Mount Fyans Wind Farm: Brolga Assessment

FINAL REPORT

Prepared for Hydro Tasmania

6 July 2017

Biosis offices

AUSTRALIAN CAPITAL TERRITORY

Canberra

Floor 1, Unit 3, 38 Essington Street
Mitchell ACT 2911

Phone: (02) 6241 2333
Fax: (03) 9646 9242
Email: canberra@biosis.com.au

NEW SOUTH WALES

Sydney

Unit 14 17-27 Power Avenue
Alexandria NSW 2015

Phone: (02) 9690 2777
Fax: (02) 9690 2577
Email: sydney@biosis.com.au

Wollongong

8 Tate Street
Wollongong NSW 2500

Phone: (02) 4229 5222
Fax: (02) 4229 5500
Email: wollongong@biosis.com.au

QUEENSLAND

Brisbane

Suite 4 First Floor, 72 Wickham Street
Fortitude Valley QLD 4006

Phone: (07) 3831 7400
Fax: (07) 3831 7411
Email: brisbane@biosis.com.au

VICTORIA

Ballarat

506 Macarthur Street
Ballarat VIC 3350

Phone: (03) 5331 7000
Fax: (03) 5331 7033
Email: ballarat@biosis.com.au

Melbourne (Head Office)

38 Bertie Street
Port Melbourne VIC 3207

Phone: (03) 9646 9499
Fax: (03) 9646 9242
Email: melbourne@biosis.com.au

Wangaratta

16 Templeton Street
Wangaratta VIC 3677

Phone: (03) 5721 9453
Fax: (03) 5721 9454
Email: wangaratta@biosis.com.au

Document information

Report to:	Hydro Tasmania
Prepared by:	Katrina Sofo Mark Venosta
Biosis project no.:	16307

File name: 16307.Mt.Fyans.Brolga.Report.FIN02.20170706

Citation: Biosis 2017. Mount Fyans Wind Farm. Report for Hydro Tasmania. Authors: Sofo, K. & Venosta, M. Biosis Pty Ltd, Melbourne. Project no. 16307.

Document control

Version	Internal reviewer	Date issued
Draft version 01	IS	20/02/2015
Draft version 02	KS	02/02/2017
Final version 01	ASF	24/02/2017
Final version 02	KS	06/07/2017

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Hydro Tasmania: Michael Hogan & Chris Bury
- Entura: Natalie Lukies & Daniel Bennett
- Department of Environment Land Water and Planning for access to the Victorian Biodiversity Atlas

The following Biosis staff were involved in this project:

- Gavin Thomas for field surveys
- James Shepherd & Sally Mitchell for mapping

Contents

List of Figures

Summary

Biosis Pty Ltd was commissioned by Hydro Tasmania to undertake survey and assessment of Brolgas in relation to the proposed Mount Fyans Wind Farm. The study area is located near the township of Mortlake, approximately 200 km west of Melbourne.

The objective of the study was to identify all potential Brolga breeding and flocking habitats within and adjacent to the proposed wind farm and to then determine any current sites with potential to be impacted by the proposed wind farm. To mitigate potential impacts, appropriate turbine-free buffers will be applied to these sites in accordance with the *Interim Guidelines for the Assessment, Avoidance, Mitigation and Offsetting of Potential Wind Farm Impacts on the Victorian Brolga Population* (Brolga Guidelines) (DSE 2012).

The current report includes a comprehensive assessment of Brolgas for the proposed wind farm site, in accordance with the Brolga Guidelines (DSE 2012). The assessment incorporates information on Brolgas from a range of sources, including databases searches, a landowner survey questionnaire and survey for Brolgas from the local area. The Brolga investigations have included aerial surveys to locate breeding sites, an analysis of home ranges of breeding pairs, and confirmation of a flocking site at Lake Sheepwash.

The aerial surveys and analysis of several sources of data provided numerous records of Brolgas utilising sites both within and adjacent to the Mount Fyans wind farm study area. By undertaking further analysis of records and assigning turbine free-buffers to breeding and flocking sites, we were able to identify areas of constraint for the proposed Mount Fyans wind energy facility which will enable its design to comply with the Brolga Guidelines (DSE 2012).

1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned in early 2009 by Hydro Tasmania (then Roaring 40's Renewable Energy) to undertake a preliminary desktop assessment in relation to the proposed Mount Fyans Wind Farm (Biosis 2009), which identified the potential use of the landscape by Brolgas *Antigone rubicunda*. In late 2009 Biosis undertook field surveys for Brolgas in relation to the proposed Mount Fyans Wind Farm. This assessment occurred prior to a number of other flora and fauna assessments of the site (Biosis 2013). Additional aerial surveys were undertaken in 2014 in an attempt to determine the breeding status of Brolgas within the Mount Fyans wind farm study area at that time.

The region surrounding the proposed Mount Fyans wind farm is known to support breeding and flocking habitat for Brolgas. The species is listed as threatened under the *Flora and Fauna Guarantee Act* 1988 (FFG) and as and Vulnerable on the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013). Several large wetlands and many ephemeral wetlands exist in the local area and there are historical and recent records of the species flocking and breeding at these locations. Regular records of larger numbers of Brolgas are mostly from more permanent wetlands during Brolga flocking seasons, while the number of records of breeding birds appears to be related to ephemeral wetlands that are preferred breeding habitats.

A well-known flocking site occurs at and adjacent to Lake Barnie Bolac (also described as Lake Barnie Buloke), with birds known to utilise resources in the surrounding landscape during the flocking season. Throughout the course of our assessment we have confirmed the use of another site to the north of Lake Barnie Bolac, Lake Sheepwash, as a flocking site.

Examination of database records and discussion with landowners confirms that Brolgas have bred repeatedly in the local area and it is likely that many of these are pairs returning annually to traditional sites. While relatively few records of Brolgas occur within the Mount Fyans wind farm study area, the preliminary assessment identified that, under ideal conditions, there is likely to be an abundance of suitable freshwater marsh breeding habitat in the local area (within 10 km of the study area).

Databases contain records of historical observations of Brolgas from the region. These provide a basis for understanding how the species has utilised the area in past years. In addition to examining historical records of Brolgas from the local area on various databases, additional information was sought via a landowner questionnaire. This provided useful information on sightings of Brolgas on their properties, as well as on the current condition of historically suitable habitat features such as wetlands, and how these have altered over the years.

1.2 Scope of assessment

The objectives of this investigation are to:

- Review Brolga records from relevant databases and other primary sources.
- Report on the results of the landowner survey undertaken by Hydro Tasmania.
- Report on the results of aerial surveys and home range analyses undertaken at Mount Fyans and as part of the proposed Penshurst Wind Farm assessment.
- Report on the results of follow-up aerial surveys for the Mount Fyans study area.

- Identify breeding and flocking sites with potential to be impacted by the proposed wind farm, in accordance with the *Interim Guidelines for the Assessment, Avoidance, Mitigation and Offsetting of Potential Wind Farm Impacts on the Victorian Brolga Population* (Brolga Guidelines) (DSE 2012).
- Provide a consolidated map of validated breeding and flocking records relevant to the study area.

