TeIN THE MATTER OF the Resource Management Act 1991

AND

IN THE MATTER OF private Plan Change 12 to the Waipa District Plan for the rezoning of Growth Cell T2 from 'deferred residential zone' to 'residential'

STATEMENT OF EVIDENCE OF DR ROBERT MARK BELLINGHAM

ECOLOGY

15 MARCH 2021

Introduction

1. My full name is Robert Mark Bellingham. I am a principal ecologist employed by Ecology New Zealand Ltd (ENZL), a specialist provider of ecological services across New Zealand.

2. I am an accredited Ecology Specialist with the EIANZ's[1] Certified Environmental Practitioner Scheme. I hold a PhD in Conservation Planning from Auckland University and I am a full member of the New Zealand Planning Institute. I have been a practicing ecological and planning consultant for over 25 years. My practice area has mainly been in the upper North Island.

3. I have appeared as an ecologist and planner before the Planning Tribunal/Environment Court and council plan reviews since 1986. The most recent major cases where I have appeared have been before the Independent Hearings Panel for the Auckland Unitary Plan, and then the Environment Court appeals on Rural Subdivision in the Auckland Unitary Plan.

4. I have assessed Significant Natural Areas (SNAs) for the Rodney District Council's Rodney Plan 2000 and I have assessed many additional sites in Auckland Region that have potentially met the SNA criteria through ecological restoration and regeneration of natural areas. I initiated the DOC Threatened Species assessment process when I was employed as Royal Forest & Bird Protection Society's Senior Planner in Wellington in 1990 and provided advice to DOC on these matters.

5. I have also lectured in Environmental Planning at Auckland and Massey Universities. I have served on the Ministerial Advisory Committees for the Review of Protected Area Legislation (1989-90), Oceans Policy (2002-4), and as an Auckland Regional Councillor.

[1] Environment Institute of Australia and New Zealand.

Code of Conduct

6. I have read and agree to comply with the Environment Court's Expert Witness Code of Conduct (Consolidated Practice Note 2014). This evidence is within my area of expertise, except where I state that I am relying on the evidence of other experts. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Scope of evidence

7. My evidence will cover:

   (a) The site's existing environment;

   (b) The methodology used in our investigations on site;

   c) The results of our investigations in relation to bats, birds and reptiles;

   d) My assessment of the likely adverse effects from an ecology perspective;

   e) Officer's report;

   f) Submissions.

8. I will be referring to the following reports:

   (a) Automatic acoustic long-tailed bat survey and potential ecological constraints. Prepared for Sanderson Group Ltd by Boffa Miskell, June 2020, attached at **Appendix 1**;

(b) Te Awamutu Bat Survey. Prepared for Sanderson Group Ltd by J Gollin & M Choromanski, Ecology NZ, February 2021 (survey dates 4-19 November 2020), attached at **Appendix 2**;

(c) Ecological Impact Assessment Frontier Rd, Te Awamutu. Prepared for Sanderson Group Ltd by Dr M Bellingham, Ecology NZ August 2020, attached at **Appendix 3**;

9. I have read and am familiar with the submissions, officer's report and the proposed changes to be made to the Waipa District Plan.

10. I have visited the site and prepared the Ecological Impact Assessment and advised on the November 2020 bat survey methodology.

Executive summary

11. The Boffa Miskell long-tailed bat survey of the site was conducted in May 2020 (Attachment 1) in suboptimal conditions for bats, as the night-time temperature dropped below 10°C on 13 of 23 survey nights. Boffa Miskell recommended repeat surveying between November and April.

12. A further bat survey was conducted by ENZL in November 2020 (Attachment 2). The second bat survey detected a higher number of bat passes than the May 2020 survey, as was expectant due to season. The results of the survey indicated that activity levels are comparatively low compared to areas in the Waikato where ENZL has detected much higher activity.

13. Neither the May 2020 survey nor the November 2020 resurvey indicated that the site was being used for roosting. The resurvey results support the Boffa Miskell conclusion that there are low levels of bat activity on-site and that long-tailed bats appear to be using the project site primarily for commuting.

14. The November 2020 survey has confirmed the presence of long-tailed bats at the site, but the level of bat activity is well below activity levels in other areas of the Waikato where higher activity has been detected by ENZL (Appendix 2, page 7).

15. ENZL also undertook observation and visual searches for other ecological values on the site, but the findings were limited and the effects on these values negligible.

Figure 1: Location of 12 ABM Stations at the site.

Existing Environment

16. The site is located between Pirongia and Frontier Roads, Te Awamutu, and is situated within the Waipa Ecological District of the Waikato Region. The land

cover is predominantly rye grass pasture, with two minor watercourses at the north and south of the site with predominantly exotic shrubland along these watercourses. There are very few indigenous or exotic trees on the site and they are mainly exotic species. There are four established residential dwellings and another in the process of being built on the northern part of the site.

Methodology

17. The Boffa Miskell survey, in May 2020, was outside of the optimal bat monitoring season (November to April) and could not provide robust results regarding the use of habitat features by long-tailed bats within the project site. Therefore, another acoustic bat survey was recommended by Boffa Miskell between November and April.

18. ENZL undertook this second survey and used the same number and type of ABMs as the first, placed in the same survey locations within the site, so the two surveys could be accurately compared. A total of 12 Automatic Bat Monitors (ABM; Department of Conservation model AR-4) were deployed across the project site targeting habitat features preferred by long-tailed bats (*Chalinolobus tuberculatus*) for roosting, commuting, and foraging.

19. In relation to reptiles on the site, visual searches were conducted by Ecology NZ in likely habitat around shelterbelts, shrubberies, gardens and buildings. The site is predominantly grazed dairy pasture of exotic grasses which generally is very low-quality habitat for reptiles and therefore further investigation was not necessary.

20. Bird presence was recorded by Ecology NZ from observer sightings and bird calls.

Results

21. In relation to bats, during the November 2020 survey, activity was recorded at only two of the 10 ABM (Automated Bat Monitors) Stations analysed, with a total of 63 bat passes recorded over the 15 nights. Almost all of the bat activity was located at ABM Station 1 (refer to Figure *1*), at the most southern end of the site and it recorded a total of 62 passes. One very faint bat pass was detected at ABM Station 9 (refer to Figure *1*) at the northern end of the site.

22. Only one feeding buzz was detected at ABM Station 1 (refer to Figure *1*), indicating that the area may provide some foraging habitat for bats. In general, all activity was recorded between 11pm and 2am indicating that this site may be predominately used for commuting.

23. None of the ABMs recorded activity within an hour of sunset or sunrise, providing no evidence that roosting is occurring on-site. Neither the May 2020 survey nor the November 2020 resurvey indicated that the site was being used for roosting. The resurvey results support the Boffa Miskell conclusion that there are low levels of bat activity on-site, restricted to particular areas of the site and that long-tailed bats appear to be using the project site primarily for commuting.

24. In relation to birds, the site has minimal habitat for indigenous bird species and only occasional common species, grey warbler and silvereye were recorded in shrub vegetation. However, a lack of vegetation diversity and habitat limits the diversity and abundance of indigenous bird species. No at-risk or threatened bird species were observed during the site walk over by Ecology New Zealand or Boffa Miskell and it is unlikely that any of these species would be more than transient visitors to the site.

25. Searches for reptiles across the T2 area found no sign of skinks or geckos. The habitat quality for lizards is generally poor due to historical vegetation removal

and high modification of the area. Overall, I observed minimal reptile habitat in the T2 area although it is possible that they are present in very low numbers.

Effects

26. The proposed change in land-use within the project site may impact the infrequent use of the site by long-tailed bats due to loss or degradation of commuting and/or potential foraging habitat and ongoing disturbance due to artificial light that may result in bats avoiding illuminated areas.

27. However, the impact can be addressed through site specific conditions at the land use consent stage of the project.

28. In particular, the proposed change in land-use could be addressed through the following actions:

    (a) Replacement of tree vegetation to retain a potential commuting route through the south-west edge of the site and enhancement of potential foraging habitat in the future stormwater pond and vegetation around the pond and adjacent reserve network; and

    (b) Minimising disturbance from artificial light sources around the stormwater pond and park locality by adopting street lighting standards that will minimise any adverse effects of light spill on long-tailed bat use.

29. These changes to site management could retain bat activity, and prevent a change in how the project site is used by bats or the complete avoidance of the project site by bats.

30. The proposed site changes and resulting urban development are likely to have minimal adverse effects on bird and reptile use of the site. Additional tree and

shrub vegetation on the site, including park and street trees could enhance habitat for common indigenous bird species. This is more appropriately addressed at the land use consent stage when detailed designs for the stormwater pond and adjacent reserve come before Council.

Officer's Report

31. I confirm that I have read the Officer's Report and have no disagreement or comments to make.

Submissions

32. I consider that the ecological investigations in Appendices 2 and 3 address submissions requesting further surveys of indigenous fauna on the site and the mitigation measures proposed in paragraph 28 address the findings of these additional ecological investigations.

Conclusions

33. I have addressed the ecological impacts of the plan change and addressed the submissions relevant to ecological matters. I conclude that there are no reasons why the proposed plan change could not be approved. Appropriate mitigation measures can be implemented through the subsequent resource consent phases.

Dr Mark Bellingham

15 March 2021

Appendix 1

Boffa Miskell report

Boffa Miskell

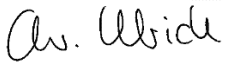
Te Awamutu Village

Automatic acoustic long-tailed bat survey and potential ecological constraints

Prepared for Sanderson Group

16 June 2020

Document Quality Assurance

Bibliographic reference for citation: Boffa Miskell Limited 2020. *Te Awamutu Village: Automatic acoustic long-tailed bat survey and potential ecological constraints*. Report prepared by Boffa Miskell Limited for Sanderson Group.		
Prepared by:	Dr Tine Ulrich Ecologist Boffa Miskell Limited	
Reviewed by:	Andrew Blayney Ecologist – Associate Principal Boffa Miskell Limited	
Status: Final	Version: 1.0	Issue date: 16 June 2020

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Cover photograph: Automatic acoustic bat monitor deployed on a poplar tree, © Andrew Blayney, 2020.

CONTENTS

1.0 Introduction

The Sanderson Group wish to obtain resource consent to develop property designated as T2 as a residential subdivision located between Pirongia and Frontier Roads in Te Awamutu. Boffa Miskell Limited (BML) was engaged to undertake an automatic acoustic bat survey and a high-level assessment of potential ecological constraints throughout the project site.

The scope of this technical report is:

- present the outcomes of an automatic acoustic bat survey that was undertaken to determine whether and how long-tailed bats are using habitat features present within the site envelope;
- provide a description of any non-bat ecological value present throughout the project envelope;
- detail a high-level summary of potential ecological constraints onsite; and
- provide options available for the management of potential effects of development.

2.0 Methods

2.1 Automated acoustic bat survey

A bat survey was undertaken using automatic bat monitors (ABMs) manufactured by the Department of Conservation (DOC) which passively record both, long-tailed bat (at 40 kHz) and short-tailed bat (at 28 kHz) echolocation calls on two concurrently operating frequency channels. The ABMs operate remotely by recording and storing each potential echolocation call (bat pass) along with the date and time of the occurrence of the potential bat pass.

The bat survey was conducted over 23 consecutive nights from 5 May to 28 May 2020. During this survey, 12 ABMs were deployed across the project site targeting habitat features preferred by long-tailed bats for roosting, commuting and foraging. Also targeted were areas that do not provide specific habitat features generally associated with long-tailed bats use, such as open pasture, to evaluate bat activity across the whole project site. The locations of the ABMs are presented in Appendix 1.

Long-tailed bat activity is influenced by overnight weather conditions such as temperature, rainfall, wind speed and moonlight (Ciechanowski et al., 2007; O'Donnell, 2000). Hourly weather data from the survey period was sourced from the nearest weather station available in New Zealand's National Climate database (Waikeria Ews, Station 41389 - approximately 13 km south-east to the project site; https://cliflo.niwa.co.nz/) and included temperature, rainfall, humidity and wind speed data.

Weather data was analysed to ensure weather conditions were suitable for bats to be active and therefore detectable via acoustic monitoring during the survey period. Suitable conditions are

henceforth referred to as ‘fine weather nights’; and are defined for the purpose of this survey report as follows[1] (Department of Conservation, 2019):

- Air temperature between 10°C and 17°C from sunset until four hours after sunset;
- Rainfall of no more than 2.5 mm occurs in the first two hours after sunset;
- No less than 70% humidity;
- Mean overnight wind speed does not exceed 20 km/h;
- Overnight wind gusts do not exceed 60 km/h; and
- Not during a full moon or on one night either side of a full moon.

