IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the Proposed Waikato District Plan (Stage 1) – Hearing 21A – Significant Natural Areas

STATEMENT OF EVIDENCE OF TERTIA THURLEY FOR THE DIRECTOR-GENERAL OF CONSERVATION

29 OCTOBER 2020

Department of Conservation
Private Bag 3072
Hamilton 3240
Counsel acting: Troy Urlich
Telephone: 027 324 8991
Email: turlich@doc.govt.nz

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1. INTRODUCTION

Qualifications and Experience

1.1 My full name is Tertia Thurley. I am employed by the Department of Conservation (**DOC**) as a Technical Advisor Ecology. My current role involves providing bat advice to DOC internal staff and external agencies.

1.2 My qualifications are a BSc (1987) and Master of Arts (Environmental Studies) (1996) from Victoria University of Wellington.

1.3 I have worked for DOC since 1996. I have considerable experience in monitoring and management of threatened species.

1.4 I have 9 years' experience working with bats in New Zealand. I have extensive direct experience of surveying, radio-tracking, roost finding, catching and handling bats.

1.5 My work has included establishing a short-tailed bat conservation project at Pureora Forest over a 5-year period, which I continue to be involved with. This project involved catching, radio tracking, PIT tagging and monitoring long-term survival of short-tailed bats, thus measuring responses to our pest control regimes at Pureora. I also established, participated in and had oversight over a long-tailed bat project at Pureora, which ran from 2011 to 2017. This project involved catching and tagging long-tailed bats, radio tracking bats to their roosts, assessing tree roosts and capturing bats at roosts, again to measure their long-term responses to predator control. I have also been involved with a long-tailed bat mark-recapture project in the King Country and various bat projects in Northland.

1.6 I am certified as a "Trainer" (Class E level) by the DOC's Bat Recovery Group, which means that I am considered highly competent to catch, handle and mark bats as well as undertake survey and monitoring, and to train others in these skills.

1.7 I am currently Leader of the New Zealand DOC Bat Recovery Group. As such, I have oversight of much of the research and management that involves bats in New Zealand.

1.8 I am engaged by the Director-General to provide evidence on his submission 585.38 seeking new objectives, policies and rules to recognise bat zones and tree protection, and seeking the mapping of bat zones to provide protection for important bat roost trees.

2. CODE OF CONDUCT

2.1 I confirm I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2014. I have complied with the practice note when preparing my written statement of evidence and will do so when I give oral evidence before the Commissioners.

2.2 The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in the evidence.

2.3 Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

3. SCOPE

3.1 I have been asked to provide evidence in relation to long-tailed bats and their protection within the Waikato District. My evidence will cover:

a. The conservation status of long-tailed bats;

b. Specialist requirements of long-tailed bats;

c. Long-tailed bats in the Waikato District;

d. The consequences to bats of the removal of trees;

e. The effect of artificial lighting and roads on bats;

f. Response to District Plan Review, Technical responses to submissions relating to ecology, section 2, bats.

3.2 Key documents I considered in preparing my evidence include:

a. DOC bat distribution database;

b. Section 42A report;

c. Waikato District Plan Review. Technical responses to submissions relating to ecology. Section 2. Bats.

4. EXECUTIVE SUMMARY

4.1 Long-tailed bats have the highest threat classification of Nationally Critical. They are predicted to decline by >70% over the next three generations. Long-tailed bats are Absolutely Protected Wildlife under the Wildlife Act 1953.

4.2 The Waikato District holds several known long-tailed bat populations and it is highly likely that known bat distribution will increase with increased survey effort.

4.3 Long-tailed bats present in urban and rural landscapes are very vulnerable because trees and taller vegetation are important habitat requirements, and these resources are limited in these landscapes. Ongoing pressures from tree clearance and development further restrict habitat.

4.4 Trees and vegetation such as hedgerows are used for roosting, foraging and commuting. Tree felling may result in bat deaths and injuries at the time of tree felling because bats cannot wake up in time to escape trees as they are felled. Roost trees have very specific thermal requirements, and if loss of these trees continues, I expect that bat populations will not persist in the Waikato District. Because bats forage along edges of taller vegetation, loss of trees also results in loss of foraging habitat. Long-tailed bats also use vegetation for commuting between roosting and foraging sites, so loss of vegetation along these routes can fragment and isolate bat communities.

4.5 Though there are large areas of the Waikato District which have not been surveyed for bats, bats are known from some areas. Records of bat activity can be used, buffered by 7.3km (the longest known bat range span in the Waikato) to form proposed bat zones.

4.6 Within areas used by bats, it is important to protect roost trees (potential roost trees are those greater than 15cm diameter at breast height (DBH) which have features such as cavities), and to protect trees used for foraging and commuting. It is also important not to further limit their habitat by installing artificial light, and in the absence of data on the impact of artificial light on long-tailed bats, guidelines developed in Europe should be followed to minimise and mitigate its effects. Potential adverse impacts of housing, roading and other infrastructure also need to be considered.

