ABZECO
Applied Botany, Zoology & Ecological Consulting

Montmorency Biodiversity Group Fauna Habitat Connectivity Project

Prepared for Banyule City Council

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Table of Contents

Acknowledgements 3
1 Introduction 4
1.1 Scope of works 4
2 Background 6
2.1 Study area 6
3 Methods 7
3.1 Nesting Box Surveys 7
4 Results 8
4.1 Nesting Box Monitoring Results 8
Table 1. Summary of Sugar Glider Nesting Box Survey Results from April 2016 to October 2019 16
Figure 1: Habitat Connectivity Mapping and nesting box locations through Montmorency 17
Figure 2: Habitat Connectivity Mapping, Nesting Box Locations & Sugar Glider Records Across ESO1 18
Figure 3: Potential Future Habitat Connectivity Along the Plenty River 19
Figure 4: Habitat Connectivity Across Main Road 20
Figure 5: Habitat Connectivity Mapping, Nesting Box Locations & Sugar Glider Records Across ESO1 21
5 Discussion & Recommendations 22

Cover images clockwise from the top left; Gliders in a box - How many can you count? Montmorency Biodiversity Group volunteers checking boxes, Gliders in a bowl shaped nest of leaves, Montmorency Biodiversity Group volunteers checking boxes.

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1 Introduction

Banyule City Council (the Council) has provided Montmorency Community Group with funding for the Sugar Glider monitoring project through their Environmental Sustainability and Communities for Nature grant programs.

The key objective of this project is to identify important fauna habitat and functional wildlife corridors throughout the area using Sugar Gliders as an indicator species. In particularly this project seeks to identify important fauna habitat connectivity through Montmorency between the Plenty River and Diamond Creek (east-west) and between Main Road to the south and Sherbourne Road to the north. Nesting boxes have been used to record habitat use by sugar gliders in the municipal reserve system, Road reserves and on private residential land. A secondary objective was to engage the public by providing nesting boxes for Sugar Gliders on residential land, in schools and other private land over the last four years.

This project is intended to assist Council and the general public to develop a greater understanding on existing fauna habitat values in the Montmorency area. In particular the project aims to better understand how wildlife moves through the area, between the nearby creek corridors, through private land and municipal reserves. To achieve this vegetation throughout the study area has been mapped through aerial photo interpretation then systematically ground truthed.

The habitat mapping completed by this project includes field based site assessments of vegetation on both private and public land with assistance from the Montmorency Biodiversity Group. These assessments were made on foot from the street and used to better inform desktop mapping of existing patches of vegetation and habitat connectivity.

The nesting box survey results are used to determine if the identified habitat connectivity is functional. This is indicated by evidence of regular occupation and breeding activity. Functional habitat is vegetation that provides food, shelter and a mate with connectivity to other populations for gene flow.

Montmorency is valued for its extensive canopy of native trees and reserve system. The entire suburb is covered under a Vegetation Protection Overlay (VPO1). While VPO1 clearly articulates that the area supports important fauna habitat values, that fauna connectivity exists and must be maintained, there is no strategic plan or supporting mapping that identifies where these important habitat values occur. Under the requirements of the Banyule Planning scheme the role of identifying the relative fauna habitat value of any given tree or patch of vegetation and how it functions in the broader landscape is a requirement of the applicant requesting a planning permit to remove vegetation.

Along with providing valuable information on fauna habitat values this project will help to build the sugar glider population in Montmorency. It will also assist in raising community awareness, understanding and support for maintaining and enhancing the local bio-link corridors through for a wide range of birds and other fauna species.

This report presents the project findings and recommendations that can be used by Council and others to better inform decision on the importance of protecting and enhancing our local fauna habitat and associated biodiversity values.

1.1 Scope of works

The scope of works for the project includes four main tasks:

1) **Identify Local Habitat Nodes**– create a GIS layer based on tree canopy cover through aerial image interpretation. This data identifies localised habitat patches that are predicted to function as a refugia for wildlife, providing food, shelter, a mate and connectivity to other areas of similar habitat.
2) **Identify Local Habitat links** – create a GIS layer that identifies habitat links through aerial photo interpretation of tree canopy connectivity.
3) **Compare predictive habitat mapping with Sugar Glider survey data** – Assess the mapping a map that shows current point records of Sugar Gliders from nesting boxes. Include all boxes that have any evidence of occupation and those boxes that have had no records to date. Undertake ground truthing of canopy connectivity.
4) **Identify Gaps in Habitat connectivity** –identify opportunities for improving habitat connectivity by strategic planting to increase canopy cover and installation of aerial rope bridges. This is indicated by a lack of Sugar Glider records from an area with suitable tree cover but little or no connectivity to areas where gliders have been recorded.

2 Background

2.1 Study area

Banyule City Council is a predominantly residential municipality covering approximately 63 km^2 (63,000 ha) located 7 kilometres north east from Melbourne CBD. Banyule extends from the Yarra River north toward the foothills of the Great dividing range, following the Plenty River with the Darebin Creek marking its western extent. Its features include sites of botanical, zoological and habitat significance including wetlands, river flats, vegetated riparian corridors and stands of remnant trees in municipal reserves and private land.