All ABMs were set to have the same date and time settings and were programmed to monitor from one hour before sunset to one hour after sunrise[2].

All ABM recordings were downloaded and acoustic data from all fine weather nights was analysed using BatSearch 3.12, a programme designed by DOC for use with their ABMs. This software converts the potential bat echolocation calls (bat passes) into spectrograms that are visually analysed.

2.2 Other habitat values

In addition to the bat survey, a site walk-over was conducted on 5 May 2020 to identify any further habitat features across the project envelope such as native vegetation, waterways, wetlands, and potential lizard habitat.

[1] Conditions outlined by DOC in 2019: Pre tree-felling protocols

[2] Sunset and sunrise times were taken from the closest available location on the LINZ Sunrise/Sunset tables, see https://www.linz.govt.nz/sea/nautical-information/astronomical-information).

3.0 Results

3.1 Bat survey

Due to COVID-19 and the restrictions imposed during Alert Level 4, we were unable to conduct the bat survey at a more optimal time for bat surveying[3]. As such, this survey was undertaken during a later time period with a higher likelihood of sub-optimal weather conditions for bat activity and detection. To increase the likelihood of detection of bats, the survey was conducted for a total of 23 nights, as opposed the standard two week survey period (Sedgeley, 2012).

During the survey, the minimum temperature from sunset until four hours after sunset dropped below 10°C during 16 survey nights, and relative humidity was below 70% at the start of 13 survey nights. A summary of the weather conditions is shown in Appendix 2. No nights have been excluded from analysis for bat activity due to weather conditions. However, a full moon was observed on the third night of the survey; therefore, three nights from 6 May to 8 May were excluded from bat data analysis.

A total of 23 bat passes was recorded across all survey locations during the entire survey period. Bat activity was recorded at six out of the 12 survey locations, ranging from 0.05 ± 0.05 to 0.85 ± 0.60 average bat passes per night (± standard error of the mean [SEM]; Figure 1; Appendix 1 and 3). Bat activity was observed by the seepage area and ephemeral drain within the southern extent of the project site featuring large oak, poplar and acacia trees (ABM 1); by the pond towards the northern range of the site featuring large oak and poplar trees; and along the gully wetland vegetation, the driveway avenue and within the garden in the northern extent of the site featuring mature swamp cypress, willow, oak and other exotic trees (north of ABM 6) (Appendix 1).

The highest level of bat activity (0.85 ± 0.60 average bat passes per night) was recorded by the seepage area within the southern extent of the site (ABM 1: Figure 1; Appendix 1 and 3). ABMs that recorded at least one call, detected activity between one (5%) and two (10%) survey nights (Appendix 3).

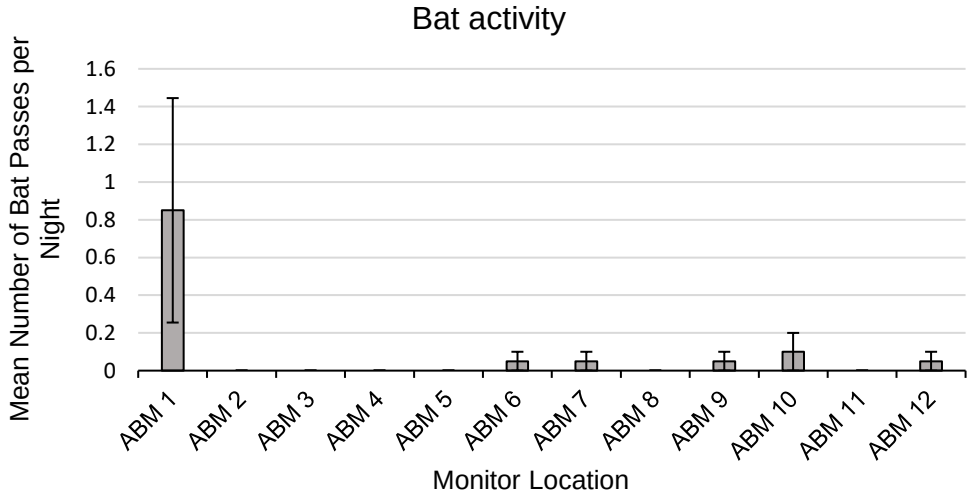


Figure 1. Average bat activity across the entire survey period (mean ± SEM) at each survey location.

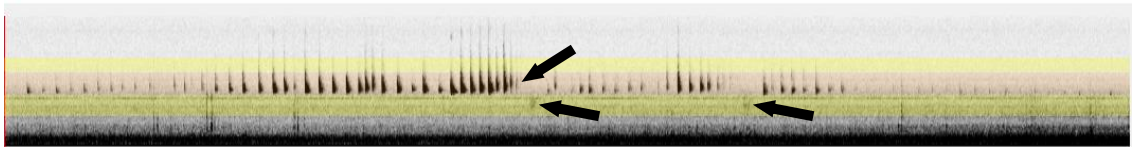
[3] The optimal season for bat monitoring is between November and April, when weather is optimal for bat activity and detection.

One potential feeding buzz call was recorded at ABM 10 by the northern border of the site (Figure 2).

No social calls were recorded during this survey, and no bat activity was detected within one hour of sunset or one hour of sunrise (this could indicate roosting nearby) at any of the monitored locations during this survey.

Temporal distribution of detected bat activity throughout the night for each survey location are provided in Appendix 4. All bat activity detected at ABM 1 occurred at the beginning of the night, while all bat passes recorded at all the northern ABM locations occurred within a 32-minute window on 13/05/2020. Within the 32-minute window there were two distinct flybys with detections occurring within two minutes of each other from ABM 6 to ABM 9, suggesting a single bat flying north from ABM 6. Approximately 30 minutes later detections at ABM 10 and 12 occurred within one minute of each other, suggesting a single bat heading either north or south[4].

A



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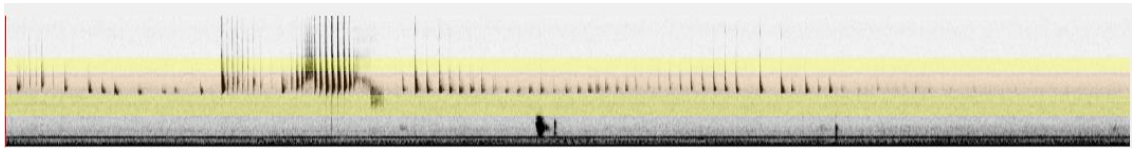

Figure 2. Recording of an echolocation call with potential feeding buzz characteristics, as indicated by the arrows (A). A clear confirmed feeding buzz recorded at a different site in the Waikato Region is provided for comparison (B). The red frequency band extends from 35 to 50 khz and indicates the frequency range of echolocation calls produced by long-tailed bats.

3.2 Avifauna (birds)

The current land-use within the project site is predominantly pasture for grazing cattle with a few areas of tall, mature vegetation dominated by exotic trees, several residential gardens, a pond, and two areas of wetlands/waterways. The bird species assemblage utilising the project area is likely to be a typical mix of common native and non-native species. No at risk or threatened bird species were observed during the site walk-over and it is unlikely that any at risk or threatened bird species would be anything more than rare and transient visitors to the site.

3.3 Herpetofauna (lizards)

The habitat quality for lizards throughout the site is generally poor due to historical vegetation removal and high modification of the area. Nonetheless, habitat suitable for the native copper skink (*Oligosoma aeneum*) (Not threatened (Hitchmough et al., 2016)) is present throughout the site. This native species is known to live in farmland and residential environments utilising habitats such as weedy areas, artificial and natural debris, rank grass, compost piles, and

[4] With three calls detected within 1 minute it is not possible to determine the distance of travel as ABMs time is set manually and variation is likely to be at least +/- 30 seconds.

residential gardens (Van Winkel et al., 2018). Likewise, plague skink (*Lampropholis delicata*), which is an exotic unwanted organism, are likely present within the project site.

Habitats suitable for copper skink are as follows (ABM locations have been used as reference points and are mapped in Appendix 1);

- ephemeral drain / seepage – complex dense vegetation, woody debris and rank grass surrounding ABM 1;
- residential gardens – debris, complex ground covers, compost piles and dense vegetation – locations near ABM 3 and 12; and
- pond and wetland/stream – debris, rank grass, complex vegetation – ABM 6 to 9.

3.4 Freshwater (waterways, wetlands, and fish)

In the south of the site in the ABM 1 area there is an ephemeral seep and drain that may periodically hold water for a short period of time but during heavy rain on 5 May was dry. Near ABM 6 there is a large pond and downstream of this is an ephemeral or intermittent waterway[5], with associated riparian wetland, flowing towards the Mangapiko stream.

Native fish species in the catchment that may be present in these habitats are longfin eel (At Risk – Declining), shortfin eel (Not Threatened), and black mudfish (At Risk - Declining). Threat status follows Dunn et al. (2018).

[5] Water flowing on the 5 May visit during heavy rain but not flowing on 28 May during dry weather. Visible channel that is sparsely vegetated.

4.0 Summary of ecological constraints

4.1 Bats

During the survey period, low levels of bat activity were observed. Long-tailed bats appear to be using the project site for infrequent commuting along the seepage area / ephemeral drain at the southern end of the site, as well as within the northern extent of the project site along the gully wetland, driveway avenue, garden area and farm pond. During this survey period, no activity was detected that would indicate roosting on site, and no clear evidence of foraging within the project envelope was observed.

Lower levels of bat activity are to be expected for surveys conducted during colder weather conditions outside the optimal bat monitoring season (November to April). Therefore, these survey results do not allow any conclusions about the level of bat activity and how habitat features throughout the site would be utilised by bats during more suitable weather.

The proposed change in land-use within the project site may potentially have an impact on long-tailed bats due to:

- loss of potential roost habitat;
- direct mortality of bats when trees occupied by bats are felled;
- additional habitat fragmentation in the context of the wider landscape due to the loss or degradation of commuting and/or potential foraging habitat; and
- ongoing disturbance due to artificial light that may result in bats avoiding illuminated areas.

These potential effects may lead to:

- decreased bat activity;
- a change in how the project site is utilised by bats; or
- the complete avoidance of the area encompassing the project site by bats.

The long-tailed bat is one of two native bat species remaining within New Zealand. It is classified as “Threatened – Nationally Critical” (O’Donnell et al., 2018) due to predation, habitat degradation and/or habitat loss.

Native bats are ‘absolutely protected’ under the Wildlife Act (1953), while bat habitat is protected under the Resource Management Act (1991). Correspondingly, our recommendations pertaining to the management of potential effects on long-tailed bats are outlined in Section 5.0.

4.2 Herpetofauna

Several areas of rank grass, woody debris, wetland and riparian zone as well as residential garden may be inhabited by the native copper skink. While this species is ‘Not Threatened’ (Hitchmough et al., 2016), all native lizard species are ‘absolutely protected’ under the Wildlife Act (1953) and any lizard habitat is protected by the Resource Management Act (1991).

The proposed change in land-use throughout the project site may impact any resident lizard population due to:

- loss of habitat; and
- direct mortality if vegetation inhabited by lizards is being removed.

4.3 Avifauna

Avifauna are not likely to pose a constraint to development in this area.

4.4 Freshwater

The pond and waterway downstream of the pond has potential to provide habitat for three species of native fish, two of which are At Risk – Declining. Development in the area may cause;

- loss of fish habitat;
- loss of wetland habitat; and
- direct mortality of native fish during stream works.

5.0 Recommendations

5.1 Bat management

Please see summarised below the options for the management of impacts on long-tailed bats due to the proposed land development and change in land-use.

Table 1. Bat management options

Effects management response option	Pros	Cons	Comment
Repeat automated survey during bat monitoring season between November and April	Provides more certainty toward whether and to what extent bats are utilising habitat features throughout the site for roosting and foraging.	Delay in project timeframes.	Recommended to get a more complete picture of long-tailed bat utilisation of the site. May not be feasible within project and consenting timeframe constraints.
Tree fell protocol	Effectively avoids the possibility of direct injury or mortality for bats.	Provides no mitigation for loss of habitat. Requires significant planning and staging for tree felling.	Required regardless of approach.
Potential roost tree retention.	Reduces effect profile of development.	Value of trees to bats uncertain – very low detected activity (however the survey was very late in the bat monitoring season and lower levels of activity were expected). If retained, the trees need to be buffered from disturbance and light as physical retention ≠ functional retention if bats avoid area because of development. No established standards for lighting, buffering, or setbacks in NZ. Therefore, difficult to establish retained value without requiring large setbacks from development. Not appropriate as an isolated solution (trees in middle of development). Lighting specialist required to model light impacts on retained habitat.	Health and viability of trees needs to be assessed. Only a response to roost habitat avoidance and not mitigation for loss of foraging habitat or commuting.