1.3 Location of the study area

The study area is located near the township of Mortlake, approximately 200 km west of Melbourne (Figure 1). The study area is approximately 12,625 hectares in area. It is bordered to the south by the Hamilton Highway, to the north by Woorndoo-Dundonnell Road, to the east by Six Mile Lane and Darlington-Nerrin Road and to the west by the Hamilton Highway and Salt Creek. The section of the site between the Mortlake-Ararat Rd and Salt Creek was not formally part of the study area in 2009 and hence it was not assessed during the 2009 Brolga survey. Nonetheless, it was included with the 3 kilometre buffer that was flown during the aerial survey in 2014.

The study area is within the Victorian Volcanic Plain Bioregion, and the surface geology is the result of quaternary basalt flows, with small areas of more recent alluvial sediments (derived from basalt) around lakes and waterways. The most recent basalt flows have formed a complex of stony rises, interspersed with low-lying areas and wetlands particularly in the northern section of the study area. Older basalt flows have weathered to a more undulating or flat landscape.

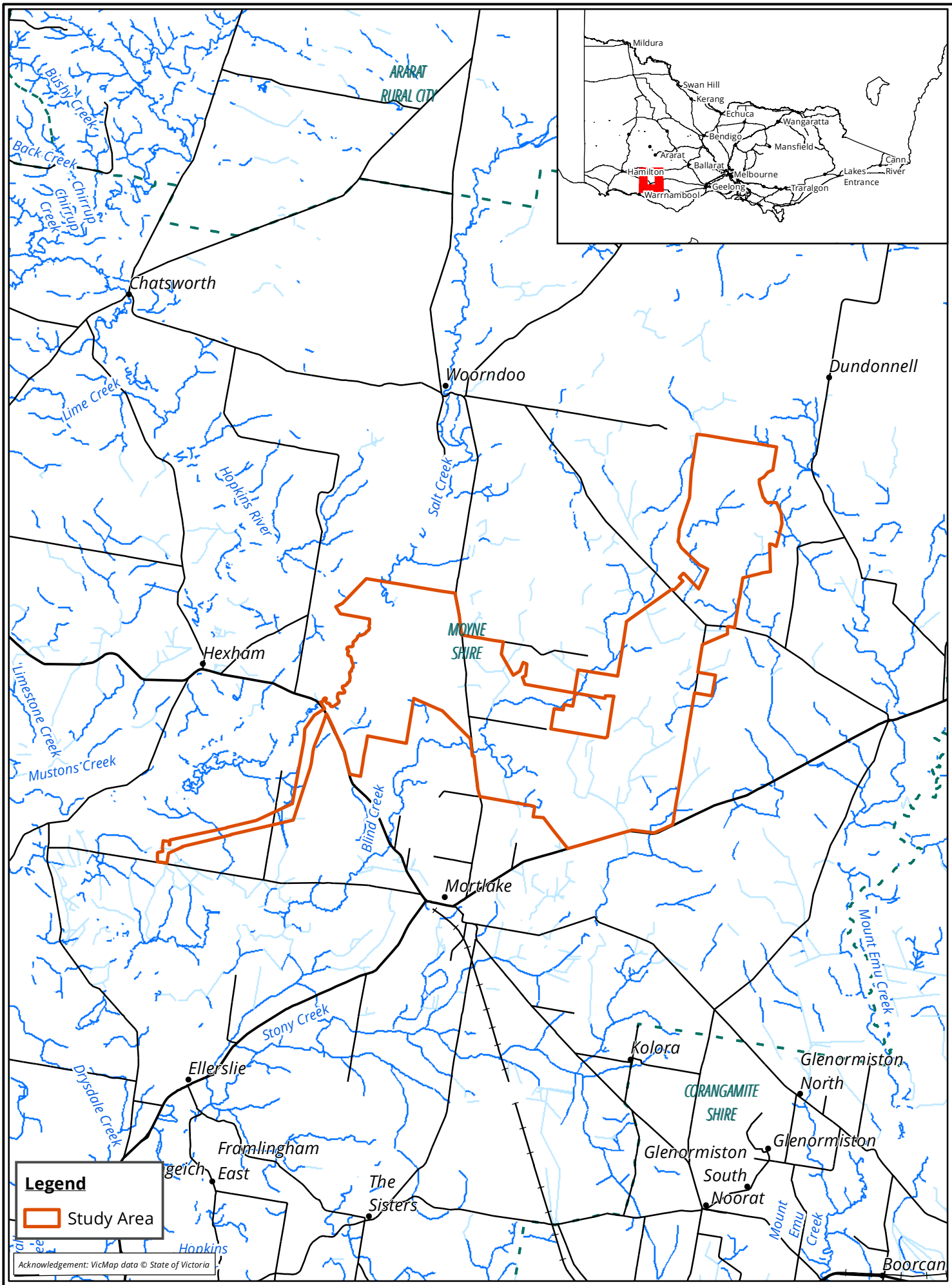
Most of the study area has been cleared of native vegetation and is currently managed for grazing and cropping. Nonetheless, remnant areas still persist within the stony rises, in low-lying areas and associated with depressions and drainage lines. Several roadsides within the area are known to support high-value native grasslands. Very few remnant native trees are present within the main wind farm area (Biosis 2013).

The project study area also includes the proposed corridor for a power transmission to connect the wind farm to the electricity grid. This extends from the south-western edge of the wind farm, through an area supporting open River Red Gum woodland and a commercial Blue Gum plantation before terminating at the Mortlake Power Station. The bulk of the transmission line corridor was not assessed as part of 2009 Brolga aerial survey as it was not part of the study area in 2009.

The study area includes upper reaches of Blind Creek, a number of unnamed tributaries of Stony Creek and Mount Emu Creek, part of Lake Sheepwash and a number of other wetlands and farm dams.

The study area is within the:

- Victorian Volcanic Plain Bioregion
- Hopkins River Basin
- Management area of the Glenelg Hopkins CMA
- Moyne Shire Local Government Area.



biosis

Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Figure 1: Location of the proposed Mt Fyans wind farm

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping\16307_F1_Locality

0 2,000 4,000 6,000 8,000
Metres
N
Scale 1:200,000 @ A4, GDA 1994 MGA Zone 54

2 Methods

2.1 Literature and database review

A review of historical records of Brolgas within a 10 km radius of the proposed wind farm site was undertaken. The databases reviewed included:

- Victorian Biodiversity Atlas 'VBA_FAUNA25, FAUNA100 & FAUNA Restricted' May 2017 © The State of Victoria (including data from the Atlas of Living Australia).
- Southwest Victorian Brolga Flocking Site Database (Ballarat University).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2017 (BA Atlas).

A review of each of the database's verification process was undertaken to better understand the level of reliability and accuracy of all records. The records from these sources were collated and examined to remove any duplicates, and to determine/verify those that are considered to be breeding records and those that are considered to be flocking records. The determination of breeding and flocking records is made in accordance with the definitions specified in the Brolga Guidelines (DSE 2012).

Other sources of biodiversity information included:

- Biosis records that are not yet on the VBA.
- Incidental records provided by landowners from the local area.