The Shire has three bioregions: Victorian Volcanic Plain, Gippsland Plain and Highlands Southern Fall. The Victorian Volcanic Plain is in the western section, running from the Yarra River parallel with the Darebin Creek. This high rainfall section of the volcanic plains supports productive Grassland and Grassy Woodland ecosystems. The Gippsland Plain is located in the central part of the Shire and includes low lying riverine floodplain, swampy flats and surrounding hills. The fertile floodplains and swamps support Riparian Forest, Swamp Scrub, Plains Grassy Woodland, Plains Grassy Forest, Plains Grassland and Gilgai Wetland ecosystems. The Highlands Southern Fall occupies the Silurian lowland hills in the eastern section and is the southerly aspect of the Great Dividing Range. These dissected uplands have moderate to steep slopes, high plateaus and alluvial flats along the main valleys. The nutrient poor hills typically support dry woodland and forest ecosystems of Valley Grassy Forest, Herb-rich Foothill Forest, Box Ironbark Forest and Grassy Dry Forest.

The Shire is surprisingly well vegetated with a good cover of remnant native canopy persisting in the eastern section of the municipality. Canopy trees are scattered as individuals and in small stands across all land tenures with the rare Melbourne Yellow Gum a notable feature of the ridges and hill crests of Greenhills. Montmorency supports numerous remnant trees with a few large old Yellow Box and Red Box providing a glimpse of the pre-European state. The area also has extensive plantings of non-indigenous native trees that provide important fauna resources and contribute to canopy connectivity. These stands of remnant and planted native trees continue to support a diverse range of native flora and fauna some of which are listed as of conservation significance. All indigenous flora and fauna species are of local conservation significance to Banyule given the decline across most of the municipality. Identification, protection and enhancement of environmentally significant sites and the strengthening of habitat linkages remain the key to maintenance and enhancement of biodiversity values throughout the eastern section of the municipality.

3 Methods

3.1 Nesting Box Surveys

To assist in the logistics of mounting this survey, Montmorency was divided in to four precincts:

- Precinct 1: Boxes along the Plenty River, the Montmorency ovals and those close to Para Road. It comprised 7 boxes in reserves and the school and five in private residences, one of which contained bees.
- Precinct 2: All boxes north of the railway line. It comprised 8 boxes in reserves and 10 in private residences. Two of the boxes in reserves contained bees, one resident's box could not be accessed, and another resident did not want two boxes checked.
- Precinct 3: Boxes situated to the east of a line approximately along Reichelt Avenue and its continuation as Rattray Road. It comprised 23 boxes in reserves and 14 in private residences. One box in a resident's property was not a Glider box and its lid was screwed down.
- Precinct 4: Boxes situated to the west of a line approximately along Reichelt Avenue and its continuation as Rattray Road. It comprised 9 boxes in reserves and 25 in private residences. The box in Petrie Park was overlooked.

The system of recording box occupancy is: A = gliders present; B = a well-formed bowl of leaves; C = Fresh green leaves present; D = no bowl or fresh leaves but chewing of the entrance hole present; E = No signs of prior occupancy.

All ladder climbing on private land is undertaken by accredited, trained volunteers using current best practices with specialised equipment that meets Australia safety standards. For this stage of the project and at times in the future all ladder climbing on public land will be undertaken by trained accredited Abzeco staff or other contractors approved for this task by Banyule Council. Abzeco has had assistance putting up new boxes, maintaining and modifying boxes from trained volunteers. These volunteers help with many tasks including mapping, carrying equipment and holding the ladder.

Visible ID numbers have been placed on each box to aid record keeping and to assist with reporting of Glider behaviour made by the public in the vicinity of a box. All nest boxes on both private and public land are being modified to allow inspection with a pole camera from the ground. This will greatly speed up the survey process and is a much safer method than climbing a ladder.

When there are no Gliders in a box, evidence of prior occupancy is very obvious because of the presence of a very neat bowl or spherical shaped leaf nest and on occasion the presence of fresh green leaves. The form of the bowl varies and observers have recorded seeing a "fully formed", "half-formed", "one-third formed" or similar descriptors. For the purposes of reporting occupancy rates any form of leaf nest is considered evidence of previous occupation. This information is extremely valuable for indicating where connectivity for glider movement is present.

When nesting boxes are put up a large amount of leaf material is loosely placed into the box in order to reduce the internal volume. This is specifically to reduce the internal volume which deters European honey bees from setting up hives. When gliders create their nest the internal volume increases which can result in bees taking over occupancy of the box. Bees have been driving gliders from nesting hollows during the day in order to take over occupancy. Bees also compete with gliders, honeyeaters and other nectar/pollen feeders for food.

4 Results

4.1 Nesting Box Monitoring Results

All results presented in this section were taken from survey reports prepared by by Ian Endersby. Much of the wording is also derived from Ian's reports. Ian has been responsible for the collation and reporting of all survey data for this project to the volunteer team. I understand that these reports have also been provided to Council.

Nesting Box Monitoring Survey Saturday 20th and Sunday 21st of May 2016

Twenty-one Sugar Glider boxes on Council Reserves were surveyed as well as six boxes on private property adjacent to two of the Reserves: Peck's Dam and Belmont Reserve. Of those in Reserves, seven (33%) held Gliders and 6 (29%) had evidence of previous Glider occupancy by the formation of a nest bowl. Eight boxes (38%) had neither Gliders nor evidence of occupancy. At least 13 adult Sugar Gliders were observed and one box contained young.