Effects management response option	Pros	Cons	Comment
Artificial roost boxes.	Relatively cheap compared to other options. Able to be added where larger trees remain or can be installed on poles.	Only potential mitigation for roost loss. Potentially very long lag time between establishment and occupancy. Significant variability in uptake and use so efficacy is unable to be predicted.	More appropriate as an enrichment to created or enhanced habitat than a standalone solution. Lag between effect and potential mitigation mean additional response required to mitigate for the time gap.
Targeted protection of known roosts in the wider landscape.	Effective mitigation with little lag between implementation and efficacy. Able to be carried out over small spatial scales. Long-term cost low.	Requires known, established maternity roost not currently under management. Significant cost and time in trying to identify roosts. Initial cost very high.	Would require survey of bat activity to identify hot spots, catching bats in that area and radio tracking back to roosts. Southern links in the Hamilton area took several years to achieve this and had known roosts/hot spots to initially trap.
Wider restoration of habitat features in the wider landscape.	More holistic approach to mitigation that provides wider benefits. Mitigation to target an area of known bat habitat. Proven efficacy of restoration and pest animal control at known roost sites if they exist. Less lag phase if roosts are already present.	No roost sites known in wider landscape and extremely difficult to identify. Requires permission from landowners and a long-term agreement/commitment of restoration works. Will require analysis and offset calculation to prove adequacy in quantum. Data currently available means significant uncertainties of parameters.	Response has the most likely efficacy but the minimum scale over which it would have to be implemented to be effective may be disproportionate to the scale of effects site development.

Effects management response option	Pros	Cons	Comment
Compensation via monetary payment to LTB conservation.	Provides less uncertainty once agreed.	No established quantum/scale of payment. Offset calculations and equivalent monetary values are not available for NZ species and biobanking approaches overseas are not transferable. Value of payment likely to be arrived at via agreement with interested parties. Last option in mitigation hierarchy and simply proposing as preferred option without exploring other possibilities isn't appropriate.	Will not be easy to resolve or reach agreement with interested parties. Only been proposed in other projects as a way to manage uncertainty and lag phase for mitigation approaches.

5.2 Herpetofauna

We recommend that prior to any construction activities and development impacting the identified potential lizard habitat areas a thorough survey of these areas is conducted to determine whether copper skinks are present and if so where. In areas where copper skinks are present, lizards can be captured and removed from the area, to be released at a nearby suitable site. Lizard capture is done utilising a combination of available survey and capture tools and methods including destructive habitat searches.

Undertaking lizard salvage works requires permission from DOC to catch, handle and release lizards. This is facilitated through a Wildlife Act Authority (WAA) application for this specific project. Processing time of a WAA application can be extensive, and we recommend submitting one well in advance of any lizard salvage work to be carried out on the project site.

5.3 Freshwater

We recommend that prior to any construction activities and development impacting the identified wetland and waterway habitats a thorough survey of the area is conducted to determine what native fish and present. In areas where native fish are detected within areas to be impacted, they can be salvaged and transferred to habitat outside of the impact footprint. To replace wetland habitats and fish habitat, an integrated stormwater and native habitat solution can be implemented to provide native fish habitat and wetland habitat within stormwater infrastructure. If parts of waterways are to be retained, these can also be restored and enhanced to provide high-quality habitat for native fish.

6.0 References

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Appendix 1: Automatic acoustic bat monitor locations and survey results

Boffa Miskell

www.boffamiskell.co.nz

0 200 m

1:4,500 A3

Data Sources: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Projection: NZGD 2000 New Zealand Transverse Mercator

BM200127 SANDERSON GROUP TE AWAMUTU VILLAGE

Bat Monitoring Results - May 2020

Date: 12 June 2020 | Revision: 0

Plan prepared for Sanderson Group by Boffa Miskell Limited

Project Manager: Jo.Soanes boffamiskell.co.nz | Drawn: JWa | Checked: ABI

Appendix 2: Bat survey weather data

Survey period: 05.05.2020 – 23.05.2020
Sunset: 5:26 p.m. (at the start of the survey) to 5:09 p.m. (at the end of the survey).
Sunrise: 7:04 a.m. (at the start if the survey) to 7:22 a.m. (at the end of the survey).
Full moon: 07.05.2020

Table 2. Weather data for the duration of the bat survey.

Survey night	Date	Time	Minimum Temperature (°C)	Precipitation (mm)	Relative Humidity (%)	Surface wind speed (km/hr)	Maximum wind gust (km/hr)
Night 1	05.05.2020	1700	11.4	0	76	5.8	12.2
		1800	9.4	0	81	8.6	15.1
		1900	8.4	0.6	87	4.7	28.1
		2000	7.4	0.2	93	3.2	12.2
		2100	6.3	0	96	4.3	9.4
		2200	5.3	0	98	2.5	6.1
		2300	5.3	2.6	100	7.9	18
	06.05.2020	0	7	3.2	100	5.8	15.1
		100	7	0	100	5.4	12.2
		200	7	0	98	5	11.9
		300	7.1	0	98	1.8	7.9
		400	6.4	0	97	8.3	15.1
		500	5.3	0.2	94	11.9	20.9
		600	4.8	0	95	10.8	18
		700	4.8	0	93	9.7	19.1
		800	5.4	0	88	11.2	24.8
Night 2	06.05.2020	1700	11.8	0	58	15.1	30.6
		1800	9	0	67	9	19.1
		1900	6.2	0	80	3.2	9.7
		2000	5.1	0	89	1.8	6.5
		2100	3.5	0	94	0.7	5
		2200	2.4	0	98	1.8	6.8
		2300	1.7	0	100	0.4	3.2
	07.05.2020	0	0.8	0	100	1.1	7.6
		100	0.4	0	100	0	1.4
		200	-0.1	0	100	0.4	2.5
		300	-0.3	0	100	1.1	4.3
		400	-0.5	0	100	0.4	3.2
		500	-0.2	0	100	1.8	5
		600	1.3	0	100	1.8	6.1
		700	2.4	0	100	1.1	4.7
		800	3.2	0	100	1.1	6.5
Night 3	07.05.2020	1700	14.7	0	75	2.9	10.8
		1800	12.1	0	80	2.9	10.8
		1900	11.1	0	85	2.2	8.3
		2000	11.3	0	86	3.2	11.2
		2100	12.1	0	85	2.5	9.4
		2200	11.4	0	88	1.8	7.9
		2300	11.6	0	91	2.9	7.9
	08.05.2020	0	10.2	0	92	2.2	9
		100	9.6	0	96	1.1	6.1
		200	10.2	0	96	2.2	11.5
		300	9.6	0	95	1.4	6.1
		400	9.1	0	97	1.8	11.5
		500	8.6	0	98	1.8	6.8
		600	7.5	0	99	1.4	6.1
		700	7.5	0	100	1.1	5

Survey night	Date	Time	Minimum Temperature (°C)	Precipitation (mm)	Relative Humidity (%)	Surface wind speed (km/hr)	Maximum wind gust (km/hr)
		800	7.8	0	100	1.1	4
Night 4	08.05.2020	1700	16.5	0	70	3.2	15.1
		1800	13.7	0	75	3.2	13.3
		1900	11	0	85	0.7	5.8
		2000	9	0	92	0	3.6
		2100	7.4	0	96	0.4	3.6
		2200	6.5	0	98	0.4	4
		2300	6.1	0	100	1.4	11.2
	09.05.2020	0	5.4	0	100	1.4	6.1
		100	5.1	0	100	0.7	5.4
		200	4.6	0	100	2.2	8.6
		300	5.1	0	100	1.4	5.8
		400	5.6	0	100	0.7	3.6
		500	5.3	0	100	0.7	3.2
		600	5.2	0	100	1.4	4
		700	4.8	0	100	4.7	7.9
		800	4.8	0	100	0.4	3.2
Night 5	09.05.2020	1700	16.4	0	64	0	2.9
		1800	12.2	0	80	0	0
		1900	9.3	0	90	0	2.2
		2000	7.8	0	95	0	0
		2100	6.6	0	97	0	4
		2200	6.3	0	99	0.7	3.6
		2300	6.1	0	100	0.7	4.7
	10.05.2020	0	5.9	0	100	1.8	5.4
		100	5.1	0	100	0.7	3.6
		200	4.8	0	100	2.5	7.6
		300	5	0	100	2.5	4.7
		400	7.2	0	100	4	7.2
		500	8.4	0	100	4	7.2
		600	8.5	0	100	3.6	8.6
		700	9	0	100	5.8	9.7
		800	9.2	0	100	4.7	9
Night 6	10.05.2020	1700	14.9	0	80	7.6	16.9
		1800	14.6	0	83	4	8.6
		1900	14	0	87	5	7.6
		2000	13.8	0	86	3.6	8.6
		2100	13.4	0	87	0.7	4
		2200	13	0	89	2.2	5.8
		2300	12.7	0	92	1.8	8.3
	11.05.2020	0	12.4	0	94	0	2.9
		100	12.1	0	96	0.4	3.6
		200	11.5	0	96	2.2	6.8
		300	11.6	0	93	6.1	11.9
		400	12.2	0	88	5.8	10.4
		500	12.2	0	86	2.5	5.8
		600	12	0	87	1.8	4.7
		700	11.3	0	91	0.4	3.6
		800	11	0	93	1.8	6.1
Night 7	11.05.2020	1700	15.5	0	60	4.3	8.6
		1800	10.9	0	74	0.4	2.9
		1900	9.9	0	89	1.1	12.6
		2000	8.3	0	93	1.1	5
		2100	7	0	95	0.7	3.6
		2200	5.7	0	97	0.4	3.2
		2300	4.7	0	99	1.8	5.4
	12.05.2020	0	4.7	0	100	4.3	7.2
		100	4.6	0	100	2.2	6.8
		200	4.1	0	100	1.1	4.7
		300	4.9	0	100	1.4	8.3
		400	6.4	0	100	4.3	9

Survey night	Date	Time	Minimum Temperature (°C)	Precipitation (mm)	Relative Humidity (%)	Surface wind speed (km/hr)	Maximum wind gust (km/hr)
		500	6.3	0	99	4.7	8.6
		600	5.9	0	99	2.2	7.2
		700	6.1	0	98	2.2	6.1
		800	6.9	0	98	2.5	11.2
Night 8	12.05.2020	1700	14.5	0	68	7.2	14.8
		1800	11.8	0	75	5	8.6
		1900	10.8	0	82	6.1	14.8
		2000	10.5	0	85	6.1	10.8
		2100	10.8	0	86	6.5	11.2
		2200	12	0	84	7.2	11.5
		2300	11.4	0	85	6.1	10.4
	13.05.2020	0	11.5	0	84	5	11.9
		100	9.2	0	83	8.6	13.7
		200	8.1	0	86	6.8	12.2
		300	6.7	0	88	2.5	6.1
		400	7	0	94	1.8	6.1
		500	6.1	0	94	0	4
		600	5.3	0	96	4	9.4
		700	5.6	0	90	9	14.8
		800	6.5	0	88	4	10.8
Night 9	13.05.2020	1700	14.7	0	63	8.6	20.2
		1800	10.8	0	75	0	3.2
		1900	8.4	0	88	1.1	5.8
		2000	7.3	0	93	0	0
		2100	6.7	0	96	0.7	4.3
		2200	6.9	0	98	3.6	9.4
		2300	7.8	0	96	4	9
	14.05.2020	0	6.4	0	95	1.8	7.2
		100	5.7	0	98	1.4	5.4
		200	4.7	0	98	1.8	7.9
		300	4.1	0	99	2.2	5.8
		400	3.6	0	100	4	8.3
		500	3.1	0	100	1.4	8.3
		600	2.4	0	100	1.1	5
		700	2.5	0	100	1.8	4.7
		800	2.6	0	100	0.4	3.2
Night 10	14.05.2020	1700	14.8	0	65	2.2	9
		1800	11.1	0	81	0.7	3.6
		1900	8.7	0	90	0	0.7
		2000	7	0	95	0	0
		2100	5.9	0	97	0	0
		2200	5	0	99	0	0
		2300	4.5	0	100	0	0.4
	15.05.2020	0	4.1	0	100	2.9	6.8
		100	3.4	0	100	2.5	6.5
		200	3.2	0	100	1.4	4.7
		300	3.1	0	100	1.1	6.5
		400	3	0	100	1.8	5.4
		500	2.2	0	100	1.4	5.8
		600	2	0	100	1.4	5
		700	1.5	0	100	1.8	5
		800	1.6	0	100	1.8	5
Night 11	15.05.2020	1700	13.6	0	75	1.8	5.8
		1800	11	0	84	1.1	4.7
		1900	9.6	0	90	0.4	2.5
		2000	8.3	0	94	0.4	4.3
		2100	7.4	0	96	0.4	4.7
		2200	7.3	0	98	1.1	4.7
		2300	6.9	0	99	0	0
	16.05.2020	0	6	0	99	0	0
		100	5.7	0	100	0	0