The following reports were reviewed as part of the assessment:

- *Mount Fyans Wind Farm Due Diligence Ecological Assessment. Report for Roaring 40s Renewable Energy* (Biosis Research 2009).
- *Penshurst Wind Farm: Targeted fauna assessment. Report for RES Australia* (Biosis Research 2011).
- *Flora and fauna assessment of the Mount Fyans Wind Farm, Victoria* (Biosis 2013).
- *Brolga Home Ranges: Mount Fyans and Penshurst Combined Sets* (Symbolix 2010).
- *Mount Fyans Wind Farm Brolga Landowner Survey – Summary Report (Hydro Tasmania 2014).*
- *Interim guidelines for the assessment, avoidance, mitigation and offsetting of potential wind farm impacts on the Victorian Brolga population 2011* (DSE 2012) (Brolga Guidelines).

The Brolga Recovery Group is a community special interest group operating under the auspices of Birdlife Australia: Ballarat. The Brolga Recovery Group was first contacted in November 2013 to ask if they were able to provide any additional records of Brolga from with 10 km of the study area. Several follow-up requests for data were made between November 2013 and April 2014, however, no additional data has been received to date.

2.2 Brolga aerial surveys

2.2.1 Aerial surveys - 2009

During preliminary investigations in 2009 and in conjunction with survey work on Brolgas in the nearby Penshurst area, discussions were held with Richard Hill, Senior Biodiversity Officer for the former Department of Sustainability and Environment (DSE) (now the Department of Environment, Land, Water & Planning (DELWP)) to investigate the most appropriate method of assessing Brolgas across broad study areas. It was apparent that rainfall in August/September 2009 had caused many ephemeral wetlands to fill and provide suitable breeding habitat for waterbirds including Brolgas. Due to the large and inaccessible nature of the Penshurst and Mount Fyans study areas it was decided that the most appropriate and rigorous method to assess Brolga occurrence was by means of aerial survey. This included flying over both study areas and out to a buffer of at least a further 3km.

On 3 and 4 November 2009 a Cessna 172 over-wing was used to fly east-west/west-east transects across the Mount Fyans study area and 3 km buffer. Transects were spaced 500 m apart from north to south. Flight speed was kept as slow as possible at 60-70 knots, while altitude was also kept as low as safely possible at 500 ft. The plane followed pre-determined transects loaded into its on-board GPS system. Two observers were used, one on the front right side, the other on the rear left side. Visual observations were recorded on paper and GPS coordinates taken for clearly identifiable landmark(s). A written description was made of the direction and distance from the landmark to the point of interest. This method required quick response from the observer to obtain as accurate a location as possible. Binoculars (10 x 42) were also used to aid in identification. As required, the aircraft broke from its transect route and circled to permit additional observations prior to resuming transect flight.

Over two subsequent days, one observer working on the ground, attempted to reach and observe as many wetlands as possible from the road network between the 3 km study area survey buffer and the 10 km study area database search buffer. The aerial survey method is the subject of a paper (Veltheim and Venosta in prep) and was used as the basis of the aerial survey method prescribed by DSE (2012).

After reviewing the results of the Penshurst aerial survey further discussion was held with DELWP (Andrew Pritchard, then Manager Flora and Fauna SW; and Clare Tesselaar, Biodiversity Planning Officer) on 26 October 2009 to propose methods to satisfy the requirements of the *Draft Guidelines for the Assessment of Potential Windfarm Impacts on the Brolga* (DSE 2009) (now the *Interim Guidelines for the Assessment, Avoidance, Mitigation and Offsetting of Potential Wind Farm Impacts on the Victorian Brolga Population* (DSE 2012)). No previous investigation of home ranges used by breeding Brolgas in Victoria had been made. As the Penshurst (and subsequently Mount Fyans) study area was identified as supporting a number of breeding pairs of Brolgas it was decided that a home range analysis would be required to determine the area utilised by pairs of Brolgas involved in successful breeding attempts. Individual breeding sites were expected to differ in the resources they offer to pairs of Brolgas and the requirements of a given breeding pair were also expected to vary through the course of a breeding event from nest-building through to fledging of chicks. For these reasons the study design included establishing home ranges for a representative number of pairs at different sites and throughout the breeding season to encompass the range of movements expected to occur and that would define the birds' breeding home-ranges. The sizes of home ranges would then be used to inform appropriate turbine-free buffer zones designed to achieve a zero net impact on the Victorian population.

After discussion with DELWP, RES Australia and Roaring 40's Renewable Energy it was decided to share home range data collected across the two wind farm sites to achieve a larger and more robust sample size.

2.2.2 Aerial surveys - 2014

On 8 and 9 October 2014, additional aerial surveys of the Mount Fyans study area was undertaken to provide further data on Brolga breeding pairs within and adjacent to the site. The methods used were consistent with the methods for the 2009 surveys, as outlined above (Section 2.2.1).

2.3 Home range analysis

Biosis engaged Symbolix to assist with study design and analytical methods. The method used for home range kernel analysis is described in Symbolix (2010a), while the method employed to determine stability of the measurements to increased survey effort (asymptote analysis) is described in Symbolix (2010b). These reports are provided at Appendix 1.

To carry out the home range surveys initially two, and subsequently one, observer visited each breeding Brolga pair at the two study sites as many times as possible from dawn to dusk leaving at least 2 hours between sequential observations to ensure independence of behaviours between one visit and the next. At Penshurst these observations were carried out from 30 November – 4 December 2009, 21 – 24 December 2009, 11 – 15 January 2010 and 18 – 20 January 2010. At Mount Fyans the observations were carried out from 14 – 18 December 2009, 21 – 24 December 2009, 4 – 8 January 2010, 18 – 22 January 2010, 1 – 6 February 2010 and 15 – 18 February 2010. Opportunistic observations of the locations of Brolgas were also noted when moving through the study area during other targeted species surveys throughout November 2009 – March 2010.

The data collection method used included visual observation to locate the breeding pair. This location was marked onto a high resolution aerial image by hand and number of individuals and time of the observation was noted along with a description of the bird(s) behaviour. The location records were considered to be accurate to within metres, particularly once the observer was familiar with the area around the evolving home range. For most pairs, observation was taken by driving through the surrounding area to locate the birds, either within the individual property or from roadsides where these were close enough to observe the birds. Once birds were located the observer then moved out of view as quickly as possible to avoid disturbance or other influence of the bird(s) behaviour. If the birds were unable to be located at a known breeding site within two hours the search was abandoned and noted as such.

For home range analysis the location data was digitised in the office by hand using digital images of the same aerial imagery used in the field. The observer that gathered the data in the field also entered the digital location, again noting the number of individuals, time and any behaviour described.

Where enough data was collected to describe a stable home range (pairs 1, 2 and 4 at Penshurst and pairs 6, 8, 17 and 19 at Mount Fyans) kernel analysis was undertaken as described in Symbolix (2010a). This data was then used to describe the home range and inform the turbine free buffering process. For failed pairs and previous sites with breeding recorded, Symbolix (2010a) developed the radius of containment approach. This provides a statistical probability, based on previous records for that pair collected during the study that the birds are within a certain radius. This home range analysis and radius of containment principle was independently reviewed by a DELWP biometrics expert (Andrew Gormley) at the Arthur Rylah Institute for Environmental Research and a DELWP Brolga expert (Richard Hill, Senior Biodiversity Officer). After receiving support for this methodology

and analysis, Biosis, RES, Roaring 40's Renewable Energy and DELWP met on 26 March 2010 to formulate appropriate turbine free buffers based on the data analysis carried out to that time. The agreed and signed minutes of this meeting are attached at Appendix 2.