Peck's Dam

Although previous sightings of Sugar Gliders have been made in this Reserve none was detected during this survey either in the boxes within the Reserve or in four boxes on adjacent properties. However, four of the Reserve boxes had nest bowls in the leaf litter consistent with having been previously occupied by Sugar Gliders.

This result indicates that Sugar Gliders will travel significant distances to other habitat, together with the vagaries of sampling. Individual marking of Montmorency Sugar Gliders with tags or microchips is not feasible at this stage so the destination of the Peck's Dam colony is only conjecture but there is some continuity with Kirwana Reserve. There is a need for more frequent surveying of Peck's Dam boxes and dusk surveys. This is labour intensive but warrants consideration.

Belmont Reserve

Two Sugar Glider boxes have been installed in Belmont Reserve and each held Gilders. In addition there is a lorikeet box also in the Reserve and that held four Ringtail Possums. Two boxes on private property adjacent to the Reserve held no Gliders or evidence of occupancy. It is difficult to count and characterise the occupants of boxes without undue disturbance so estimates of numbers are the minimum within the box. With this proviso, one box held two adult gliders while the other held two adults plus young. One of the adults in the box containing young adopted a defensive, guarding posture when the box was opened.

At 100% occupancy of the installed boxes there is a case for increasing the number. Some care should be made in assessing suitable locations which allow for continuity of glide paths from the existing boxes. Possibly the absence of Glider presence or evidence in the two boxes on private property might indicate that they are too isolated from suitable habitat. Dusk surveys are warranted to determine the gliding and travel behaviour of members of this colony.

A motion-sensitive, nocturnal camera was deployed close to one of the occupied boxes to determine its efficacy for future monitoring. If the results are positive, and the box is still occupied, it will be moved further away from the box to test the range over which it could be useful for monitoring other localities, particularly cross-over points with main roads and other barriers.

Olympic Avenue Reserve

There are two boxes in Olympic Avenue Reserve, one of which held one Glider and the other had a nest bowl. It is not possible to say whether the one Glider was using each box in turn or there are other Gliders in the Reserve or travelling from somewhere such as Belmont Reserve which is fairly well connected by canopy. There is a case for adding additional boxes within the reserve and monitoring more frequently.

The use of the thermal imaging camera to detect heat sources within the box is showing some promise as non-invasive technique which avoids the need for deploying ladders and climbing equipment. Ideally it should be tested against visible surveys of box contents to ensure that there are no sources of observational or instrumental error. Such a test might be restricted in the time of day when use of the thermal camera is optimal but it warrants consideration.

Rattray Reserve

This Reserve contains five Sugar Glider boxes. Of the two boxes which held Sugar Gliders one held one adult Glider and the other held three. These two boxes were the one closest to the Reserve entrance and the one most further away. There was one other box with a nest bowl and two with no evidence of occupancy.

Rattray Reserve probably needs no additional boxes at this stage but, as with every reserve, more monitoring would improve our knowledge of this species' behaviour and possible needs.

Kirwana Reserve

Of the three boxes installed in this Reserve two each had two adult Gliders. The two boxes are a considerable distance apart and there is some overstorey connectivity between them.

Additional boxes might be warranted in this Reserve.

Petrie Park

The one box in Petrie Park was not checked due to lack of time.

Nesting Box Monitoring Survey Sunday 24st and 31st of July 2016

Seventeen Sugar Glider boxes on Council Reserves were surveyed on 24th July and ten on 31st July. In addition one box at Montmorency Secondary College was checked on the 24th and four boxes at Montmorency Primary School on 31st. Of those in Reserves, seven (26%) held Gliders and 16 (59%) had evidence of previous Glider occupancy by the formation of a nest bowl. Eight boxes (15%) had neither Gliders nor evidence of occupancy. At least 9 adult Sugar Gliders were observed. The one box at Montmorency Secondary College was occupied but none of the four at Montmorency Primary School had any evidence of Glider occupation.

Peck's Dam

The previous survey on 10th April found no Sugar Gliders but well-formed nests in boxes 16, 19, 20 and 21. This survey, 13 weeks later, revealed one Glider in box 20 and some evidence of occupancy in all others. Box 16, which previously had a well-formed nest had a half formed nest with green leaves. Box 15 had a poorly formed nest while all others were well formed.

The results of the April survey suggested that only boxes around the dam were being used but now all boxes in the reserve have some evidence of occupancy. Box 15, which had a poorly formed nest on this survey, is at the end of the reserve, remote from the others, and could represent the extreme end of the range in this reserve.

Belmont Reserve

Two Sugar Glider boxes have been installed in Belmont Reserve as well as a lorikeet box. In the April survey each of the Glider boxes contained at least two individuals and there were four Ringtail possums in the Lorikeet box. On this occasion the two Glider boxes had been recently occupied, nests of green leaves being the evidence, while the lorikeet box contained two Gliders.

Olympic Avenue Reserve

There are two boxes in Olympic Avenue Reserve, one of which held one Glider and the other had a nest bowl in the April survey. The situation was exactly the same in the July survey except that there were two Gliders in the occupied Box 22.