Survey night	Date	Time	Minimum Temperature (°C)	Precipitation (mm)	Relative Humidity (%)	Surface wind speed (km/hr)	Maximum wind gust (km/hr)
		200	5.7	0	100	0	0
		300	6	0	100	1.8	5.4
		400	6.1	0	100	1.8	5.8
		500	5.7	0	100	2.2	5.4
		600	5.3	0	100	1.8	5.4
		700	4.4	0	100	1.4	4
		800	4.1	0	100	1.8	4.3
Night 12	16.05.2020	1700	15	0	63	6.8	14.4
		1800	12.2	0	70	3.6	9.4
		1900	9.4	0	81	2.9	13
		2000	9.6	0	82	11.2	17.6
		2100	9.8	0	76	6.1	15.5
		2200	9.1	0	81	6.8	15.5
		2300	8.4	0	86	1.4	6.1
	17.05.2020	0	6.5	0	87	0.7	4
		100	5.3	0	94	1.4	6.8
		200	4.1	0	97	1.4	6.1
		300	3.2	0	99	2.2	7.2
		400	2.8	0	100	1.4	5
		500	2.3	0	100	0.7	4
		600	1.9	0	100	0.7	4.7
		700	1.7	0	100	0	0
		800	1.7	0	100	0.7	4.7
Night 13	17.05.2020	1700	14.9	0	60	8.3	16.2
		1800	11.8	0	73	5.8	9.4
		1900	8.4	0	82	1.1	5
		2000	7.6	0	90	6.5	16.2
		2100	8.4	0	87	8.3	13
		2200	8.2	0	88	8.3	15.8
		2300	8	0	85	6.8	14.8
	18.05.2020	0	6.5	0	90	5.8	9.7
		100	4.7	0	88	2.9	6.5
		200	3.7	0	95	1.8	5.8
		300	2.7	0	98	1.4	4.3
		400	1.5	0	100	0.7	4
		500	1	0	100	0.4	4.7
		600	0.1	0	100	1.1	7.6
		700	-0.1	0	100	0.7	6.5
		800	0.3	0	100	1.4	5
Night 14	18.05.2020	1700	14.7	0	63	1.8	10.8
		1800	9.7	0	75	0	2.9
		1900	6.9	0	88	0.4	4.7
		2000	5.4	0	94	0	0.4
		2100	4.3	0	97	0.4	4.7
		2200	3.4	0	99	0.4	3.6
		2300	3.4	0	100	0.7	4
	19.05.2020	0	4.2	0	100	1.8	7.2
		100	4.5	0	100	0.7	4.7
		200	4.7	0	100	1.8	5.4
		300	4.9	0	100	0.7	5
		400	3.2	0	100	1.1	5.4
		500	2.2	0	100	1.8	5.4
		600	1.5	0	100	0.4	3.6
		700	1.2	0	100	0.4	3.2
		800	1.1	0	100	2.2	7.2
Night 15	19.05.2020	1700	15.3	0	61	2.9	9.4
		1800	12	0	69	6.1	15.5
		1900	10.8	0	70	9	16.6
		2000	9.4	0	71	9	16.6
		2100	6.4	0	75	6.5	14.4
		2200	5.1	0	88	9.4	14.4

Survey night	Date	Time	Minimum Temperature (°C)	Precipitation (mm)	Relative Humidity (%)	Surface wind speed (km/hr)	Maximum wind gust (km/hr)
		2300	4.3	0	86	2.5	12.2
	20.05.2020	0	2.4	0	92	1.4	5.4
		100	1.7	0	96	3.6	11.9
		200	2.2	0	92	9.4	17.3
		300	0.6	0	91	1.8	6.1
		400	-0.6	0	96	0.7	4.7
		500	-1.5	0	99	1.8	5.4
		600	-1.7	0	100	0.4	3.2
		700	-2.1	0	100	0.4	3.6
		800	-2.1	0	100	1.1	6.1
Night 16	20.05.2020	1700	11.4	0	51	0.7	3.2
		1800	5.7	0	69	0	3.2
		1900	2.8	0	86	0	3.2
		2000	0.9	0	93	1.1	5.4
		2100	0.2	0	97	0	2.2
		2200	-0.5	0	99	1.1	4.7
		2300	-1.1	0	100	0.7	2.9
	21.05.2020	0	-1.7	0	100	1.1	5.4
		100	-1.9	0	100	2.2	5.4
		200	-2.1	0	100	2.9	5.8
		300	-2.3	0	100	3.6	6.5
		400	-2.3	0	100	2.5	5
		500	-2.7	0	100	2.2	5.8
		600	-3.1	0	100	1.8	5.4
		700	-3.4	0	100	1.8	4.7
		800	-3.3	0	100	2.2	5
Night 17	21.05.2020	1700	12.6	0	57	0.7	4.7
		1800	6.2	0	76	0.7	3.6
		1900	3	0	89	1.1	5.8
		2000	1.3	0	94	0	0
		2100	0.3	0	98	0	0
		2200	-0.7	0	100	1.4	5.4
		2300	-1.3	0	100	1.8	4.7
	22.05.2020	0	-1.8	0	100	1.8	6.5
		100	-2	0	100	2.2	5.8
		200	-2	0	100	2.2	5.8
		300	-2.6	0	100	1.8	5.4
		400	-2.6	0	100	2.2	5.4
		500	-2.6	0	100	1.8	4.7
		600	-2.8	0	100	4	7.2
		700	-2.6	0	100	3.2	8.3
		800	-2.7	0	100	2.5	8.3
Night 18	22.05.2020	1700	12.6	0	59	0.4	4
		1800	6.9	0	76	0	2.9
		1900	3.6	0	90	1.1	5
		2000	2.2	0	95	0.4	5.8
		2100	1	0	98	0.7	4.3
		2200	-0.1	0	100	0.4	2.9
		2300	-1.1	0	100	0.4	3.2
	23.05.2020	0	-1.5	0	100	0.4	3.6
		100	-1.9	0	100	0	0
		200	-2.7	0	100	0.4	2.9
		300	-2.8	0	100	0.4	2.9
		400	-3.6	0	100	0.4	2.5
		500	-3.9	0	100	0.7	2.5
		600	-4	0	100	0.4	2.2
		700	-4	0	100	0	0
		800	-4	0	-	0	0
Night 19	23.05.2020	1700	8.4	0	81	2.2	7.6
		1800	6.3	0	88	0.7	4.3
		1900	4.4	0	93	0.4	4

Survey night	Date	Time	Minimum Temperature (°C)	Precipitation (mm)	Relative Humidity (%)	Surface wind speed (km/hr)	Maximum wind gust (km/hr)
		2000	3	0	97	0.4	3.6
		2100	2.7	0	99	1.4	5
		2200	2.7	0	100	1.1	5
		2300	2.8	0	98	6.1	22
	24.05.2020	0	7.1	0	83	6.1	18.4
		100	5.7	0	88	2.9	9
		200	4.8	0	94	3.2	9
		300	4.8	0	95	7.2	17.6
		400	5.7	0	94	4.3	7.9
		500	6.1	0	91	6.8	20.5
		600	9.7	0	79	13	22.3
		700	9.8	0	80	11.2	20.5
		800	10	0	79	13	24.1
Night 20	24.05.2020	1700	12.7	0.6	92	11.9	24.1
		1800	12.6	0.2	95	10.1	17.3
		1900	12.8	0.4	97	7.2	11.9
		2000	13.2	0.4	99	7.9	14.4
		2100	14.6	0.4	97	5.4	13.3
		2200	14.9	1.4	97	10.1	19.8
		2300	15.1	0.2	94	10.4	20.5
	25.05.2020	0	15.6	0	88	13.3	28.1
		100	15.2	0.2	91	9.4	22
		200	14.8	0.8	93	10.4	21.6
		300	14.6	0.8	94	10.8	26.3
		400	14.6	1.8	95	10.4	20.9
		500	14.6	1.6	98	16.9	30.6
		600	15.4	0	96	20.9	40.7
		700	16.4	0.2	96	19.4	34.9
		800	16.4	0.2	98	15.5	26.6
Night 21	25.05.2020	1700	16	0	92	4.3	14.4
		1800	15.3	0	92	4	13
		1900	14.9	0	93	5	15.5
		2000	13.8	0	95	1.1	5.8
		2100	13.4	0	97	0.4	3.6
		2200	12.5	0	98	1.8	5.4
		2300	10.8	0	98	0.7	4
	26.05.2020	0	10.4	0	99	0.4	3.2
		100	10.4	0	99	0.4	5.4
		200	10.7	0	100	1.4	5.4
		300	10.4	0	100	1.8	7.2
		400	10.4	0	100	1.4	5.4
		500	10.2	0	100	2.5	5.8
		600	10.2	0	100	1.4	4.3
		700	9.6	0	100	1.4	5
		800	9	0	100	2.5	6.1
Night 22	26.05.2020	1700	14.8	0	73	9	16.2
		1800	14.3	0	77	9	17.3
		1900	13.4	0	79	10.1	19.4
		2000	13.3	0	78	10.8	22
		2100	11.8	0	79	11.9	20.5
		2200	10.7	0	82	9	14.8
		2300	11	0	80	9	17.3
	27.05.2020	0	10.6	0	82	7.6	14
		100	9.9	0.4	91	9.7	15.1
		200	9.7	0.2	91	9	16.2
		300	9.9	0	85	7.6	18.7
		400	10	0	86	5.8	13
		500	10	0	81	7.9	15.1
		600	9.8	0	81	7.9	16.2
		700	9.7	0	79	5	14
		800	9.7	0	77	9.4	18.7

Survey night	Date	Time	Minimum Temperature (°C)	Precipitation (mm)	Relative Humidity (%)	Surface wind speed (km/hr)	Maximum wind gust (km/hr)
Night 23	27.05.2020	1700	11.2	0	76	4	8.3
		1800	8.6	0	85	3.6	5.8
		1900	7	0	92	1.1	4.7
		2000	5.5	0	96	0.4	4.7
		2100	4.3	0	98	0.4	4.3
		2200	3.7	0	100	0.7	3.2
		2300	3.9	0	100	7.2	12.6
	28.05.2020	0	5.8	0	100	5.8	11.9
		100	4.9	0	99	4	11.9
		200	4.7	0	99	5	9.4
		300	3.7	0	99	2.9	6.5
		400	3.1	0	100	2.2	5.4
		500	2.6	0	100	2.9	6.5
		600	2	0	100	1.4	5.4
		700	1.2	0	100	0.4	2.2
		800	1.2	0	100	2.2	5

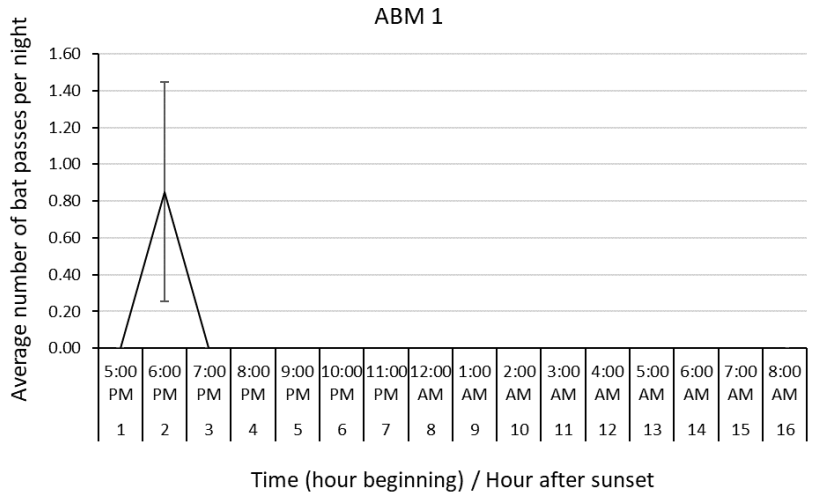
Appendix 3: Bat survey result

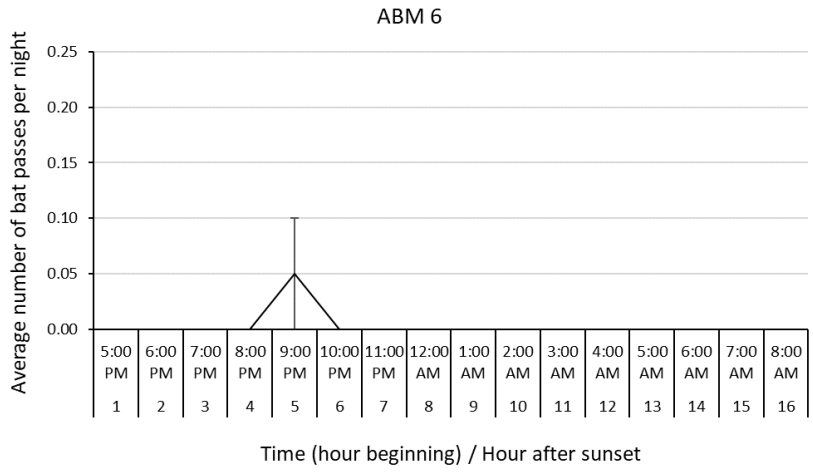
Table 3. Bat survey information and results summary.