2.4 Landowner survey

Hydro Tasmania, with assistance from Entura and Biosis, conducted a survey of landowners within a 5 km radius of the study area. The survey involved contacting landowners by telephone and conducting six site visits to 42 landowners between 2 May 2013 and 20 March 2014. Further details of the landowner survey are provided in Hydro Tasmania (2014), Appendix 3.

2.5 Flocking survey of Lake Sheepwash

During the course of our assessments for Mount Fyans it was suggested by DELWP that a dam in the north-east of the study area might be a flocking site. An retired DELWP biologist had made observations of numbers of Brolga using the site in the past, although these records do not appear in the VBA. The landowner stated that the dam wall had collapsed after heavy rains and that it was unlikely to hold water in the future. Despite this, there were local reports of Brolga using the dam during March/April 2013.

Biosis conducted surveys over four days from 27-30 May 2013 to confirm that the site was being used by a number of Brolga as a night roost. One zoologist observed Lake Sheepwash at dawn and dusk to establish if Brolga were roosting at the site. Where possible, birds were followed in an attempt to establish movements and confirm their return to the roost site.

2.6 Permits

Biosis undertook the assessments detailed hereunder the following permits and approvals, or predecessor authorizations:

- Research Permit/Management Authorisation and Permit to Take Protected Flora & Protected Fish issued by the Department of Environment and Primary Industries under the *Wildlife Act 1975, Flora and Fauna Guarantee Act 1988* and *National Parks Act 1975* (Permit number 10007569).
- Approvals 07.15 and 10.15 from the Wildlife and Small Institutions Animal Ethics Committee.

2.7 Legislation and policy

The implications for Brolgas were assessed in relation to the following legislation and policy:

- *Flora & Fauna Guarantee Act 1988* - associated action statements and listing advice.
- *Planning and Environment Act 1987* – specifically Clauses 12.01 and 52.32 in the relevant Planning Scheme.
- *Wildlife Act 1975.*
- *Environment Effects Act 1978.*
- *Interim guidelines for the assessment, avoidance, mitigation and offsetting of potential wind farm impacts on the Victorian Brolga population 2011* (DSE 2012).

2.8 Mapping

Hydro Tasmania supplied aerial photography and site plans.

Mapping in the field was conducted using hand-held (uncorrected) GPS units (WGS84) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files which contain our fauna spatial data are available to incorporate into design concept plans. However this mapping may not be sufficiently precise for detailed design purposes.

3 Results

3.1 Database review

The databases that contain historical records of Brolga sightings relevant to the study area include the VBA, BA Atlas and the Southwest Victorian Brolga Flocking Site Database (referred to hereafter as BFD (*Brolga Flocking Database*)). Figure 2 shows the location of Brolga records from these resources, highlighting the records that have been added to the database between 2014 and May 2017.

The VBA, BA Atlas and the BFD are a collection of records of species sightings, obtained either from incidental observations or systematic survey, from a wide range of contributors. With regards to Brolgas, these databases are used as a tool to gain an understanding of where individuals of this species have previously been recorded in the landscape and where current and historical breeding or flocking sites occur.

3.1.1 Victorian Biodiversity Atlas (VBA)

The VBA is an online tool for use by government agencies, environmental consultants, researchers and the public. The atlas, managed by DELWP, is a collection of observations about the distribution and abundance of species in Victoria. The VBA includes all records from previous databases managed by the Department, including the Flora Information System, the Atlas of Victorian Wildlife, the Aquatic Fauna Database and the Victorian Rare or Threatened Population (VROTPop) Database. It also includes records from the Atlas of Living Australia.

Records can be submitted to the VBA by any member of the public who registers as a contributor. The system requires contributors to complete a set of mandatory fields, which starts an automatic verification process for the accuracy of the data (e.g. record is within the accepted range for a species). A panel of experts/specialists for various taxonomic groups is involved in reviewing and verifying new records. The expert review cycle for the VBA is proposed to be undertaken every 3-4 months. The verification process for historical records generally followed the new process, however, with the multiple datasets managed over the years, the review process may not have been consistent (M. Hardy, DELWP, *pers. comm*.). Consequently, many old records have limited information, with many observations lacking important information (e.g. breeding records, number of individuals observed) or some fields that are now mandatory.

The VBA consists of two point datasets, categorized based on the level of accuracy of the location of the record. The VBA_FAUNA25 contains the records for which the level of accuracy is less than 500 m. The VBA_FAUNA100 contains records with an accuracy of 500 m or greater. For the Mount Fyans Brolga dataset, the stated accuracy of the spatial location of records ranges from 0.005 - 9 km. Older records generally have less accurate locations due to observers relying on maps and grid references when submitting their location details, prior to the widespread use of GPS units. The new system allows for accurate locations provided by GPS units, which lists the accuracy provided by the unit.

There are several other limitations that must be considered when looking at the records within the VBA. It is acknowledged by DELWP that the data may contain errors and omissions. Common errors result from mistakes made when transcribing the information, such as a digit being omitted or entered incorrectly, resulting in the wrong location or incorrect taxon identification number being used. Other errors occur when different common names have been used for one species, the units of measurement or coordinate types differ, or as a result of contributors and data enterers having differing sets of assumptions. Data can also appear skewed for a particular species or region if there has been a greater interest or survey effort at one location or for one species.

An overview of the Brolga records from the VBA within 10 km of the Mount Fyans study area provides the following information:

- A total of 977 observations, with dates from between 1965 and 2013.
  - *640 observations submitted by one contributor (66% of all records)*
  - *104 observations from literature reports.*
- VBA_FAUNA25: 147 records (precision 0 - 500 m).
- VBA_FAUNA100: 830 records (precision 500 m – 9 km).
- 12 observations of Brolgas within the Mount Fyans wind farm study area, including four listed as breeding records.
- 15 observations of flocks of Brolga numbering ≥ 10 birds.
  - *Largest flock of 100 (estimate) recorded 1.5 km south of Lake Barnie Bolac.*
  - *For the purposes of Figure 2, potential 'flocking' records are shown as observations of ≥ 10 birds* (as per the definition used in DSE 2012).
- 730 breeding observations.
  - *Of these breeding records, 668 do not include the number of birds observed; one includes a count of 80 birds.*
  - *There is often no other supporting information with these observations to verify them as 'breeding' records.*
  - *The locations of many of the 'breeding' observations are questionable when they are not associated with a wetland.*
  - *93 records are sourced from literature reports, of which 68 have the date as 1 January of the year recorded, which is assumed to simply be a default in the absence of an actual date record.*

3.1.2 BirdLife Australia – New Atlas of Australian Birds

The BA Atlas, managed by BirdLife Australia, is a collection of records on the distribution and abundance of bird species across Australia. The new Atlas has been in operation since 1998 and contains over 7 million bird records. The aim of the Atlas is to collect information on Australian birds, including distribution, abundance and important bird areas, and to use this information to monitor birds for the purpose of conservation, now and into the future.