Rattray Reserve

This Reserve was monitored on 31 July. It contains five Sugar Glider boxes. Two of the boxes contained at least one Glider, one had a well-formed nest and another had fresh green leaves. In April two boxes were occupied and one had a nest. In this survey, 13 weeks later, Box 23 which had one Glider in April had no evidence of recent occupation. Where the nest was in July (Box 28) had had three Gliders in April; the box containing a nest in April (25) had one Glider in July; of the two other boxes which showed no signs of occupancy in April, one had a Glider and the other fresh green leaves in July

Kirwana Reserve

Each of the three boxes installed in this Reserve had some evidence of occupancy but no Gliders. One had a fully formed nest and that had had two Gliders in April. Another had a shallow nest and that also had two Gliders in April. The third box had a heap of green leaves but there had been no sign of occupation in the April survey.

Petrie Park

The one box in Petrie Park was not checked through lack of time during the survey of 10th April. However on 1st May it contained one Glider. Thirteen weeks later it also held one Glider.

The habitat for this Glider does not seem very suitable. There is scope for putting additional boxes along the very narrow verge of trees between the Park and the railway line which might give insights into the behaviour of this individual, assuming it has been the same Glider on both occasions.

Mayona Road

The four boxes in Mayona Road were surveyed on 1st May, three weeks later than the main April survey. On that occasion two boxes held Gliders and one had a well-formed nest. In July, the box which had held a nest still had a bowl of green leaves. The box which held two Gliders in May held one in July and the box which had one Glider in May had a nest in July. These boxes are strung along the linear reserve opposite Montmorency Station and there is evidence of occupancy right along this short corridor.

Montmorency Secondary College

The one box at this site has not previously been monitored but it contained at least one, and possibly two, Gliders during this July survey. Being so close to the corridor habitat of the Plenty River would imply this is an important monitoring locality. Plans to put additional boxes along the Plenty River might prove or disprove that a substantial population exists in this habitat, which to the human eye, seems ideal. If it does exist it would provide the source for movement along Montmorency corridors when they become viable Glider pathways. This box has yet to have its GPS coordinates determined.

Montmorency Primary School

Four Glider boxes were installed at Montmorency Primary School. They have not been checked previously and none showed prior occupancy at the July survey. One box had hosted a small colony of Honey Bees at some time but they were no longer present.

Buena Vista - Kirwana

Subsequent to the surveys in July another box was installed in a small unnamed but treed Reserve between Buena Vista Drive and Kirwana Grove.

Nesting Box Monitoring Survey Sunday 16th of October and 6th of November 2016

Sixteen Sugar Glider boxes on Council Reserves were surveyed on 16th October and twelve on 6th November. In addition one box at Montmorency Secondary College was checked on the 6th. Of those in Reserves, seven (25%) held Gliders and 19 (67%) had evidence of previous Glider occupancy by the formation of a nest bowl. Two boxes (8%) had neither Gliders nor evidence of occupancy. At least 11 adult Sugar Gliders were observed as well as two juveniles. The presence of two half-grown juveniles is consistent with females giving birth in southern Australia in July-August with a litter size usually two . The one box at Montmorency Secondary College was occupied, holding an estimated four Gliders. Two boxes had bees or honeycomb.

An additional five boxes were installed adjacent to the Plenty River in Sims Road and the surrounding parkland.

Peck's Dam

There are nine boxes in the Pecks Dam reserve and each of them has shown signs of occupancy during the year, either a well-formed nest or Sugar Gliders. A group of Gliders was found in Box 20 in the July survey and one in Box 18 in October; Box 20 had been taken over by bees between July and October. These observations are consistent with a small population of Gliders at Pecks Dam which move around the reserve camping at various places.

Belmont Reserve

Two Sugar Glider boxes have been installed in Belmont Reserve as well as a lorikeet box. In the October survey Box 35 contained bees and the Lorikeet box was not checked. In April the two Glider boxes both contained Gliders and the Lorikeet box had Ringtail possums. In July only the Lorikeet box had Gliders and the two Glider boxes had nests as evidence of occupancy. No Gliders were found in the Reserve in October but there was one nest.

Olympic Avenue Reserve

There are two boxes in Olympic Avenue Reserve. One of them [Box 22in the south of the Reserve] has had Gliders present at each survey. The other has had a nest each time. It would seem that the Gliders utilise both boxes and it is probably just a quirk of sampling that just one has been found to be occupied. Sampling over consecutive days with the thermal camera might resolve this puzzle.

Rattray Reserve

This Reserve contains five Sugar Glider boxes every one of which has contained Gliders at some time during the year. Adult numbers have varied between one and three and it would appear that breeding activity occurred with two sub adults being seen in Box 26 with their presumed parents in November. In April and July two boxes held Gliders but in November only one did.

Kirwana Reserve

Two of the three boxes held Sugar Gliders in April. Since then there has been evidence of occupancy during each survey but no Gliders. Perhaps there is a natural refuge within or close to the Reserve.

Petrie Park

The one box in Petrie Park has held Gliders during each survey with two or more being present in November although the habitat for this Glider does not seem very suitable.

Mayona Road

There are four boxes in Mayona Road along this short corridor. All but Box 40 have had either nests or Gliders but there were no Gliders in the November survey. Perhaps a review of the locality and aspect of Box 40 is warranted.

Montmorency Secondary College

The one box at this site has been monitored twice and on both occasions it contained Sugar Gliders, including a group of four in November. This site is close to the Plenty River corridor where additional boxes have now been installed. Future surveys might give a better picture of the Glider population in this possible source area.