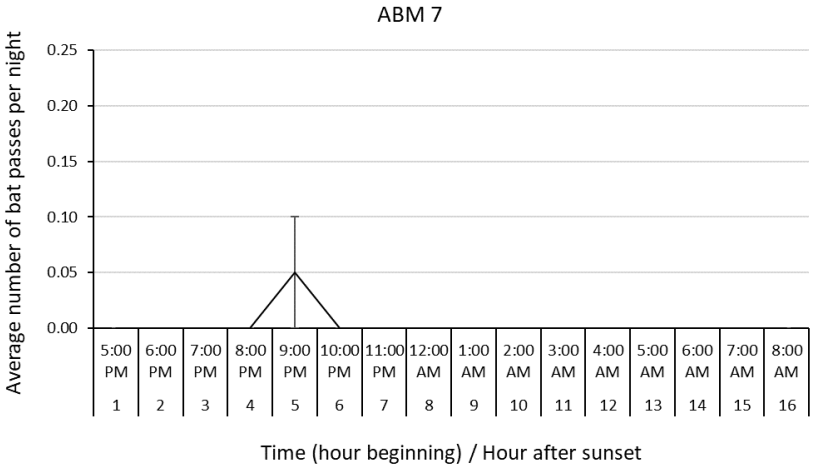
ABM Location	ABM ID	Date ABM set	Nights deployed	Nights analysed	Total No. of Bat Passes	Mean No. of Bat Passes per Night (± SEM)	# Nights Where Bat Activity Detected	% of Nights with Bat Passes
ABM 1	Ham_ABM_6	05.05.2020	23	20*	17	0.85 ± 0.60	2	10.0
ABM 2	Ham_ABM_8				0	0.00 ± 0.00	0	0.0
ABM 3	Ham_ABM_5				0	0.00 ± 0.00	0	0.0
ABM 4	Ham_ABM_1				0	0.00 ± 0.00	0	0.0
ABM 5	Ham_ABM_2				0	0.00 ± 0.00	0	0.0
ABM 6	Ham_ABM_10				1	0.05 ± 0.05	1	5.0
ABM 7	Ham_ABM_4				1	0.05 ± 0.05	1	5.0
ABM 8	Ham_ABM_12				0	0.00 ± 0.00	0	0.0
ABM 9	Ham_ABM_11				1	0.05 ± 0.05	1	5.0
ABM 10	W21				2	0.10 ± 0.10	1	5.0
ABM 11	Ham_ABM_9				0	0.00 ± 0.00	0	0.0
ABM 12	Ham_ABM_7				1	0.05 ± 0.05	1	5.0

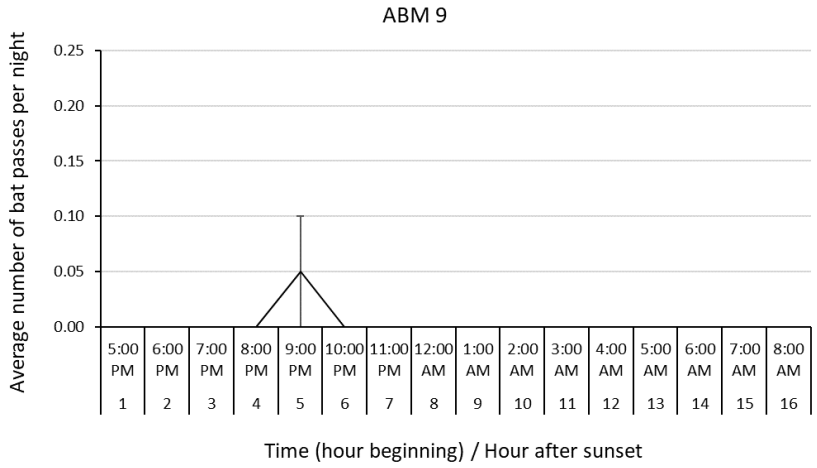
*three nights were excluded from analysis due to a full moon on 7 May 2020

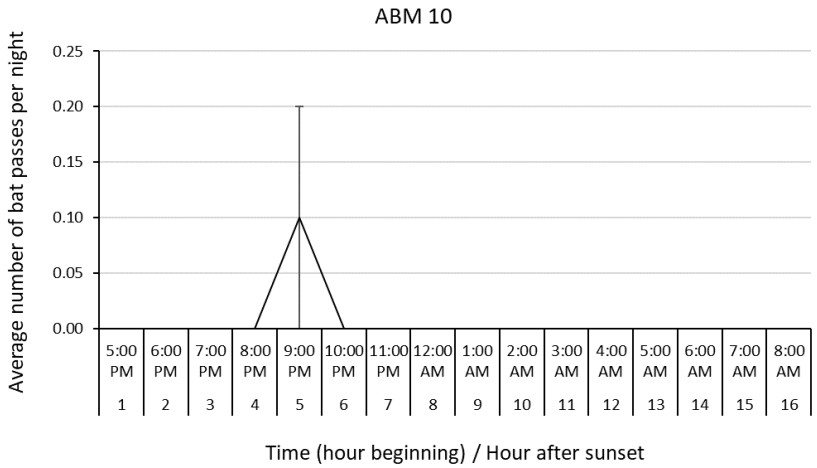
Appendix 4: Temporal distribution of average bat activity throughout the night (± standard error)

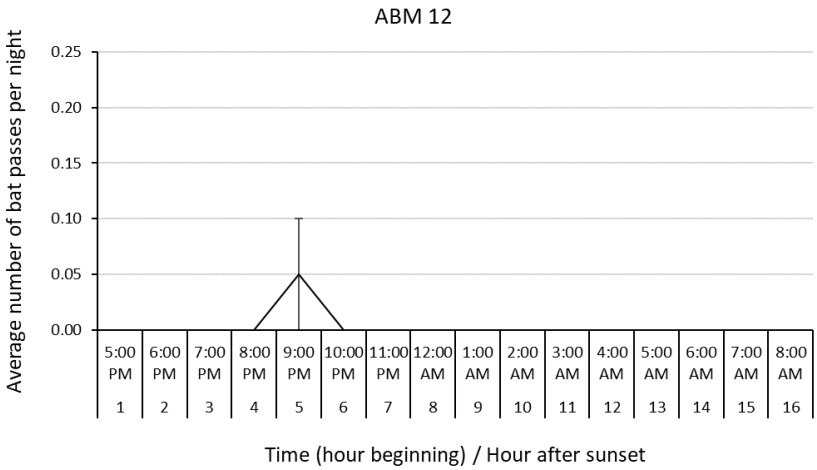







ABM 9
Average number of bat passes per night
0.25
0.20
0.15
0.10
0.05
0.00
5:00 PM 1
6:00 PM 2
7:00 PM 3
8:00 PM 4
9:00 PM 5
10:00 PM 6
11:00 PM 7
12:00 AM 8
1:00 AM 9
2:00 AM 10
3:00 AM 11
4:00 AM 12
5:00 AM 13
6:00 AM 14
7:00 AM 15
8:00 AM 16
Time (hour beginning) / Hour after sunset


ABM 10
Average number of bat passes per night
0.25
0.20
0.15
0.10
0.05
0.00
5:00 PM 1
6:00 PM 2
7:00 PM 3
8:00 PM 4
9:00 PM 5
10:00 PM 6
11:00 PM 7
12:00 AM 8
1:00 AM 9
2:00 AM 10
3:00 AM 11
4:00 AM 12
5:00 AM 13
6:00 AM 14
7:00 AM 15
8:00 AM 16
Time (hour beginning) / Hour after sunset


ABM 12
Average number of bat passes per night
0.25
0.20
0.15
0.10
0.05
0.00
5:00 PM 1
6:00 PM 2
7:00 PM 3
8:00 PM 4
9:00 PM 5
10:00 PM 6
11:00 PM 7
12:00 AM 8
1:00 AM 9
2:00 AM 10
3:00 AM 11
4:00 AM 12
5:00 AM 13
6:00 AM 14
7:00 AM 15
8:00 AM 16
Time (hour beginning) / Hour after sunset

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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Appendix 2

Ecology New Zealand report

Ecology New Zealand Limited
9F Beatrice Tinsley Crescent
Albany
Auckland
Email: info@ecologynz.nz

MEMORANDUM

Attention: John Oliver
Bloxam Burnett & Olliver
PO Box 9041, Hamilton 3240

Date: 9 December 2020

From: Jennifer Gollin

Re: 20039.2-001.Rev0 – Te Awamutu Bat Survey November 2020

1. INTRODUCTION

Ecology New Zealand Limited (ENZL) was commissioned on behalf of Bloxam Burnett & Olliver (BBO) to carry out a supplementary native bat surveys for the proposed Plan Change T2 at Frontier and Pirongia Roads, Te Awamutu (the 'site'). This memorandum summarises information on bio-acoustic survey methods and results of the works undertaken in November 2020. These works are being carried out due to the proposed change in land-use and land development within the project site potentially having an impact on local bat populations.

1.1. Context

These survey works were carried out based on the recommendations outlined in the "Te Awamutu Village – Automatic acoustic long-tailed bat survey and potential ecological constraints" report prepared by Boffa Miskell (June 2020). These recommendations state that an acoustic survey for bats should be repeated between November and April to truly determine whether and to what extent bats are utilising habitat features throughout the site for roosting and foraging.

The bat management works described in this memorandum was overseen by ENZL Senior Ecologist, Marc Choromanski, who is recognised by the Department of Conservation as a Level D Competent bat ecologist.

2. PREVIOUS SURVEY RESULTS

In May 2020, Boffa Miskell carried out a bat survey over 23 consecutive nights (5th of May to the 28th of May 2020). A total of 12 Automatic Bat Monitors (ABM; Department of Conservation model AR-4) were deployed across the project site targeting habitat features preferred by long-tailed bats (*Chalinolobus tuberculatus*) for roosting, commuting, and foraging (Figure

1). Areas were also targeted that do not provide specific habitat features, such as open pasture, to evaluate bat activity across the whole project site.

A total of 23 bat passes were recorded across all survey locations during Boffa Miskell's survey, with bat activity recorded at 6 of the 12 survey locations (Figure 1). The highest level of bat activity was associated with ABM Station 1 which occurred by the seepage area and ephemeral drain within the southern extent of the project site, with the remaining activity recorded at the Northern end of the site (Figure 1). One potential feeding buzz was recorded at ABM Station 10 at the northern border of the site. No social calls were recorded during this survey and no bat activity was detected within one hour of sunset or one hour of sunrise which could indicate roosting behaviour on-site.

The results of the May 2020 survey suggest that there are low levels of bat activity on-site and that long-tailed bats appear to be using the project site primarily for infrequent commuting. This commuting being documented along the seepage area/ephemeral drain at the southern end of the site, and within the northern extent of the project site along the gully, wetland, driveway avenue, garden area and farm pond[1].