5. NEW ZEALAND BATS - OVERVIEW

5.1 Bats are New Zealand's only land mammal. There are 3 species of bat known from New Zealand: the long-tailed bat (Plate 1), the lesser short-tailed bat and the greater short-tailed bat. Greater short-tailed bats may now be extinct, with the last confirmed siting in the 1960s. Lesser short-tailed bats are generally confined to large forests, feeding and roosting within these forests. In contrast, long-tailed bats generally roost within forest but spend a lot of time in the open. This has allowed them to persist in more modified habitats than short-tailed bats.

Plate 1: Long-tailed bat in the hand (photo: Colin O'Donnell)

5.2 Long-tailed bats are small, weighing approximately 10g. They can be very long-lived (>20 years). They emerge from roost trees at dusk, return to them at dawn, and can be seen as they fly silhouetted against the sky at these times. They forage on the wing, eating beetles, moths and other flying insects.

6. THE CONSERVATION STATUS OF LONG-TAILED BATS

6.1 The New Zealand long-tailed bat is an endemic bat, which means that it is found only in New Zealand.

6.2 The long-tailed bat is classed as Nationally Critical, the highest threat category for a New Zealand species.[1] This is because the panel of experts that assess New Zealand bat species has predicted a decline of >70% in the total population due to existing threats over the next three generations.

6.3 DOC administers the Wildlife Act 1953 and long-tailed bats are Absolutely Protected Wildlife under this Act. Under Section 63 of the Act it is an offence to kill, hunt, possess, molest or disturb protected species without proper authority.

6.4 Bats were once common in New Zealand and were regularly seen by early settlers in their "scores", "hundreds" and "thousands".[2] Their range and numbers have declined since, and in most areas continue to do so.[3]

6.5 Declines in long-tailed bats result from a combination of threats: predation by ship rats, possums, stoats and cats; habitat loss through land clearance; and habitat degradation and fragmentation through forest clearance.[4]

6.6 Within the indigenous forest landscape of the Eglinton Valley in Fiordland National Park the population was found to be declining at 5% per annum due to predation[5]. In the rural South Canterbury landscape, where bats face greater pressures, bats were found to be declining at a rate of 9% per year due to the combined pressures of predation, felling of roost trees for firewood, naturally falling roost trees and vegetation clearance.[6]

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1 The conservation status of New Zealand bats, 2018. Department of Conservation, New Zealand Threat Classification Series 21. Department of Conservation, Wellington.

2 O'Donnell CJF 2000. Conservation status and causes of decline of the threatened New Zealand Long-tailed Bat *Chalinolobus tuberculatus* (Chiroptera:Vespertilionidae). Mammal Review 30:89-106.

3 O'Donnell CJF, Christie JE, Hitchmough RA, Lloyd B, Parsons S 2010. The conservation status of New Zealand bats 2009. New Zealand Journal of Zoology 37:297-311.
O'Donnell CJF, Borkin KM, Christie JE, Lloyd B, Parsons S, Hitchmough RA 2018. The conservation status of New Zealand bats, 2018. Department of Conservation, New Zealand Threat Classification Series 21. Department of Conservation, Wellington.

4 O'Donnell CJF 2000. Conservation status and causes of decline of the threatened New Zealand Long-tailed Bat *Chalinolobus tuberculatus* (Chiroptera:Vespertilionidae). Mammal Review 30:89-106.

5 Pryde MA, O'Donnell CFJ, Barker RJ 2005. Factors influencing survival and long-term population viability of New Zealand long-tailed bats (*Chalinolobus tuberculatus*): implications for conservation. Biological Conservation 126: 175-185.

6 Pryde MA, Lettlink M, O'Donnell CFJ 2006. Survivorship in two populations of long-tailed bats *(Chalinolobus tuberculatus*) in New Zealand. New Zealand Journal of Zoology, Vol 33:85-95.

6.7 Given the similarities of the Waikato rural landscape and south Canterbury rural landscape, bat communities in rural Waikato are likely to be facing pressures similar to those in rural south Canterbury. Waikato bats are also under increasing pressure from roading and housing development.[7] This can come from loss of trees which further limits roosts (which are already in short supply), loss of trees which bats use to commute along so their habitat becomes further fragmented, loss of trees to forage beside, and increase in lighting and noise creating habitat which is unsuitable for bats.

6.8 The long-tailed bat population in south Hamilton is the only population in the Waikato where there is some information on population size. There are at least 61 bats, based on counts at three active roosts on 16 January 2018.[8] This is a conservative estimate, but illustrates that this is a small population.

7. SPECIALISED REQUIREMENTS OF LONG-TAILED BATS

7.1 In order to function, bat populations need suitable roost sites, foraging, drinking and socialising areas, and commuting routes. For long-tailed bats these requirements are very specialised.