The records within the Atlas are provided by a broad range of contributors. The Atlas allows anyone to become a contributor, provided they register as an Atlasser through BirdLife Australia. All new Atlassers are provided with a starter kit with instructions on how to participate in the program. When submitting a record a standard form must be completed with mandatory fields such as species, date, time, type of survey and location. The Atlas is focused on structured surveys as well as incidental records. The BA website includes a range of additional information and instructions on how different surveys should be conducted, using prescribed methods such as timed 2-hectare searches and area searches.

A verification process by BirdLife Australia involves an initial check of the location of records to determine if they are within the accepted range for a particular species. A range of local experts are also used to check the validity of records. Similarly to the VBA, there are potential errors and limitations associated with the BA Atlas records. The level of accuracy of location data is provided by

three categories: 0 – not given; 1 - <100 m; 2 - <500 m. For the Mount Fyans Brolga dataset, the accuracy of the spatial location of records ranges from 0 to 2. Older records that have relied on map coordinates and grid references are less accurate than locations recorded by GPS units. The use of clear survey instructions and information kits assists in reducing errors, however, the potential remains for transcription errors within the data, particularly for location details.

An overview of the Brolga records from the BA Atlas within 10 km of the Mount Fyans study area provides the following information:

- A total of six observations, with dates from between 1991 and 2012.
- Accuracy of records:
  - *One observation with no precision specified.*
  - *Two observations with 0 - 100 m precision.*
  - *Three observations with0 - 500 m precision.*
- One observation within the wind farm study area.
- No observations of flocks of Brolgas numbering ≥ 10 birds.
- Two breeding observations.

3.1.3 Southwest Victorian Brolga Flocking Site Database (BFD)

The BFD is a collection of all observations of Brolga from southwest Victoria and southeast South Australia. The intention of the database was for use by the Bird Observers Club of Australia, government departments and researchers (Sheldon 2003). It consists of a compilation of records (from the early 1900s to 2004) from the Victorian Government (formerly Department of Sustainability and Environment), BirdLife Australia Atlas (formerly Birds Australia), the University of Ballarat, and the defunct Friends of the Brolga Group. Consequently, many of the records within the BFD are duplicates of records within the VBA and BirdLife Australia Atlas.

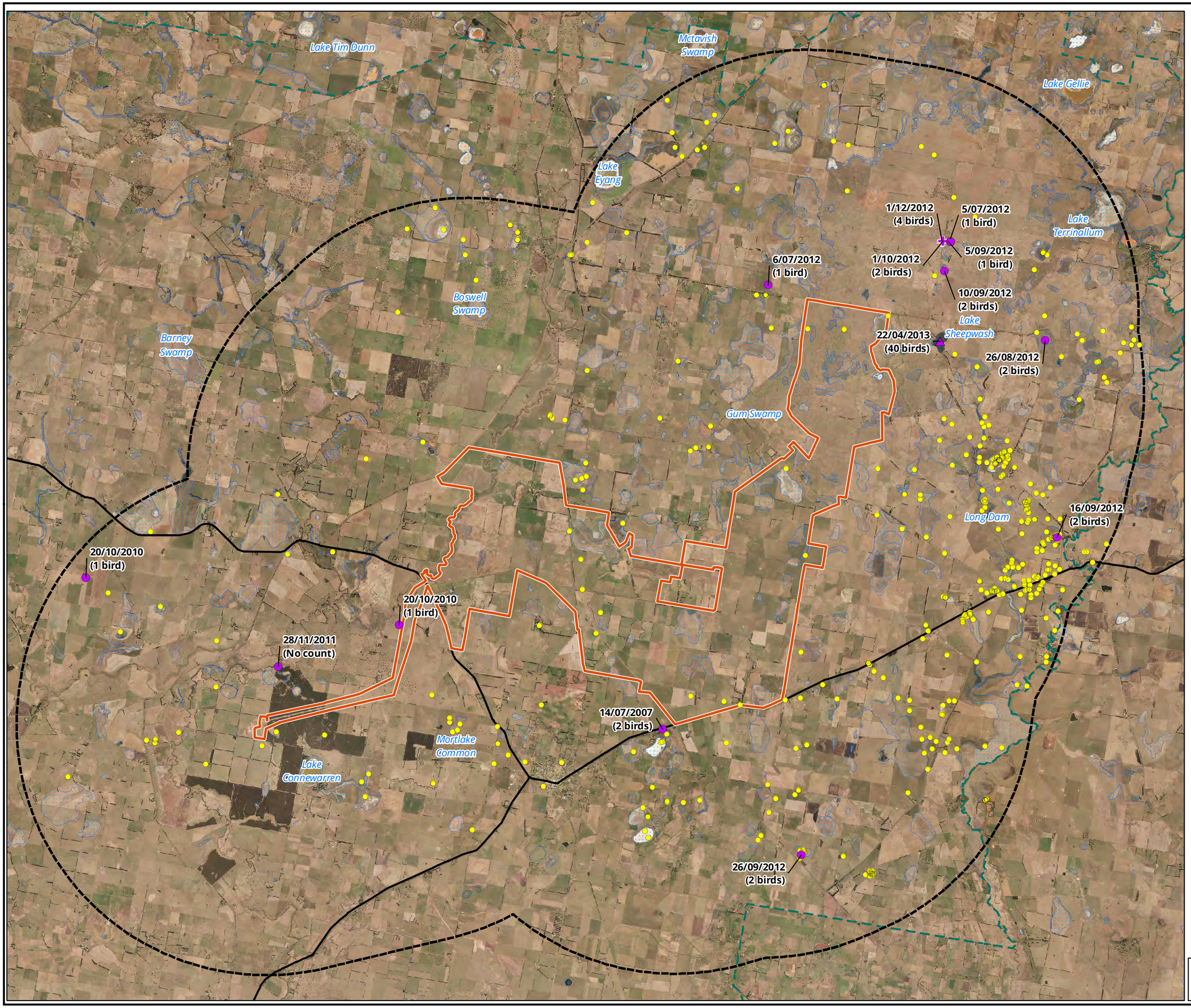
The database was used to generate a list of 29 historical Brolga flocking sites within south-west Victoria, and one site in South Australia. The selection of the flocking sites was based on a set of criteria, including records (with validity) since 1990; more than one year of Brolga records; direct wetland association; one or more records of counts equal to or greater than 10 birds; and Brolgas recorded in more than one month (Sheldon 2004).

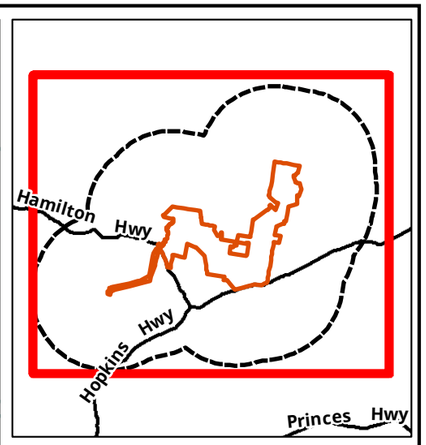
It is noted that although titled as a 'flocking' database, not all sites recorded in the database are flocking sites. As stated in the user manual (Sheldon 2003), any records of Brolga recorded during the flocking season (December to May) have been included in an attempt to avoid excluding any potential flocking records.