This survey was outside of the optimal bat monitoring season (November to April) and could not provide robust results regarding the use of habitat features by long-tailed bats within the project site. Therefore, another acoustic bat survey was recommended between November – April. This survey utilised the same number and type of ABMs, placed in the same survey locations within the site, so the two surveys could be accurately compared.

3. METHODOLOGY

This supplementary bat survey undertaken by ENZL used AR-4 model ABMs to record ultrasonic echolocation calls emitted by bats. ABMs record and store data passively and remotely and have the capacity to record both long-tailed (40kHz) and lesser short-tailed (*Mystacina tuberculata*; 28kHz) bat calls at a range of up to approximately 40m[2]. The ABMs operate remotely by recording and storing each potential echolocation call (bat pass) along with the date and time of the bat pass.

The bat survey was conducted during November 2020 and ABMs were deployed at fixed locations throughout the project footprint (Figure 1; Figure 2).

ABMs were programmed to record from one hour before sunset to one hour after sunrise every night. Long-tailed bat activity is influenced by overnight weather conditions such as temperature, rainfall, wind speed and moonlight[3], therefore weather data from the survey period was analysed to ensure conditions were suitable. Hourly weather data during the survey period was sourced from the nearest weather station available in New Zealand's National Climate Database (Waikeria Ews; 41389) and included temperature, rainfall, humidity and windspeed data. Suitable weather conditions for bat activity are defined as[3].

- Air temperature between 10°C and 17°C from sunset until four hours after sunset
- Rainfall no more than 2.5mm in first two hours after sunset
- No less than 70% humidity
- Mean overnight wind speed does not exceed 20km/h

[1] Boffa Miskell, 2020. Te Awamutu Village – Automatic acoustic long-tailed bat survey and potential ecological constraints.

[2] Department of Conservation, 2012. Bats: Counting away from roosts – automatic bat detectors

[3] O'Donnell CFJ 2000. Influence of season, habitat, temperature and invertebrate availability on nocturnal activity of the New Zealand long-tailed bat (*Chalinolobus tuberculatus*). New Zealand Journal of Zoology, 27:3, 207-221.

- Overnight wind gusts do not exceed 60km/h
- Not during a full moon or on one night either side of full moon

The data recorded on the ABMs was analysed by a Level B DOC recognised bat ecologist, using BatSearch Version 3.11 software which is a developed by DOC for use with their ABMs. The data from this programme was then entered into a specific ENZL bat processor which outputs results relating to mean bat passes, total bat passes and activity within hours after sunset. The data is further analysed with regards to date and time of bat passes to determine the timing of activity across the site and the occurrence of feeding buzzes[4] was also noted.

[4] When long-tailed bats capture flying insects, they increase the frequency of their echolocation 'clicks' as they home in on prey. This unique type of echolocation call can be identified on the spectrograms.

Figure 1: Location of 12 ABM Stations at the site.

Figure 2: Representative ABM placement within tree along a pond at ABM Station 6.

Figure 3: Representative ABM placement on steel waratahs where tree was not present at ABM Station 5.

4. RESULTS

During the deployment of ABMs, one ABM device malfunctioned, therefore this was not placed on-site, and only 11 of 12 fixed survey sites were surveyed. The ABM located at Station 5, was placed on a 1.65m high steel waratah post as the original tree had been felled. A waratah was used in place in order to keep the locations consistent (Figure 3).

ABMs were deployed between 4th of November to 19th of November 2020. Over these 15 days, the minimum temperature was 7.8°C and three of the survey nights had more than 2.5mm of rainfall within 2 hours of sunset. This allowed for the analysis of 12 valid survey nights of this 15-day monitoring session which was deemed appropriate for comparison to previous data. A two-week survey period is recommended for accurate analysis of bat activity during the optimal bat monitoring season (November to April). To increase the likelihood of detection of bats outside of the optimal monitoring season Boffa conducted a survey for a total of 23 nights in May to increase the likelihood of optimal weather conditions which was not deemed necessary for the ENZL survey in November. On the 19th of November, it was discovered that one ABM was missing and only data from 10 ABM stations were analysed. No data is available during this monitoring session for ABM Station 02 and 08.

During the monitoring session, activity was recorded at only two of the 10 ABM Stations analysed, with a total of 63 bat passes recorded. ABM Station 1 (Figure 1) which was positioned at the most southern end of the site, recorded a total of 62 passes which was the highest for the site during this monitoring session. One bat pass was detected at ABM Station 9 (Figure 1)

which was positioned at the northern end of the site. The bat pass recorded at ABM Station 9 was very faint but due to the clear bat passes detected at ABM Station 1 it was assumed that this was a definite long-tailed bat pass.

None of the ABMs recorded activity within an hour of sunset or sunrise, providing no clear evidence that roosting is occurring on-site. Only one feeding buzz was detected at ABM station 1 (Figure 4), indicating that the area may provide some foraging habitat for bats. In general, all activity was recorded between 11pm and 2am indicating that this site may be predominately used for commuting (Table 1; Figure 5).

Figure 4: Definite feeding buzz detected at ABM Station 01.

Table 1: Summary of Bat Activity recorded by ABM Stations.

ABM Station Number	Total Passes	Mean Bat Passes	Feeding Buzzes	Activity within One Hour of Sunset	Activity within One Hour of Sunrise
01	62	5.17	1	x	x
03	0	0	0	x	x
04	0	0	0	x	x
05	0	0	0	x	x
06	0	0	0	x	x
07	0	0	0	x	x
09	1	0.08	0	x	x
10	0	0	0	x	x
11	0	0	0	x	x
12	0	0	0	x	x
Total	**63**	**5.25**	**1**	**0/10**	**0/10**

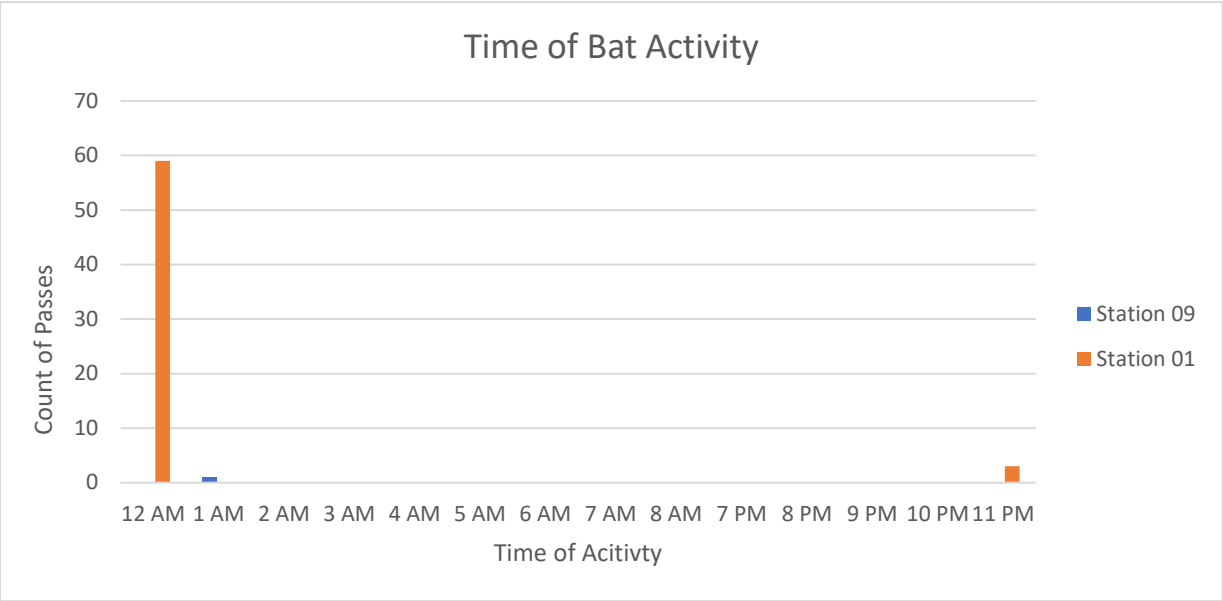


Figure 5: Graph representing time of bat activity during monitoring session across two ABM stations.

5. DISCUSSION

The results of the November 2020 survey indicated that bat activity occurs across the site in more than one season, and activity predominately occurred at the southern end of the site during November. Total bat passes were expectantly higher during the 2020 November survey compared to the May 2020 (63 bat passes vs 23 bat passes), however passes only occurred at two of 10 ABM stations (20%) during the ENZL survey compared to six of 12 ABM stations (50%) during the Boffa survey. These activity levels are comparatively low to areas in the Waikato where ENZL has detected high activity (>200 bat passes per night)[5].

The highest level of activity was in the same location during both surveys, at ABM Station 1. During the May survey, Boffa Miskell detected one potential feeding buzz at the northern border of the site at ABM Station 10, while ENZL detected a clear feeding buzz at the southern end of the site at ABM Station 1. No bat activity was recorded within one hour of sunset or one hour of sunrise during either the May or November surveys.

The surveys carried out in May and November 2020 confirmed that bats are within the site, though activity is relatively low and restricted to particular areas. As suggested within the Boffa Miskell Ltd report[6], surveys during more optimal times[7] did result in higher levels of activity detected.

Neither survey indicated that the site was being utilised for roosting. These results provide further evidence to support Boffa Miskell conclusion that there are low levels of bat activity on-site and that long-tailed bats appear to be using the project site primarily for infrequent commuting.

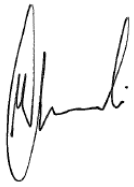
[5] Ecology New Zealand Ltd, Unpublished data, 2020.
[6] Boffa Miskall Ltd 2020. Te Awamutu Village: Automatic acoustic long-tailed bat survey and potential ecological constraints.
[7] The optimal season for bat monitoring is between November and April when weather is optimal for bat activity and detection.

6. CONLCUSION

The proposed change in land-use within the project site may potentially impact infrequent use of the site by resident long-tailed bats due to the loss or degradation of commuting and/or potential foraging habitat and ongoing disturbance due to artificial light that may result in bats avoiding illuminated areas. This will mean that tailored management options should be considered on-site to manage the potential impacts on long-tailed bats due to the proposed land development and change in land-use.

Kind Regards,

Jennifer Gollin
Ecologist



Marc Choromanski
Senior Ecologist

APPENDIX A

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ix) Where lengths or other measurements have not been provided by a surveyor, ENZL has used basic GIS mapping and measurement systems to estimate these numbers. These should not be taken as surveyor-level accuracy for the purposes of decision making.

Appendix 3

Ecological Impact Assessment

Ecological Impact Assessment

Frontier Road, Te Awamutu

Prepared for Sanderson Group Ltd
6 August 2020

Report Number 20039.1-001 V2

ECOLOGY
NEW ZEALAND

Document Sign Off

Author(s):	Dr Mark Bellingham Principal Ecologist Ecology New Zealand Limited	
Review:	Marc Choromanski Senior Ecologist Ecology New Zealand Limited	
Sign off:	Chad Croft Principal Ecologist Ecology New Zealand Limited	

Revision	Revision Date	Details	Author	Review	Approved
V2	07/08/20	EcIA	MB	MC	CC

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Appendices

1. INTRODUCTION

This report[1], prepared by Ecology New Zealand Limited ('ENZL') for Sanderson Group Ltd (the 'client'), presents an Ecological Impact Assessment (EcIA) for the proposed Plan Change 12 at Frontier and Pirongia Roads, Te Awamutu (the 'site'). Specifically, this report provides an assessment of the site's ecological features, context and values relevant to the proposed Plan Change and future land use. This report identifies the terrestrial and aquatic ecological values present and the potential, actual, direct or indirect impacts associated with the proposed Plan Change. Recommended methods to avoid, remedy or mitigate these impacts are also detailed.

1.1. Purpose

The purpose of this report is to assess the overall suitability of the site for urban development from an ecological perspective. It is intended that specific and detailed ecological management requirements will be addressed through subsequent resource consents associated with the development of the site.

1.2. Site Location, Description and Ecological Context

The site is located between Pirongia and Frontier Roads, Te Awamutu, and is situated within the Waipa Ecological District of the Waikato Region. The land cover is predominantly rye grass pasture, with two minor watercourses at the north and south of the site and four established residential dwellings and another in the process of being built.

Two watercourses are present on the property. The northern watercourse flows north to Frontier Road. The headwaters arise in a bunded farm pond, with mallard and pukeko on and around the open water area. The outfall from this pond was intermittent and then permanent stream to the boundary of the site. The edge of the pond was electric fenced from farm stock and the downstream course was unfenced. There was scattered mahoe (*Melicytus ramiflorus*), karamu (*Coprosma robusta*), cabbage trees (*Cordyline australis*) and Chinese privet (*Ligustrum sinense*) shrubs along the stream banks.