Para Road

Two additional boxes have been installed on either side of Para Road with the thought that it might facilitate the movement of Gliders from the presumed source in the Plenty River corridor across this main road and into treed corridors within Montmorency. Box 51, within the sports reserve, held three Gliders but there none in the box across the road. These three might be part of the population that also includes those found in the Montmorency Secondary College Box. Between them these two sites held seven Gliders in in the November survey.

Nesting Box Monitoring Survey Sunday 19th and 25th of February 2017

On 19th February 15 Sugar Glider boxes on five Council Reserves were surveyed. Two boxes formerly on those reserves had been removed as they contained bees and one additional box had bees on this occasion. Twenty boxes were checked on 25th February (including one at Montmorency Secondary College); two additional boxes contained bees and one had been damaged by a Ringtail Possum gaining access through the roof.

Of the boxes which were surveyed, nine (26%) held Gliders and 16 (46%) had evidence of previous Glider occupancy by the formation of a nest bowl or the presence of green leaves. Ten boxes (28%) had neither Gliders nor evidence of occupancy. At least 23 Sugar Gliders were observed of which three appeared smaller suggesting juveniles.

Three of the five boxes installed adjacent to the Plenty River in Sims Road and the surrounding parkland were surveyed but none showed evidence of occupancy.

Peck's Dam

There were originally nine boxes in the Pecks Dam reserve but one (#20) has been removed because it contained bees. Two boxes contained Gliders, numbering four and three respectively, and five had leaf bowls. A trail camera was deployed opposite Box #16 (which contained three Gliders) to record frequency and duration of occupancy over the following weeks.

Belmont Reserve

Two Sugar Glider boxes were originally installed in Belmont Reserve as well as a lorikeet box installed by a local resident to attract King Parrots Alisterus scapularis. One Sugar Glider box has been removed as it contained bees. The lorikeet box has contained Ringtail Possums or Sugar Gliders in past surveys. On this occasion the lorikeet box held a fully formed bowl and the remaining Sugar Glider box contained two Gliders.

Olympic Avenue Reserve

There are two boxes in Olympic Avenue Reserve. One of them (Box #22) has had Gliders present at each survey, four on this occasion. The other has had a nest each time.

Rattray Reserve

This Reserve contains five Sugar Glider boxes but one (#23) has suffered damage due to a Ringtail Possum gaining entry through the roof. No Gliders were present during this survey but three boxes had a bowl and the fourth contained green leaves but they had not been formed into a bowl.

Kirwana Reserve

One of the three boxes in this reserve contained bees. Of the two others, one had one Sugar Glider and the other a fully formed bowl.

Another box (#47) has been installed in a small reserve between Kirwana Grove and Buena Vista Drive. It contained at least four Gliders, three of which appeared smaller than the other visible one. If they were, indeed, young, such a litter size is exceptional for one mother, which is normally one or two . However, as Sugar Gliders usually live in social units, these might be the offspring of two females.

Petrie Park

The one box in Petrie Park has held Gliders during each survey except for this one where a fully formed bowl and green leaves were observed.

Mayona Road

There are four boxes in Mayona Road along this short corridor. All but Box #40 have had either nests or Gliders on previous surveys. On this survey one box had at least two Gliders, another box had at least one, and the third box had a ¾ bowl. The box (#38) has never been found with Gliders during surveys but often with nests. This is probably due to the vagaries of sampling so infrequently.

Montmorency Secondary College

On the two previous occasions, when this box was checked, it contained Sugar Gliders, but this time there was only a fully formed bowl.

Para Road

Two additional boxes were installed on either side of Para Road with the thought that it might facilitate the movement of Gliders from the presumed source in the Plenty River corridor across this main road and into treed corridors within Montmorency. The Box (#51), within the sports reserve, held at least two Gliders but there none in the box across the road.

Since the November survey additional boxes have been installed in the Plenty River corridor and three of these were included in this February census; no evidence of occupancy was recorded.

Sherbourne Road

Four additional boxes were installed along Sherbourne Road, two on each side, to encourage the movement of Gliders across this substantial boundary. This was the first survey since installation; two of the boxes contained bees, one showed no signs of occupancy (#53), and the fourth was not checked. Box #53 is on the side of Sherbourne Road on which all of the Glider activity in Montmorency has been recorded. Without information from the other boxes in this cluster, no conclusions can be drawn.

Main Road

Main Road was another locality where four boxes were installed on either side to encourage Gliders to move across the major barrier. One box on the side of Main Road away from where the Montmorency activity has so far been recorded had a ¾ bowl with green leaves; the other on that side was not checked. The two boxes on the Montmorency side of Main Road are in a park at least one street remote from Main Road; neither showed signs of occupancy.

Nesting Box Monitoring Survey Saturday 20th and Sunday 21st of May 2017

In total 37 boxes on public land, 8 in schools and 44 in private residences, a total of 89 were checked over the 20th and 21st of May 2017. Of the 89 boxes that could be surveyed, 13 (15%) contained Gliders. There were 23 Gliders definitely observed; the actual number could be higher as, with a practice of minimum disturbance, it is not possible to distinguish all individuals. Thirty-nine boxes (44%) had strong evidence of former occupancy by Gliders, either the presence of a nest bowl or fresh leaves. Well over half of the boxes had been home to a Sugar Glider at some time.