Although the intention was to include complete and reliable information, many records omitted data entry for some sections of the survey forms, such as bird count data, habitat parameters and wetland attributes. All records with an acceptably accurate location and year were included. Any records with a significant disparity between the location description and the map reference were rejected. As many of the records were obtained through the state government databases, the verification and accuracy of the records is as outlined in Section 3.1.1. The user manual notes that a validation level for each record is also provided as a level of accuracy, and that location references are cross referenced with known wetlands or feeding sites.

An overview of the Brolga records from the BFD within 10 km of the Mount Fyans study area provides the following information:

- A total of 31 observations, with dates from between 1976 and 2004.
- No observations within the wind farm study area.
- Nine observations of flocks of Brolgas numbering ≥ 10 birds.





Legend

- Study Area

VBA data search 11 May 2017

- Previously shown record
- Breeding
- Sighting
- Sightof >= 10 birds

Figure 2 VBA Database records of Brolga within 10km of the Mt Fyans study area

0 1 2 3 4 5

Kilometers

Scale: 1:140,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 06 July 2017,
Checked by: KS, Drawn by: SKM, Last edited by: lmilne
Location:P:\16300s\16307\Mapping
24683_F2_BrolgaRecords_as_at_10May2017

The Marsh

Mctavish Swamp

Lake Eyang

1986(No count)

1/1986(No count)

11/1986(2 birds)

1/2011(4 birds)

9/2004(2 birds)

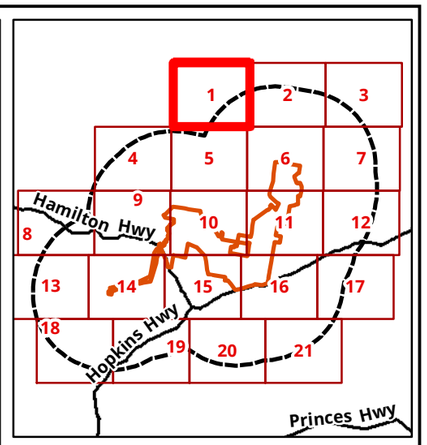
6/1992(2 birds)

9/1992(3 birds)

12/1995(4 birds)

1995(4 birds)

9/2011(21 birds)



Legend

- Study Area
- Study Area 10km buffer

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Sightings
- Sighting of ≥10 birds

Figure 2.1: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

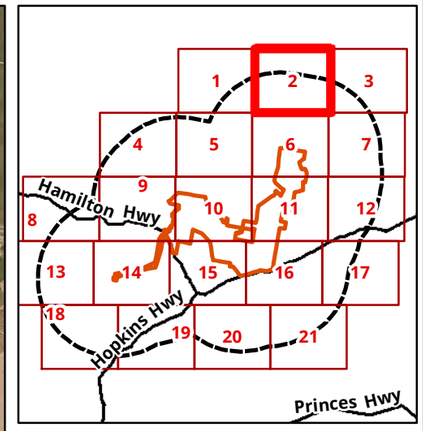
N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords

1/1984(No count)
1/1984(No count)
1/1986(2 birds)
1/2002(No count)
2/2011(2 birds)
2/2011(2 birds)
1/1984(No count)
1/2011(1 birds)
1/1984(No count)
1/1984(No count)
12/2009(No count)



Legend

- Study Area
- Study Area 10km buffer

Victorian Biodiversity Atlas

- Breeding
- Sightings

Figure 2.2: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

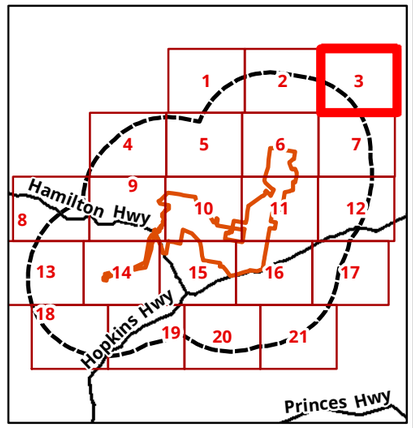
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Biosis

- Sighting <10 birds

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings
- Sighting of ≥10 birds

Figure 2.3: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

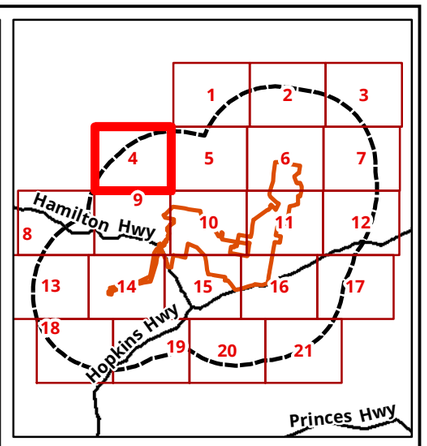
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings

Figure 2.4: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

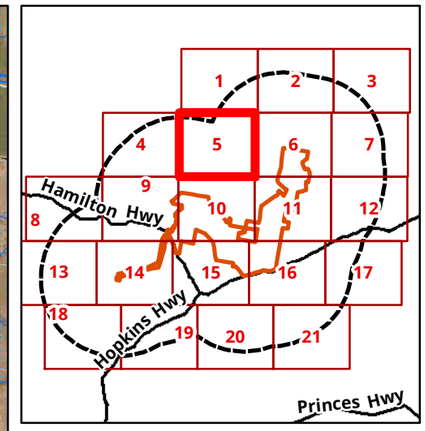
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings

Landholder Brolga records

- Breeding
- Sighting <10 birds
- Sighting of ≥10 birds

Figure 2.5: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

N

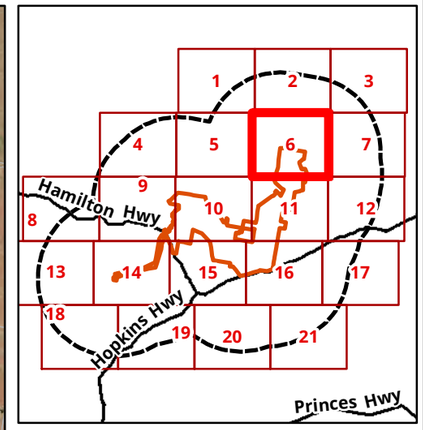
biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords

1/1984(No count)
1/1984(No count)
1/2002(No count)
c2003 (15 birds)
11/2009(2 birds)
Pair No. 4 (2009)
Pair No. 6 (2009)
9/2007(No count)
10/2007(3 birds)
9/2007(No count)
c2000-2013 (2 birds)
Pair No. 2 (2014)
12/2009(2 birds)
4/2008(No count)
1/1984(No count)
1/1984(No count)
2011 (2 birds)
c1970s (50 birds)
2007(No count)
Lake Sheepwash
June 2013 (25 birds)
5/2013(2 birds)
5/2013(36 birds)
5/2013(23 birds)
5/2013(36 birds)
10/2006(2 birds)
c2008 (6 birds)
1970-2000 (15 birds)
1983-2013 (2 birds)
2012 (3 birds)