The watercourse in the south is a bunded seepage area with ephemeral overland flows into the bunded area. The seepage area was dry, after a period of prolonged rainfall and does not appear to be part of a stream or a permanent or semi-permanent wetland. The downstream reach was on the adjacent property outside of the Plan Change 12 area.

Within the wider landscape context, the site lies on the edge of the urban residential area. The majority of neighbouring sites consisted of residential dwellings and vacant sites in the process of being developed.

[1] This report is subject to the Report Limitations provided in Appendix A.

Figure 1 Map of site at Pirongia and Frontier Roads, Te Awamutu (Boffa Miskell 2020)

2. METHODOLOGY

Preliminary site assessments for the project were undertaken by Boffa Miskell in early 2020[2]. To ground truth the findings of this initial assessment, ENZL undertook a secondary site walk over on 30th July 2020. During this walk over, terrestrial and aquatic features were identified, and their associated structure, composition, quality and value were documented. Both terrestrial and aquatic ecological values were then assessed in order to evaluate the potential, actual, direct or indirect impacts associated with the proposed development.

In conjunction with site assessments, a desktop review was undertaken to ascertain information relating to the site's ecological characteristics.

Existing information reviewed included:

- DOC Bio-web Herpetofauna database;
- DOC Bat database;
- iNaturalist New Zealand; and
- New Zealand Freshwater Fish Database.

2.1. Terrestrial

On-site investigation of indigenous fauna communities included opportunistic observations of species encountered, general habitat evaluations, bird species presence and manual habitat searches for native lizards in suitable habitat. In addition to faunal assessments, on-site vegetation communities were identified and visually assessed for their botanical and biodiversity values.

Potential bat roost trees were risk rated during ENZL's site investigation (30 July 2020) in accordance with industry best practice methodologies[3]. Risk rating was undertaken by Simon Chapman, Principal Ecologist, who is listed on the Department of Conservations database of competent bat ecologists as a Level E (Trainer) bat ecologist.

2.2. Aquatic

A high-level assessment was carried out across the site's watercourses by ENZL, to validate the findings of the Boffa Miskell reporting. This primarily included the classification of aquatic features as ephemeral , intermittent or permanent, the documentation of overall aquatic quality, and the likely presence of native fish based on available habitat.

[2] Boffa Miskell, Automatic acoustic long-tailed bat survey and potential ecological Constraints, June 2020

[3] Lindberg, S., Davies, F., & Eccles, G. (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature October 2017.

3. ASSESSMENT OF EFFECTS METHODOLOGY

3.1.1. EIANZ Assessment

The assessment of effects on both terrestrial and aquatic values was undertaken against the Ecological Impact Assessment (EcIA) guidelines (second edition, May 2018, EIANZ). The guidelines provide a transparent stepwise approach to evaluate the level of ecological effect, providing insight into the feasibility and the management of effects through avoidance, mitigation and biodiversity offsetting. These guidelines have been adopted to allow for expert judgement and the consideration of implications under New Zealand's Wildlife Act 1953.

3.1.2. Values Assessment

Four matters were used to determine the value of the ecological features present on-site, these being 'Representativeness, Rarity/distinctiveness, Diversity and Pattern, and Ecological Context'. To assign value under each of these four matters, an explanation on each matter and a series of attributes are provided for consideration in Table 4 of the EIANZ guidelines. A scoring system provided in Table 6 of the guidelines requires the combination of these assessment values to provide an overall assignment of ecological value to each feature.

3.1.3. Magnitude of Effects Assessment

An assessment of the magnitude of effects was evaluated with the consideration of impacts on identified ecological values. Impacts were considered in the context of the project footprint. Impacts are considered against several factors including:

- The scale of impacts (i.e. the real extent of the Project footprint)
- The extent or proportion of habitat loss versus local availability (e.g. the proportion of habitat loss relative to the contiguous habitat that remains)
- The duration of impacts (e.g. permanent versus temporary)
- The intensity of the unmitigated effect (i.e. the extent to which habitat loss within the Project footprint was complete or partial)

3.1.4. Overall Level of Effects Assessment

An overall level of effects assessment was undertaken using a matrix which weights the assessed ecological values against the magnitude of effects. A level of effect was determined for both unmitigated (i.e. in lieu of any avoidance, mitigation or offsetting measures being implemented) and mitigated. This assessment framework allowed for effects to be ranked on a gradient from 'Negligible' to 'Very High' and provided justification for avoidance, mitigation and offsetting requirements as appropriate.

4. ECOLOGICAL ASSESSMENT OUTCOMES

4.1. Terrestrial

4.1.1. Terrestrial Vegetation

Vegetation across the site was of low ecological quality and very low diversity with low pest plant impacts. Vegetation within the Plan Change 12 footprint was dominated by rye grass pasture with scattered exotics in the pasture. The vegetation along the watercourses included

poplar (*Populus* sp), crack willow (Salix fragilis), and occasional pine (*Pinus* sp) and *Acacia* species. Native sub-canopy vegetation consisted of karamu, mapou (*Myrsine australis*), and hangehange (*Geniostoma ligustrifolium*). Native ground cover was limited on-site to pasture grasses, blackberry (*Rubus fruticosus* agg.) and pastural weeds, such as thistle dominating.

Pest plant[4] presence was low throughout the site. Documented species were limited to occasional woolly nightshade (*Solanum mauritianum*), and blackberry.

The quality of the on-site vegetation was considered low overall. The vegetation was dominated by ryegrass pasture and exotic plant species along fence lines and areas where farm stock had been excluded. There was a low abundance and diversity of native plant species. There were no At-Risk or Threatened plant species observed at the site.

4.1.2. Terrestrial Fauna

4.1.2.1 Chiropfauna (Bats)

The long-tailed bat is classified as "Threatened – Nationally Critical" (O'Donnell et al., 2018) due to predation, habitat degradation and/or habitat loss. Native bats are 'absolutely protected' under the Wildlife Act (1953). No notable bat habitat was identified on the site.

Boffa Miskell undertook an acoustic bat survey in early May 2020[5]. A total of 23 bat passes were recorded across all survey locations during the entire survey period. Bat activity was recorded at six out of the 12 survey locations, ranging from 0.05 ± 0.05 to 0.85 ± 0.60 average bat passes per night (± standard error of the mean [SEM]; Appendix 1 and 3).

Bat activity was detected by the seepage area and ephemeral drain within the southern extent of the project site featuring large oak, poplar and acacia trees (Automated Bat Monitor - ABM 1); by the pond towards the northern range of the site featuring large oak and poplar trees; and along the gully wetland vegetation, the driveway avenue and within the garden in the northern extent of the site featuring mature swamp cypress, willow, oak and other exotic trees (north of ABM 6) (Appendix 1)[5]. The highest level of bat activity (0.85 ± 0.60 average bat passes per night) was recorded by the seepage area within the southern extent of the site (ABM 1: (Appendix 1 and 3)[5]. ABMs that recorded at least one call, detected activity between one (5%) and two (10%) survey nights (Appendix 3)[5].

One potential feeding buzz call was recorded at ABM 10 by the northern border of the site (Figure 2)[5]. No social calls were recorded during this survey, and no bat activity was detected within one hour of sunset or one hour of sunrise (this could indicate no roosting nearby) at any of the monitored locations during this survey[5].

Temporal distribution of detected bat activity throughout the night for each survey location are provided in Appendix 4 of the Boffa Report[5]. During the survey period, low levels of bat activity were detected. Long-tailed bats appear to be using the ephemeral farm pond on the southern watercourse for infrequent hawking for insects around the farm pond and rare detections along the northern watercourse. During this survey period, no activity was detected

[4] Waikato Regional Pest Management Plan, 2014-2024

[5] Boffa Miskell, Automatic acoustic long-tailed bat survey and potential ecological Constraints, June 2020

that would indicate roosting on-site, and no clear evidence of intensive foraging within the site.

Lower levels of bat activity are to be expected for surveys conducted during colder weather conditions outside the optimal bat monitoring season (November to April). Therefore, these survey results do not allow any conclusions about the level of bat activity and how habitat features throughout the site would be utilised by bats during warmer months.

ENZL undertook a potential bat roost tree survey on 30th July 2020. As part of this survey all trees on-site were risk rated for their potential to provide suitable bat roosts. The timing of the survey aligned with the time of the year where deciduous exotic trees on-site had shed their leaves, enabling a clearer assessment of possible roosting features. No potential bat roost trees were recorded.

4.1.2.2 Avifauna (birds)

The current land-use within the project site is predominantly pasture for grazing cattle with a few areas of tall, mature vegetation dominated by exotic trees, several residential gardens, a pond, and two areas of wetlands/waterways. A lack of vegetation diversity likely limits year-round food sources and a lack of habitat limits the diversity and abundance of indigenous bird species. The bird species assemblage using the Plan Change 12 area comprised of a typical mix of common native and exotic species. No At Risk or Threatened bird species were observed during the site walk-over by Ecology New Zealand or Boffa Miskell and it is unlikely that any of these species would be more than transient visitors to the site.

Table 1: Avifauna seen/heard on-site.

Common Name	Latin Name	Threat status
Australian magpie	*Gymnorhina tibicen*	Introduced & Naturalised
European goldfinch	*Carduelis carduelis*	Introduced & Naturalised
Grey warbler	*Gerygone igata*	Indigenous & Not Threatened
House Sparrow	*Passer domesticus*	Introduced & Naturalised
Mallard	*Anas platyrhynchos*	Introduced & Naturalised
Myna	*Acridotheres tristis*	Introduced & Naturalised
North Island fantail	*Rhipidura fuliginosa placabilis*	Indigenous & Not Threatened
Pukeko	*Porphyrio melanotus*	Indigenous & Not Threatened
Ring-necked pheasant	*Phasianus colchicus*	Introduced & Naturalised
Song Thrush	*Turdus philomelos*	Introduced & Naturalised

Common Name	Latin Name	Threat status
Spur-winged plover	*Vanellus miles*	Indigenous & Not Threatened
Tūī	*Prosthemadera novaeseelandiae*	Indigenous & Not Threatened
Welcome swallow	*Hirundo neoxena*	Indigenous & Not Threatened

4.1.2.3 Herpetofauna (lizards)

The habitat quality for lizards throughout the site is generally poor due to historical vegetation removal and high modification of the area. Nonetheless, habitat suitable for the native copper skink (*Oligosoma aeneum*) (Not threatened) is present at some localities on the site[6]. This native species is known to live in farmland and residential environments utilising habitats such as weedy areas, artificial and natural debris, rank grass, compost piles, and residential gardens[7]. While this species is 'Not Threatened' (Hitchmough et al., 2016), all native lizard species are 'absolutely protected' under the Wildlife Act (1953) and any lizard habitat is protected by the Resource Management Act (1991). Likewise, plague skink (*Lampropholis delicata*), which is an exotic unwanted organism, are likely present within the project site.

The table below outlines the species likely to occur on-site and their corresponding conservation status.

Table 2: Reptile species potentially utilising the Plan Change 12 site.

Common Name	Scientific Name	Conservation Status
Copper Skink	*Oligosoma aeneum*	Not Threatened
Plague Skink	*Lampropholis delicata*	Introduced and Naturalised

Habitats suitable for copper skink are as follows (ABM locations have been used as reference points and are mapped in Figure 1).

- ephemeral drain / seepage – complex dense vegetation, woody debris and rank grass surrounding ABM 1;
- residential gardens – debris, complex ground covers, compost piles and dense vegetation – locations near ABM 3 and 12; and
- pond and wetland/stream – debris, rank grass, complex vegetation – ABM 6 to 9.

[6] Hitchmough, R.; Barr, B.; Lettink,M.; Monks, J.; Reardon, J.; Tocher, M.; van Winkel, D.; Rolfe, J. 2016: Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. Department of Conservation, Wellington. 14 p

[7] Van Winkel, D., Baling, M., & Hitchmough, R. (2020). Reptiles and Amphibians of New Zealand. Bloomsbury Publishing.

4.2. Aquatic

4.2.1. Freshwater (waterways, wetlands, and fish)

Freshwater ecosystem south

In the southern portion of the site near ABM 1 there is an ephemeral seep and drain that may periodically hold water for short periods of time throughout the year (Figure 1). However, this watercourse was dry when observed during heavy rain on 5th May (Boffa Miskell 2020) and July 30th (ENZL).

