	*Grallina cyanoleuca*	Native																		1	2			§
Monarchidae	Black-faced monarch	*Monarcha melanopsis*	Native												1					1					
Corvidae	Little raven	*Corvus mellori*	Native	1	2	1	3	1				18	5		1	6						1	6	6	§
Corcoracidae	White-winged chough	*Corcorax melanorhamphos*	Native									14	9					5							§
Petroicidae	Jacky winter	*Microeca fascinans*	Native																						●
Petroicidae	Eastern yellow robin	*Eopsaltria australis*	Native		1																				

Family	Common name	Scientific name	Status	Site 01 (Post 2010)	Site 02 (Post 2010)	Site 03 (Post 2010)	Site 04 (Post 2010)	Site 05 (Early 1990s)	Site 06 (Mid 2000s)	Site 07 (Mid 2000s)	Site 08 (Mid 2000s)	Site 09 (Early 1990s)	Site 10 (Early 1990s)	Site 11 (Post 2010)	Site 12 (Early 1990s)	Site 13 (Early 1990s)	Site 14 (Mid 2000s)	Site 15 (Post 2010)	Reference 01	Reference 02	Reference 03	Reference 04	Vineyard 01	Vineyard 02	Incidental
Acrocephalidae	Australian reed-warbler	*Acrocephalus australis*	Native														4								
Locustellidae	Rufous songlark	*Cincloramphus mathewsi*	Native			1	3				1	2	2		1	3				6	8	5			
Locustellidae	Little grassbird	*Poodytes gramineus*	Native															3		2					
Hirundinidae	Tree martin	*Petrochelidon nigricans*	Native																						●
Hirundinidae	Welcome swallow	*Hirundo neoxena*	Native																	3		4			
Zosteropidae	Silvereye	*Zosterops lateralis*	Native	3			2			3				5			3	15							§
Sturnidae	Common starling	*Sturnus vulgaris*	Introduced																						●
Sturnidae	Common myna	*Acridotheres tristis*	Introduced																						●
Turdidae	Common blackbird	*Turdus merula*	Introduced	1	1									2											§
Estrildidae	Red-browed finch	*Neochmia temporalis*	Native				8																		
Passeridae	House sparrow	*Passer domesticus*	Introduced																						●
Motacillidae	Australasian pipit	*Anthus novaeseelandiae*	Native																				1		
Fringillidae	European goldfinch	*Carduelis carduelis*	Introduced																				1	3	
			SPECIES RICHNESS	**13**	**19**	**16**	**13**	**12**	**6**	**13**	**10**	**16**	**15**	**14**	**12**	**10**	**10**	**14**	**17**	**21**	**13**	**22**	**3**	**5**	***41***
			ABUNDANCE	**54**	**55**	**37**	**49**	**51**	**21**	**53**	**48**	**90**	**57**	**77**	**28**	**27**	**30**	**49**	**46**	**55**	**59**	**83**	**8**	**29**	

APPENDIX B FAUNA CAMERA SITE RESULTS

This list includes the 21 species confirmed from the fauna cameras during the November 2019 surveys, including 17 native species and four non-native (introduced) species. Species confirmed from fauna cameras is denoted with '●'. Additional fauna species have been confirmed at Tahbilk by CO2 Australia ecologists and others outside of the November 2019 surveys, although have not been included here.

Status refers to whether species is Native or Introduced, and whether 'Threatened' under Section 10 of the *Flora and Fauna Guarantee Act 1988* (Victoria).

Class	Family	Common name	Scientific name	Status	Camera 01	Camera 02	Camera 03	Camera 04	Camera 05	Camera 06	Camera 07	Camera 08	Camera 09	Camera 10
Mammal	Canidae	Red fox	*Vulpes vulpes*	Introduced				●		●		●		●
Mammal	Dasyuridae	Tuan (brush-tailed phascogale)	*Phascogale tapoatafa*	Native, Threatened										●
Mammal	Macropodidae	Eastern grey kangaroo	*Macropus giganteus*	Native								●		●
Mammal	Macropodidae	Swamp wallaby	*Wallabia bicolor*	Native		●			●			●	●	●
Mammal	Muridae	Rakali (water rat)	*Hydromys chrysogaster*	Native	●					●		●		
Mammal	Muridae	House mouse	*Mus musculus*	Introduced	●									
Mammal	Muridae	Bush rat	*Rattus fuscipes*	Native			●							
Mammal	Muridae	Black rat	*Rattus rattus*	Introduced	●	●						●		
Mammal	Phalangeridae	Common brushtail possum	*Trichosurus vulpecula*	Native	●	●		●		●				●
Mammal	Tachyglossidae	Echidna	*Tachyglossus aculeatus*	Native								●		
Bird	Acanthizidae	White-browed scrubwren	*Sericornis frontalis*	Native	●	●	●							
Bird	Anatidae	Pacific black duck	*Anas superciliosa*	Native						●				
Bird	Artamidae	Australian magpie	*Cracticus tibicen*	Native										●
Bird	Corcoracidae	White-winged chough	*Corcorax melanorhamphos*	Native										●
Bird	Corvidae	Little raven	*Corvus mellori*	Native										●
Bird	Monarchidae	Magpie-lark	*Grallina cyanoleuca*	Native			●							●
Bird	Pachycephalidae	Rufous whistler	*Pachycephala rufiventris*	Native		●								
Bird	Psittaculidae	Red-rumped parrot	*Psephotus haematonotus*	Native										●
Bird	Rallidae	Purple swamphen	*Porphyrio porphyrio*	Native							●	●		
Bird	Turdidae	Common blackbird	*Turdus merula*	Introduced		●								
Bird	Zosteropidae	Silvereye	*Zosterops lateralis*	Native		●								
				SPECIES RICHNESS	**5**	**7**	**3**	**2**	**1**	**4**	**1**	**7**	**1**	**10**