Separating the Reserves plus Schools from the Residents, we find:

- Reserves plus Schools - 45 boxes, 10 (22%) of which contained 18 Gliders and 20 (44%) had nest bowls;
- Residents - 44 boxes, 3 (7%) of which contained 5 Gliders and 19 (43%) had nest bowls.

Superficially it would seem that occupancy away from the reserves is quite similar to that within reserves but the number of Gliders was far less. One inference from that is that there is a population of Gliders within the treed areas of Montmorency which on occasions use the nest boxes but have other day time habitats as well.

Nesting Box Monitoring Survey Saturday 12th August 2017

On 12th August three survey teams examined 43 Glider boxes on Public Land and Schools in Montmorency and detected Sugar Gliders in ten of them (44%). Eighteen boxes had evidence of prior occupancy with nest bowls or fresh leaves. Sixty-five percent of the boxes examined had been used by Gliders. Of the remainder, two boxes were infested with ants and two with bees.

At least 19 Sugar Gliders were observed.

Since the monitoring started, six surveys have been conducted. Comparing different surveys is difficult because different numbers of boxes are checked each time; sometimes the survey is conducted over two days and Gliders may have moved overnight; we do not know how long it takes for Gliders to acclimatise to the presence of a new box. From this table we can see that the results, particularly for calendar 2017, are comparable. The numbers on Public Land in Montmorency seem to be stable.

Nesting Box Monitoring Survey Saturday 20th of January 2018

On 20th January three survey teams examined 43 Glider boxes on Public Land and Schools in Montmorency and detected Sugar Gliders in eleven of them (26%). Thirteen boxes (30%) had evidence of prior occupancy with nest bowls or fresh leaves. Fifty-six percent of the boxes examined had been used by Gliders. Of the remainder, three boxes were infested with bees, one with ants, and three had been propped open since the August survey in an attempt to rid them of ants. At least 31 Sugar Gliders and one young were observed.

In box #51 a Glider was found still alive but trapped by the leg in geofabric attached to the ceiling. In box #47 a Glider had died as a result of entrapment in the geofabric. This fabric had been installed to assist in preventing bees occupying boxes. Resulting from these findings the team decided to remove the fabric from boxes and to survey all the boxes in private residences and remove any fabric from them on Sunday 21st January. In that additional survey minimum of 23 Gliders were observed. Another Glider was found dead from entrapment and one found dead at the base of the tree which hosted a box. Two boxes had bee hives and two were too high to examine, so two-thirds of the boxes in residences showed no evidence of Glider occupation. However some residents reported Glider usage even though there was no current evidence.

Nesting Box Monitoring Survey Saturday 19th of Saturday 19th October 2019

Slightly fewer Gliders were seen on this survey compared with the one in February (43 vs 47) and the percentage of boxes which contained Gliders had also fallen marginally. Of some interest is the percentage of boxes in residential properties which were deemed to show no evidence of previous occupancy. It has fallen from 42% to 30% implying that Gliders are spreading through residential areas.

Immature Gliders were detected in Rattray Reserve and at residential properties in Allens Road and Grand Boulevard. This compares with sightings during the February survey at Belmont Reserve, Pecks Dam, Montmorency Oval and at residential properties in Aanensen Court, Meadow Crescent and Pedersen Way. In the literature birth dates are recorded as occurring between July and August in southern Australia, with a litter size usually of two. These October sightings are quite consistent those dates. Those seen in February, a difference of four months, would be expected to be larger but this project cannot detect such differences. Nevertheless, these sightings confirm that food supplies, environmental conditions and Glider stress levels have been conducive to breeding success

Seven boxes (nearly 7%) had active bee's hives and three had ants. Previous reports have recommended a frequent inspection of boxes purely to effect repairs and for the eradication of pests. The reason being: "While the prime purpose of the boxes has been to monitor population trends and, with a growing database, measure the efficacy of presumed wildlife corridors, they also serve the purpose of providing additional habitat. As such, it is important that they are maintained at a high standard for the benefit of the Gliders." Bee eradication by chemical means is controversial, particularly with some residents, so the Biodiversity Group committee needs to develop a policy on this topic.

Are There Historical Trends?

Given the number of boxes included in each survey to date has varied it would be misleading to view only absolute numbers when looking for trends in data. The following table provides a breakdown of Number of Gliders per box which has been calculated by dividing the number of gliders observed by the number of boxes checked. While this is an interesting metric, a more useful indicator is occupancy rate, which is the percentage of boxes with evidence of recent occupation.

With a metric like occupancy it would be expected that when the first few boxes were put up the ratio of available boxes to gliders would low and therefore occupancy rate high. Over time as more and more boxes went up we might expect the number of boxes to exceed the number of gliders. So with a rapid increase in nest box availability occupancy rates should decrease, then, with population growth through reproduction and immigration over time we would expect to see occupancy rates increase.

One confounding factor with occupancy on this project is that to be a useful indicator of population status we need all boxes have the same likelihood of occupancy. This is not the for this project as boxes are primarily being used to determine areas where functional fauna habitat exists and areas where there is a lack of connectivity. The primary indicator for functional habitat connectivity is nest box occupancy by sugar gliders.

d across the number computes Gliders per box and Evidence of Occupancy per box (glider or leaf nest present) in an attempt to standardise the results. At a gross level it looks as though the population has been steady since the first survey with about a quarter of the boxes in Reserves containing Gliders on each occasion. Three quarters or more of the boxes show evidence of use by Gliders.