Freshwater ecosystem north

In the northern portion of the site near ABM 6 there was a large pond and downstream of this was an ephemeral or intermittent waterway, with associated riparian wetland, flowing towards the Mangapiko stream (Figure 1).

Native fish species that may be present in these habitats include longfin eel (At Risk – Declining), shortfin eel (Not Threatened), and black mudfish (At Risk - Declining)[8].

4.3. Terrestrial Values Assessment

In assigning ecological value to identified terrestrial features across the subject site, the ecological matters of Representativeness, Rarity/Distinctiveness, Diversity and Pattern, and Ecological Context have been considered, based on the EIANZ 2018 guidelines.

The table below outlines the ecological values assigned to the identified ecological features of terrestrial vegetation, chiropfauna (bats), avifauna (birds), and herptofauna (lizards).The overall values assigned consider the ecological matters at an ecosystem/vegetation type, species and fauna habitat level as summarised in Table 3 below.

Table 3: Terrestrial values at Te Awamutu Plan Change 12 site

Feature	Representativeness, Rarity/distinctiveness, Diversity and Pattern, Ecological Context:	Value
Terrestrial Vegetation	Low diversity of native vegetation presence. Most of the site was covered in exotic pasture grasses.	Low
Bats	Long tailed bats (Nationally Threatened – Critical) recorded on site. Less than one bat pass per night recorded at one ABM, with most ABMs recording no bat activity. No suitable roosting or nesting habitat for long-tailed bats noted.	Very High
Avifauna	There were no threatened avifauna recorded at the site, and only low numbers and diversity of native species recorded. There was minimal indigenous bird feeding, roosting or nesting habitat.	Low

[8] Dunn, N.R.; Allibone, R.M.; Closs, G.P.; Crow, S.K.; David, B.O.; Goodman, J.M.; Griffiths, M.; Jack, D.C.; Ling, N.; Waters, J.M.; Rolfe, J.R. 2018: Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Department of Conservation, Wellington. 11 p

Lizards	Suitable habitat is sparse on-site for ground-dwelling lizard species. Species on-site are likely limited to copper skinks.	Low

4.4. Aquatic Values Assessment

Likewise to section 4.3, in assigning of ecological value to identified aquatic features across the subject site, the following matters were considered: Representativeness, Rarity/Distinctiveness, Diversity and Pattern, and Ecological Context, based on the EIANZ 2018 guidelines. The table below outlines the ecological values assigned to the identified aquatic ecological features being Freshwater ecosystem north, Freshwater ecosystem south, and indigenous fish.

Table 4: Freshwater values at Te Awamutu Plan Change 12 site

Feature	Representativeness, Rarity/distinctiveness, Diversity and Pattern, Ecological Context:	Value
Freshwater ecosystem - North	Farm pond and ephemeral or intermittent stream grazed along most of its length, peripheral wetland areas and is a headwater reach of the Mangapiko Stream.	Moderate
Freshwater ecosystem - South	Ephemeral farm pond. Dry during winter 2020. Upper reach of overland flow path on adjacent property.	Low
Indigenous fish	A detailed survey of indigenous fish species presence was deemed outside the scope of this assessment. Potential habitat available for indigenous fish.	Moderate

5. ASSESSMENT OF EFFECTS

5.1. Terrestrial Effects

5.1.1. Vegetation Clearance

The proposed plan change provides for the removal of exotic and pest plant dominated vegetation, as well as a small number of low ecological value natives to facilitate development of urban settlement on rural land. Development of the site will not impact vegetation of high botanical significance.

5.1.2. Birds

Future earthworks and vegetation clearance on-site will result in a loss of low value habitat and resources for indigenous avifauna utilising the site. The impacted vegetation is noted to only support common native and exotic species. Vegetation clearance may cause impacts on nesting birds and their eggs during the breeding season.

5.1.3. Lizards

Future earthworks and vegetation clearance on-site will result in loss of potential habitat and resources for resident lizards which may be utilising the site. In addition, vegetation/habitat clearance has the potential to result in lizard mortality.

5.1.4. Bats

No bat roost habitat has been identified across the project footprint. As such, any associated vegetation clearance is unlikely to have a direct impact on bats (i.e. injury or mortality associated with felling an occupied roost).

On a conservative basis, the proposed change in land-use within the project site may potentially have indirect impacts on long- tailed bats. This being associated with loss or degradation of commuting and/or potential foraging across the site; and ongoing disturbance from artificial light that may result in bats avoiding illuminated areas. These potential effects may lead to decreased bat activity; a change in how the project site is utilised by bats; or the complete avoidance of the project site by bats.

5.2. Aquatic Effects

Aquatic impacts which may occur across the project site include the loss of aquatic habitat for indigenous fish, potential mortality of native fish during stream works, and the loss of wetland habitat.

6. MAGNITUDE AND LEVEL OF UNMITIGATED EFFECTS

6.1. Terrestrial

The proposed Plan Change providing for urban subdivision has a low to very low risk of mortality of one or more fauna species and permanent or temporary loss of vegetation and fauna habitat. The magnitude of unmitigated effects and associated level of effect on terrestrial values is summarised below. Due to their threat status, impacts on bats have been broken in habitat impacts and injury/death impacts associated with vegetation clearance.

Table 5: Summary of the magnitude of unmitigated effects and the associated level of effect on terrestrial values.

Feature and associated impact	Ecological Value	Magnitude of Effect (un-mitigated)	Level of Effect	Comment
Terrestrial Vegetation	Low	Low	Very Low	Minor and minimal shift from baseline conditions.
Birds	Low	Low	Very Low	Minor and minimal shift from baseline conditions
Lizards	Low	Low	Very Low	Minor and minimal shift from baseline conditions.
Bats – habitat loss	Very High	Moderate	High	Major alteration of key elements/features of existing baseline condition

Bats - potential injury/death	Very High	Negligible	Low	Very slight change from existing baseline condition.

6.2. Aquatic

The proposed Plan Change providing for urban subdivision has a low to very low risk of mortality of one or more fauna species and permanent or temporary loss of fauna habitat. The magnitude of unmitigated effects and associated level of effect on aquatic values are summarised below.

Table 6: Summary of the magnitude of unmitigated effects and the associated level of effect on aquatic values.

Feature and associated impact	**Ecological Value**	**Magnitude of Effect (un-mitigated)**	**Level of Effect**	**Comment**
Freshwater ecosystem south	Low	Low	Very Low	Minor and minimal shift from baseline conditions.
Freshwater ecosystem north	Moderate	Moderate	Moderate	loss or alteration to one or more features of the existing baseline conditions.
Indigenous Fish – Potential death/injury	Moderate	Moderate	Moderate	loss or alteration to one or more features of the existing baseline conditions.

7. MANAGEMENT OF EFFECTS

The overall level of effect under EIANZ is to be used as a "*guide to the extent and nature of the ecological management response required (including the need for biodiversity offsetting)*". Where Regional or District Plans do not provide specific guidance for the management of effects a suggested guide is:

- For Very High levels of effect:
  - "*…unlikely to be acceptable on ecological grounds alone (even with compensation proposals). Activities having very high adverse effects should be avoided.*"
- For High or Moderate levels of effect:
  - *Such an effect could be managed through avoidance, design, or extensive offset or compensation actions. Wherever adverse effects cannot be avoided, no net loss of biodiversity values would be appropriate*.
- For Low or Very Low levels of effect:
  - "*…should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects*."

The need for management of effects also takes into consideration the protection of native fauna under the Wildlife Act 1953.

Whilst the majority of effects on terrestrial values are below the level of effect which would cause concern under the EIANZ guidelines, one effect will require mitigation measures. Due to the likely occurrence of native Bats within the site, which are protected under the Wildlife Act (1953), mitigation measures are required.

Impacts associated with aquatic features are below those requiring mitigation for the freshwater ecosystem to the south of the site. Impacts which do require management are largely associated with those of the higher quality areas found within the northern freshwater ecosystem and those associated with impacts on indigenous fish.

Recommendations to avoid and mitigate the effects from the proposed Plan Change are outlined in Section 7.1 and 7.2 below.

7.1. Terrestrial

7.1.1. Vegetation Clearance

Vegetation clearance will not require specific mitigation measures due to the low-quality vegetation communities present across the site.

7.1.2. Bat management

No potential bat roost trees were recorded within the site. Consequently, implementation of specific vegetation removal protocols for the management of bats is not required prior to vegetation clearance. However, development of the site has the potential to displace or disturb potential bat utilisation of the site. Therefore, Table 7 below summarises the need for further survey work to assess potential impacts on long-tailed bats, and potential options for the management of these impacts.

Table 7: Bat management options

Management options	Comments
Completion of further automated bat surveys (Nov-April).	These should be undertaken to provides more certainty on the use of the site by long-tailed bats. At current, bat utilisation is very low.
Stormwater pond design to provide better feeding habitat.	Open water areas with robust planting around them can increase invertebrates in these areas which bats feed on. Open areas of still water can be used by bats for nightly drinking.
Incorporation of low lumen, directional lighting design for external lights. Street lighting to be avoided/minimal where required.	Reduces the level of disturbance on bat commuting and foraging across the site; and specifically, near aquatic features that bats may utilise.

7.1.3. Birds

While bird management is not required under the EIANZ guidelines, all native birds are protected under the Wildlife Act (1953). Consequently, vegetation removal should be undertaken outside the bird breeding season (October – April). Where this cannot be undertaken, all woody vegetation to be removed should be inspected by an experienced ecologist to ensure they are free of active nests. Where active nests are found, these should be retained until chicks have fledged.

Landscaping and planting around stormwater detention ponds and along water courses is likely to provide positive effects for native and introduced birds on the site and it may attract additional species.

7.1.4. Lizards

Native lizards have not been confirmed to occur on-site; however, habitat is available throughout the site for ground-dwelling lizards. Therefore, a targeted survey for lizard species should be undertaken. Should they be detected, a Lizard Management Plan should be prepared by an appropriately qualified and experienced ecologist, outlining lizard management to be undertaken before and during vegetation removal. Any native lizards encountered could be relocated into habitat of equal or greater quality on-site.

7.2. Aquatic

Indigenous fish have not been confirmed to occur on-site; however, habitat is potentially available, particularly within the feature identified as freshwater ecosystem north. Targeted fish surveys should be undertaken within suitable months to determine species presence and densities. Subsequent to the findings of these surveys, a Fish Management Plan may need to be prepared by an appropriately qualified and experienced ecologist, outlining fish management to be undertaken before and during earthworks. Any indigenous fish encountered could be relocated into suitable habitat within the same watercourse, outside the proposed development site.

8. POST-MITIGATION MAGNITUDE OF EFFECTS

8.1. Terrestrial & Freshwater

The post-mitigation level of effects is outlined in **Error! Reference source not found.** 8 below. As a result of the management options outlined above, the levels of effect are expected to decrease to very low or low for all ecological features identified, under EIANZ guidelines. As such, no further management of residual effects is required. It shall be noted that, these mitigation options will be addressed in more detail and incorporated as necessary as part of subsequent resource consent applications.

Table 8: Mitigated level of effects of proposal on terrestrial and freshwater values.

Impact	Ecological Value	Suggested Management	Magnitude of (mitigated) Effect	Level of Residual Effect
Vegetation clearance	Low	Stormwater and landscape planting including enhancement and infill planting	Low	Very Low
Avifauna	Low	Vegetation clearance protocols and avoid nesting season	Low	Very Low
Lizards	Low	Develop and implement Lizard Management Plan prior to vegetation clearance	Low	Very Low
Bats	Very High	See Table 7	Negligible	Low
Freshwater	Moderate	Develop and implement Fish Management Plan prior to earthworks	Low	Low

9. CONCLUSION

This report provides an ecological impact assessment associated with the proposed Plan Change 12 between Pirongia and Frontier Roads, Te Awamutu. Overall, the value of terrestrial ecological features on the site are considered very high to low. This effects assessment is based on the limited amount of vegetation clearance required and the presence of exotic plant dominated ecosystems within the site, the absence of threatened native bird and lizard species and the absence of potential long-tailed bat roosting habitat. The ecological effects on terrestrial and aquatic values attributable to the proposed plan change and subsequent consented development, after the implementation of recommended mitigation and management actions, are considered to be low to very low in accordance with the EIANZ impact assessment methodology. With the implementation of appropriate ecological management, it is expected that any negative effects associated with the proposed plan change and subsequent development can be adequately managed.

APPENDIX A

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