Legend

- Study Area
- Study Area 10km buffer

Biosis aerial survey records

- Nest observed
- No nest observed

Biosis

- Sighting <10 birds
- Sighting of ≥10 birds

Birdlife Australia

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings

Landholder Brolga records

- Breeding
- Sighting <10 birds
- Sighting of ≥10 birds

Figure 2.6: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

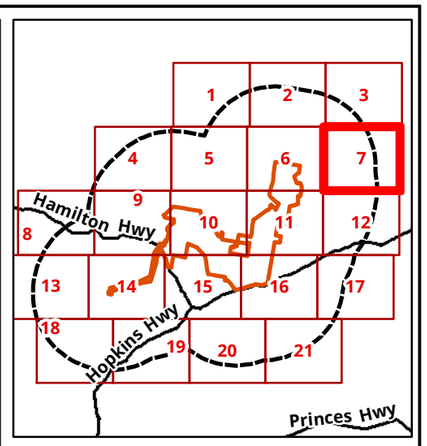
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Biosis aerial survey records

- Nest observed
- No nest observed

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings
- Sighting of ≥10 birds

Figure 2.7: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

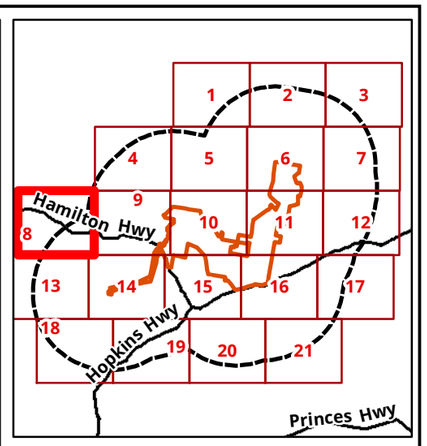
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings

Figure 2.8: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

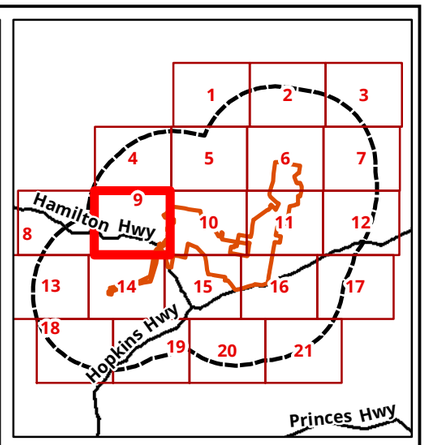
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Birdlife Australia
- Sighting

Brolga Flocking Database
- Sighting

Victorian Biodiversity Atlas
- Sightings

Landholder Brolga records
- Breeding
- Sighting <10 birds
- Sighting of ≥10 birds

Figure 2.9: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

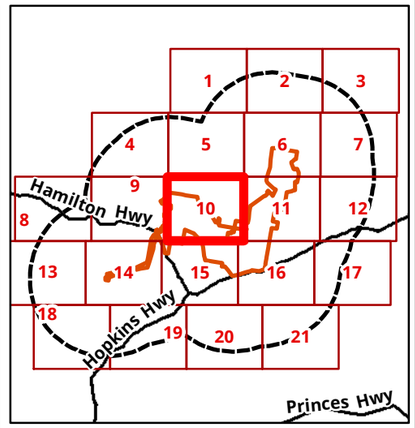
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping\16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Biosis aerial survey records
- Nest observed
- No nest observed

Birdlife Australia
- Breeding

Victorian Biodiversity Atlas
- Breeding
- Sightings

Landholder Brolga records
- Breeding
- Sighting <10 birds

Figure 2.10: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

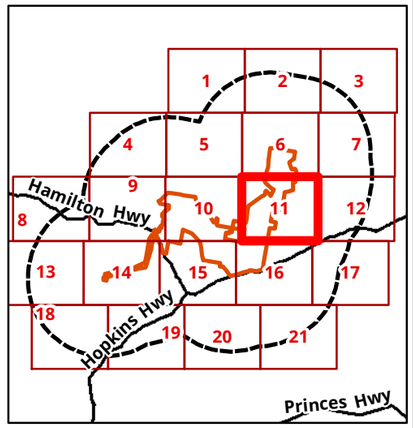
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Biosis
- Sighting of ≥10 birds

Brolga Flocking Database
- Sighting

Hamish Cumming (2007-2010)
- Breeding
- Sighting

Hamish Cumming (1969-1999)
- Breeding

Victorian Biodiversity Atlas
- Breeding
- Sightings

Landholder Brolga records
- Sighting <10 birds
- Sighting of ≥10 birds

Figure 2.11: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

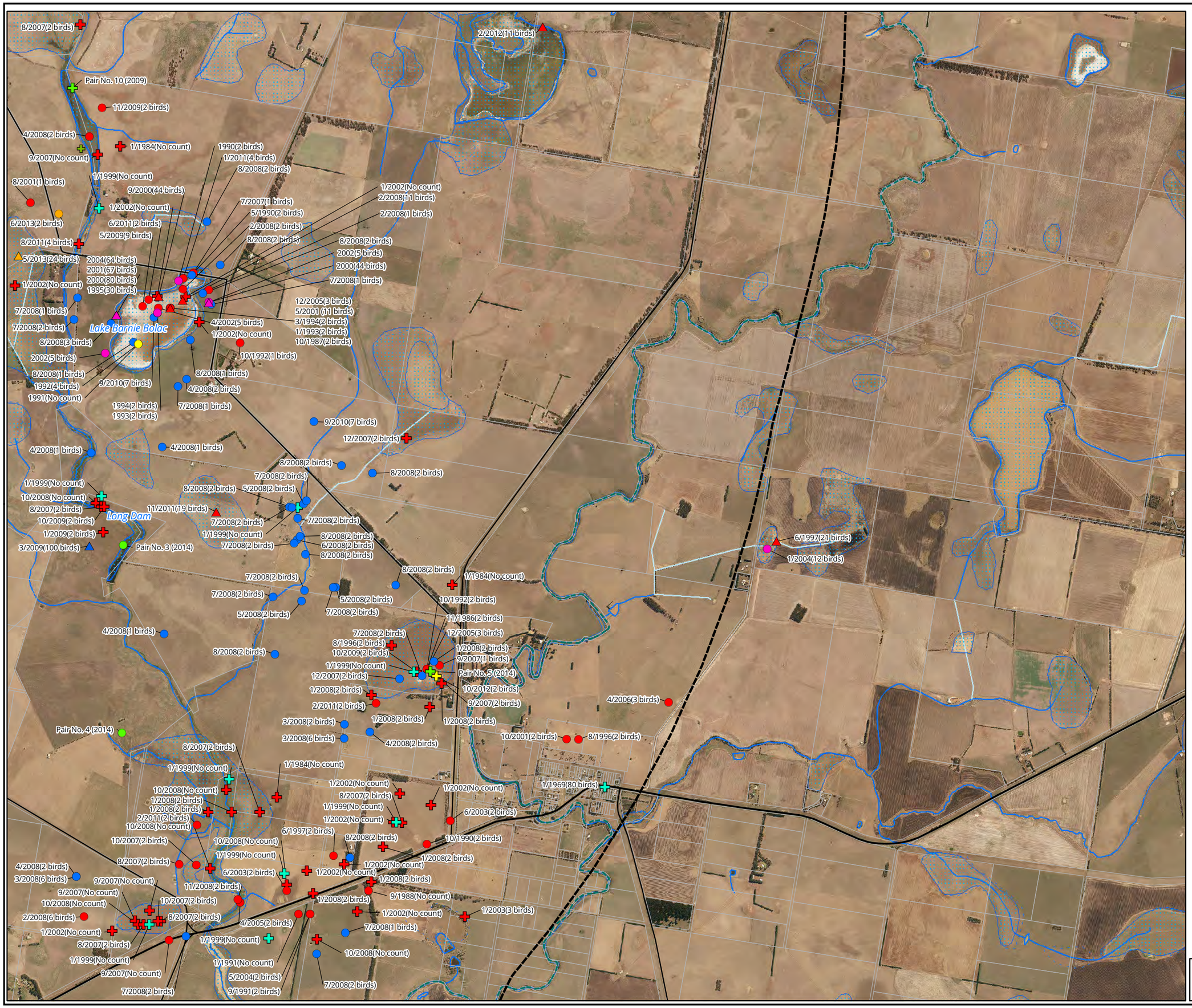
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping\16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Biosis aerial survey records
- Nest observed
- No nest observed