Table 1. Summary of Sugar Glider Nesting Box Survey Results from April 2016 to October 2019

Survey Date	No. Boxes	Glider present	Nest present	No. of Gliders	Average No. of Gliders/Box	Occupancy Rate
Apr-16	21	7	6	13	0.62	33.33%
Jul-16	32	8	16	9	0.28	25.00%
Oct-16	29	8	19	12	0.41	27.59%
Feb-17	35	9	16	23	0.66	25.71%
May-17	89	13	39	23	0.26	14.61%
Aug-17	43	10	18	20	0.47	23.26%
Jan-18	99	20	21	26	0.26	20.20%
Jul-18	103	25	25	45	0.44	24.27%
Feb-19	104	28	39	55	0.53	26.92%
Oct-19	102	21	52	53	0.52	20.59%

Figure 1: Fauna Habitat Connectivity and Nestbox Survey Oct. 2019

Gliders Recorded

- Yes
- No

- New Nest Boxes
- Approved Nestbox Location
- Local Habitat Node
- Habitat Gap Opportunity
- NEROC Regional Network
- Habitat Linkage

250 0 250 500 750 Meters

Scale: 1:9,000 (A3)

Survey Date:
Created by: Stephen Hall
Report: 14082 - v1.0
File: Abzeco14082-MontyHabitat Mapping-2019Nov.mxd

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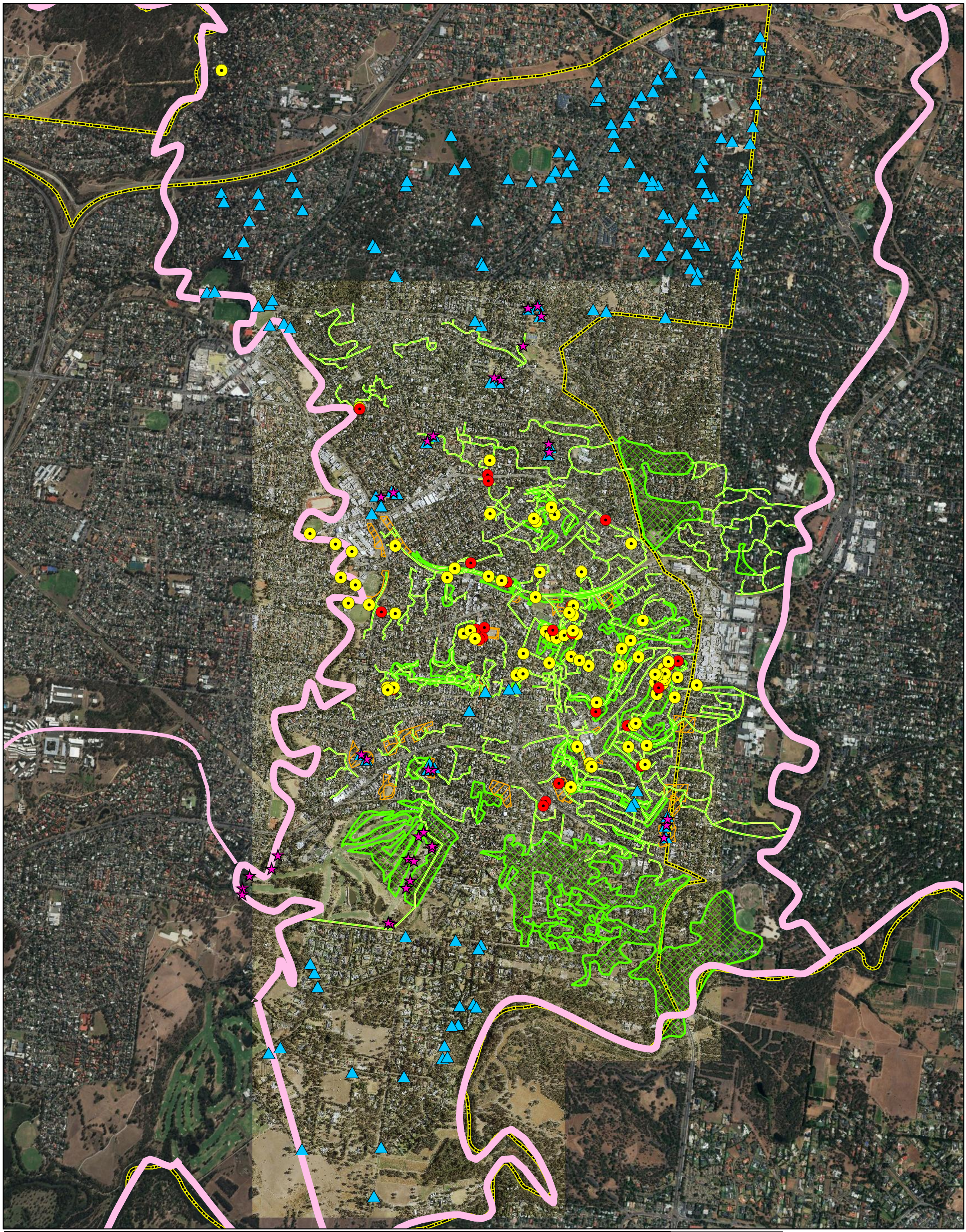
Figure 2: Fauna Habitat Connectivity and Nestbox Survey Oct. 2019