APPENDIX C ADDITIONAL INCIDENTALLY RECORDED SPECIES

This list includes the 11 incidentally recorded species referred to in Section 4.3, thus excluding the species confirmed from the 21 bird survey sites and captured on camera from the 10 fauna camera sites, as well as excluding the 41 bird species already identified as incidentally recorded species in Appendix A.

Status refers to whether species is Native or Introduced, and whether 'Threatened' under Section 10 of the *Flora and Fauna Guarantee Act 1988* (Victoria).

Class	Family	Common name	Scientific name	Status
Amphibians	Hylidae	Peron's tree frog	*Litoria peronii*	Native
Amphibians	Limnodynastidae	Eastern banjo frog	*Limnodynastes dumerilii*	Native
Amphibians	Limnodynastidae	Long-thumbed frog	*Limnodynastes fletcheri*	Native
Amphibians	Limnodynastidae	Spotted grass frog	*Limnodynastes tasmaniensis*	Native
Amphibians	Myobatrachidae	Eastern sign-bearing froglet	*Crinia parinsignifera*	Native
Amphibians	Myobatrachidae	Common eastern froglet	*Crinia signifera*	Native
Reptiles	Chelidae	Macquarie turtle	*Emydura macquarii*	Native
Reptiles	Elapidae	Red-bellied black snake	*Pseudechis porphyriacus*	Native
Reptiles	Scincidae	Pale-flecked garden sunskink	*Lampropholis guichenoti*	Native
Mammals	Petauridae	Sugar glider	*Petaurus breviceps*	Native
Mammals	Phascolarctidae	Koala	*Phascolarctos cinereus*	Native

APPENDIX D DRAFT ECOND ACCOUNT

Table D-1: Tahbilk Winery ECOND account – summary table

Summary Table		Indicator condition scores (ICS)		
Asset	**Sub-asset**	**2019**	**2020**	**2021**
Native vegetation		**48**		
	Early 1990s reveg	44		
	Mid 2000s reveg	56		
	Post 2010 reveg	45		
Native fauna		**82**		
	Early 1990s reveg	79		
	Mid 2000s reveg	70		
	Post 2010 reveg	92		

Table D-2: Tahbilk Winery ECOND account – asset table

			2019		2020		2021	
Asset	**Sub-asset**	**Indicator**	**Indicator Condition Score**	**ECOND**	**Indicator Condition Score**	**ECOND**	**Indicator Condition Score**	**ECOND**
NATIVE VEGETATION	**All sites**	**Vegetation composition**	**61**	**48**				
		Vegetation structure	**65**					
		Vegetation function	**42**					
		Site context	**37**					
	Early 1990s reveg	Vegetation composition	44	44				
		Vegetation structure	67					
		Vegetation function	40					
		Site context	32					
	Mid 2000s reveg	Vegetation composition	90	56				
		Vegetation structure	66					
		Vegetation function	47					
		Site context	50					
	Post 2010 reveg	Vegetation composition	57	45				
		Vegetation structure	62					
		Vegetation function	40					
		Site context	33					
NATIVE FAUNA	**All sites**	**Bird species richness**	**69**	**82**				
		Miner presence/absence	**98**					
		Bird species size class	**90**					
	Early 1990s reveg	Bird species richness	67	79				
		Miner presence/absence	100					
		Bird species size class	75					
	Mid 2000s reveg	Bird species richness	42	70				
		Miner presence/absence	96					
		Bird species size class	100					
	Post 2010 reveg	Bird species richness	87	92				
		Miner presence/absence	97					
		Bird species size class	96					