Biosis
- Sighting <10 birds
- Sighting of ≥10 birds

Birdlife Australia
- Breeding
- Sighting

Brolga Flocking Database
- Flocking
- Sighting

Hamish Cumming (2007-2010)
- Sighting
- Sighting of ≥10 birds

Hamish Cumming (1969-1999)
- Breeding

Victorian Biodiversity Atlas
- Breeding
- Flocking
- Sightings
- Sighting of ≥10 birds

Landholder Brolga records
- Breeding

Figure 2.12: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

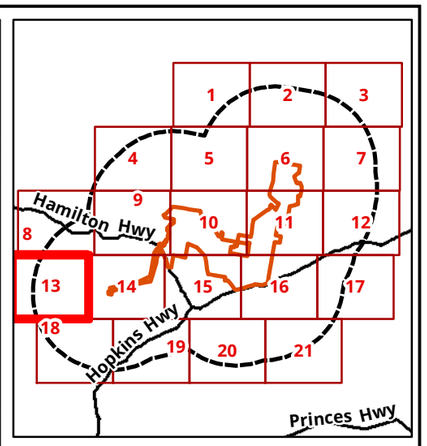
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping\16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings

Figure 2.13: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

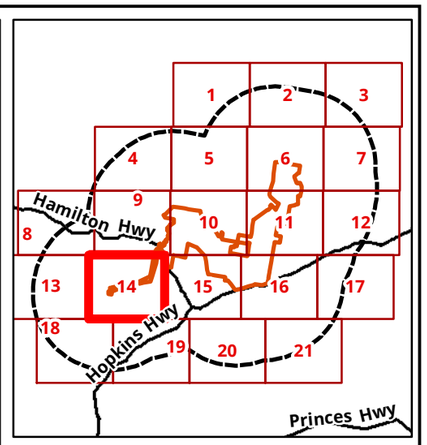
N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords

1/1984(No count)
1/1984(No count)
1/2002(No count)
9/2007(No count)
1/1984(No count)
10/2007(2 birds)
9/2008(3 birds)
Lake Connewarren
9/2008(2 birds)
12/1978(No count)
6/1978(No count)
12/2009(2 birds)
Pair No. 7 (2014)
Pair No. 18 (2009)
1995(3 birds)
2/1995(3 birds)



Legend

- Study Area
- Study Area 10km buffer

Biosis aerial survey records

- No nest observed

Brolga Flocking Database

- Sighting

Victorian Biodiversity Atlas

- Breeding
- Sightings

Figure 2.14: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

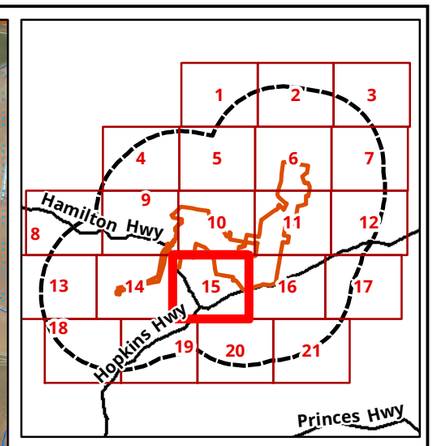
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Biosis aerial survey records

- Nest observed
- No nest observed

Victorian Biodiversity Atlas

- Breeding
- Sightings
- Sighting of ≥10 birds

Landholder Brolga records

- Breeding
- Sighting <10 birds

Figure 2.15: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords

Legend

- Study Area
- Study Area 10km buffer

Biosis aerial survey records
- No nest observed

Brolga Flocking Database
- Sighting

Hamish Cumming (2007-2010)
- Breeding
- Sighting

Hamish Cumming (1969-1999)
- Breeding

Victorian Biodiversity Atlas
- Breeding
- Sightings

Landholder Brolga records
- Breeding
- Sighting <10 birds
- Sighting of ≥10 birds

Figure 2.16: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

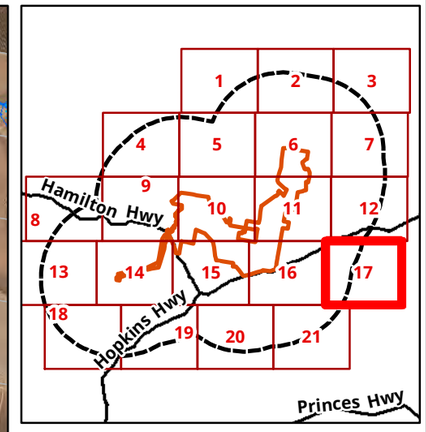
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping\16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Brolga Flocking Database

- Sighting

Hamish Cumming (2007-2010)

- Breeding
- Sighting

Hamish Cumming (1969-1999)

- Breeding

Victorian Biodiversity Atlas

- Breeding
- Sightings

Figure 2.17: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

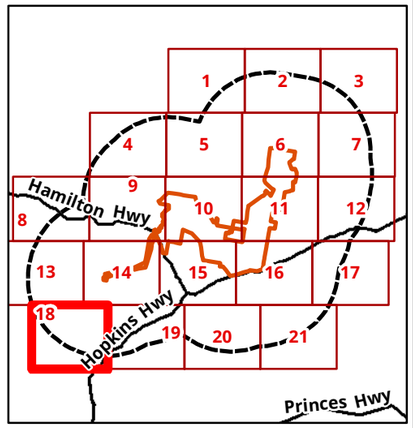
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping\16307_F2_BrolgaRecords



Legend

- Study Area
- Study Area 10km buffer

Figure 2.18: Historical and database records of Brolga within 10km of the Mt Fyans study area

0 300 600 900 1,200 1,500

Metres

Scale: 1:30,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

N

biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Hobart, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 16307,
Date: 02 February 2017,
Checked by: KS, Drawn by: SKM, Last edited by: smitchell
Location:P:\16300s\16307\Mapping
16307_F2_BrolgaRecords