Gliders Recorded
- Yes
- No
- New Nest Boxes

Approved Nestbox Location

Local Habitat Node

Habitat Gap Opportunity

NEROC District Link

NEROC Regional Network

Habitat Linkage

250 0 250 500 750 Meters

Scale: 1:21,000 (A3)

Survey Date:
Created by: Stephen Hall
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Potential Rope bridge locations

Figure 3. Plenty River + Lower Plenty Road

25 0 25 50 Meters

Scale: 1:1,000 (A3)

File: Abzeco14082-MontyHabitat Mapping-2019Nov.mxd

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Figure 4. Main Road + Bolton Street

New Nestboxes

Approved New Locations

Habitat Linkage

Scale: 1:1,200 (A3)

File:
Abzeco14082-MontyHabitat
Mapping-PlentyRiver.mxd

25 0 25 50 Meters

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Figure 5. Main Road, Diamond Creek Bridge

Habitat Linkage

25 0 25 50

Meters

Scale: 1:1,000 (A3)

File:
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5 Discussion & Recommendations

Based on the spread of records across the survey area from nesting box occupation presented in figures 1 & 2 it clear that Sugar Gliders are present in most areas of suitable habitat surveyed. There are localised areas that as yet sugar gliders have not been recorded. Given that a number of these boxes have been installed for several years it is likely that this indicates a lack of functional habitat connectivity to these areas. The aerial photo interpretation and ground truthing of canopy cover generally supports this ascertain in a number of areas. In other areas the lack of observation may be due in part to the distance of a box from occupied areas that will in time be overcome by gradual expansion of the population into these areas.

One of the key objectives of this project was to test the connectivity of Montmorency's wildlife corridors using Sugar Gliders as an indicator species for functional habitat connectivity. In this time these gliders have also become a bit of a flagship species for the community group. It is hoped that this increased awareness will assist in raising community awareness of the value of trees as fauna habitat through the area. It may further encourage the planting of suitable forage plants that provide a range of benefits to them and many other local fauna species.

While the Montmorency Biodiversity Group is able to monitor the nesting boxes for evidence of Sugar Gliders they can draw on only limited conclusions from the data as it is not possible to individually identify gliders and to track their movements. Whilst this is the case, their occupancy alone tells us a lot about the value of habitat in the area. Given the number of juvenile animals that have been observe across the area it is evident that habitat quality is suitable for a breeding population to occur. This indicates all of the required resources for this species are present.

Additional useful information on glider movement could be obtained by stag watching nesting boxes at dusk and following animals to observe their movement. This would best be undertaken during the week prior to a full moon so that the use of artificial lighting is minimised.

Using techniques such as individual recognition or radio tracking would enable us to broaden our understanding of the behaviour patterns of Sugar Gliders in Montmorency. With a careful design such a study could provide valuable information on the adequacy and locality of boxes, the connectivity between reserves and reliance on habitat connectivity provided by vegetation on private land. This project could make an ideal university project where students would have the backing and resources of a zoology department and the oversight of an ethics committee. The Montmorency Biodiversity Group, volunteers and residents have put the infrastructure in place for such a project.

The results from survey work undertaken to date clearly demonstrates that sugar gliders occur across the study area where connectivity exists and rely on the resources available from local habitat. Canopy connectivity provided by remnant and planted native vegetation is critical for them to persist in the local area. Ongoing monitoring of the boxes by both regular checking and stag watching will continue to increase our knowledge on their distribution and habitat reliance.

Mapping provided in this report when view with the survey results provides a clear indication of where important fauna habitat and connectivity persists. It illustrates how animals and moving through the area using existing vegetation. It also illustrates where likely gaps and barriers to connectivity occur. On the basis of these findings planning to increase habitat connectivity through strategic plantings and installation of crossing structures for roads and bridges could be undertaken. In particular it is evident that the Plenty River corridor is compromised by the bridge on Main Road (see figure 3). Opportunity exists here for the installation of structures to facilitate the movement of arboreal animals.

A number of potential crossing points along main road have been identified (see figures 4 & 5). The example provided in Figure 5 at the Diamond Creek is a very good representation of how an 'naturally treed' road crossing should look. Although not currently the case, in time, as trees grow, they will get to a point where canopies touch over the road. It is almost the case now.

The findings from this project are being should be further researched in order to build more comprehensive understanding and mapping of existing habitat connectivity and strategic enhancement requirements. In particular those areas where significant barriers exist, including Para Road, Main Road, Sherbourne Road and Bolton Street, should be identified in regional strategies for priority habitat enhancement works such as Aerial Rope Bridges, nesting box installation and enrichment plantings.

This project is being expanded to the north and south through the installation of 300 new boxes (see also Figure 2). The fauna habitat mapping provided in this report is currently being extended to cover these areas and will be provided in a revised report in 2020.

The survey findings and habitat connectivity mapping provided in this report should be used as a basis to inform planning decisions in the local area. Applications to remove native vegetation in Montmorency and surrounding areas ***must*** consider any report on the value or otherwise of specified vegetation, as stated under Schedule 1 to the Vegetation Protection Overlay.

On the basis of the findings presented in this report, any future application to remove native vegetation must demonstrate that it will not change the existing pattern of vegetation connectivity, landscape quality and ecosystem function for within the area. New applications for development in the area should clearly demonstrate both how faunal habitat values are being retained and enhanced to maintain connectivity through the landscape between Municipal and other Crown Land conservation reserves.