7.2 Long-tailed bats shelter and breed in trees (termed roost trees), most frequently in the forest, but also in isolated trees in the open. Roosting cavities have very specific thermal requirements and are generally very rare in the landscape even when in indigenous forest. In a study in the Eglinton Valley in Fiordland only 1.3% of random trees above 20cm diameter at breast height (DBH) had optimum characteristics for breeding.[9]

7.3 Bats select the oldest and largest trees for maternity colonies (where adult females raise their young), selecting roosts that reach maximum temperatures late in the day and retain high temperatures during the night, allowing mothers to leave the young alone and forage. In the unmodified Eglinton Forest in Fiordland these trees average 105cm DBH and tend to be 100 to >600 years

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7 Borkin KM, Smith DHV, Shaw WB, McQueen JC 2019. More traffic, less bat activity: the relationship between overnight traffic volumes and *Chalinolobus* tuberculatus activity along New Zealand highways. Acta Chiropterologica 21(2): 321-329. Le Roux DS, Le Roux NS 2012. Hamilton City bat survey 2011-12. Report prepared by Kessels & Associates Ltd for Project Echo.

8 Davidson-Watts I. 2018: Long-tailed bat trapping and radio tracking baseline report Southern Links, Hamilton. Report prepared for Aecom NZ Ltd.

9 Sedgeley JA, O'Donnell CFJ 1999. Roost selection by the long-tailed bat, *Chalinolobus tuberculatus*, in temperate NewZealand rainforest and its implications for the conservation of bats in managed forests. Biological Conservation 88:261–276.

old.[10] In the modified habitat of south Hamilton, roosts averaged 67cm DBH.[11] The smaller DBH is likely to reflect the limited selection of roost trees available.

7.4 Exotic trees can be important as roost trees in modified landscapes. All but one of 16 maternity roosts found in south Hamilton were in exotic trees. This included black locust, false acacia, Eucalyptus, London Plane, oak, macrocarpa and crack willow. Other roosts were also found in Tasmanian blackwood, grey willow and birch.

7.5 In indigenous forest long-tailed bats change roosts almost daily. In the Eglinton 70% of roosts were occupied for only one day, and only 10% of roosts were re-used in the same season.[12] In modified landscape bats change roosts less frequently; this is probably because there are fewer trees suitable for roosting. In Hamilton, Dekrout found that of the 11 bats she radio-tracked, all but two used only one roost throughout the entire radio-tracking study (5-19 days).[13] Davidson-Watts[14], in south Hamilton, found a lower rate of re-use than this, though not as low as in indigenous forest. Therefore, for the south Hamilton long-tailed bat population each known roost is likely to be of high importance.

7.6 Long-tailed bats are edge foragers, typically feeding along the edges and above canopies of trees rather than forest interior.[15] Numerous studies show that long-tailed bats also feed or commute in open habitats.[16] Figure 1 is from a

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10 Sedgeley JA, O'Donnell CFJ 1999. Roost selection by the long-tailed bat, *Chalinolobus tuberculatus*, in temperate NewZealand rainforest and its implications for the conservation of bats in managed forests. Biological Conservation 88:261–276. Sedgely JA 2001. Quality of cavity microclimate as a factor influencing selection of maternity roosts by a tree-dwelling bat, *Chalinolobus tuberculatus*, in New Zealand. Journal of Applied Ecology 38:425-438.

11 Davidson-Watts Ecology (Pacific) Ltd. 2019 Long-tailed bat trapping and radio tracking baseline report 2018 and 2019. Southern Links, Hamilton. Report for AECOM, Auckland (Appendix G)

12 Sedgeley JA, O'Donnell CFJ 1999. Roost selection by the long-tailed bat, *Chalinolobus tuberculatus*, in temperate NewZealand rainforest and its implications for the conservation of bats in managed forests. Biological Conservation 88:261–276.

13 Dekrout A.S. 2009: Monitoring New Zealand long-tailed bats (*Chalinolobus tuberculatus*) in urban habitats: ecology, physiology and genetics. *Unpublished PhD thesis*. University of Auckland, Auckland, New Zealand. 168 pp.

14 Davidson-Watts Ecology (Pacific) Ltd. 2019 Long-tailed bat trapping and radio tracking baseline report. Southern Links, Hamilton. Report for AECOM, Auckland

15 O'Donnell CFJ 2005. Order Chiroptera. In. King CM ed. The handbook of New Zealand mammals 2nd ed. South Melbourne, Oxford University Press. Pp 95-109.

16 O'Donnell CFJ 2000. Influence of season, habitat, temperature, and invertebrate availability on nocturnal activity by the New Zealand long-tailed bat (*Chalinolobus tuberculatus*). New Zealand Journal of Zoology 27:207-221. O'Donnell CFJ, Christie JE, Simpson W 2006. Habitat use and nocturnal activity of lesser short-tailed bats (*Mystacina tuberculata*) in comparison with long-tailed bats (*Chalinolobus tuberculatus*) in temperate rainforest. New Zealand Journal of Zoology 33:113-124. Davidson-Watts Ecology (Pacific) Ltd. 2019 Long-tailed bat trapping and radio tracking baseline report. Southern Links, Hamilton. Report for AECOM, Auckland.

study at Pureora,[17] and shows records of where long-tailed bats were recorded foraging (red dots). These are correlated with the forest edge (dark grey), though there are also foraging records from open pasture.

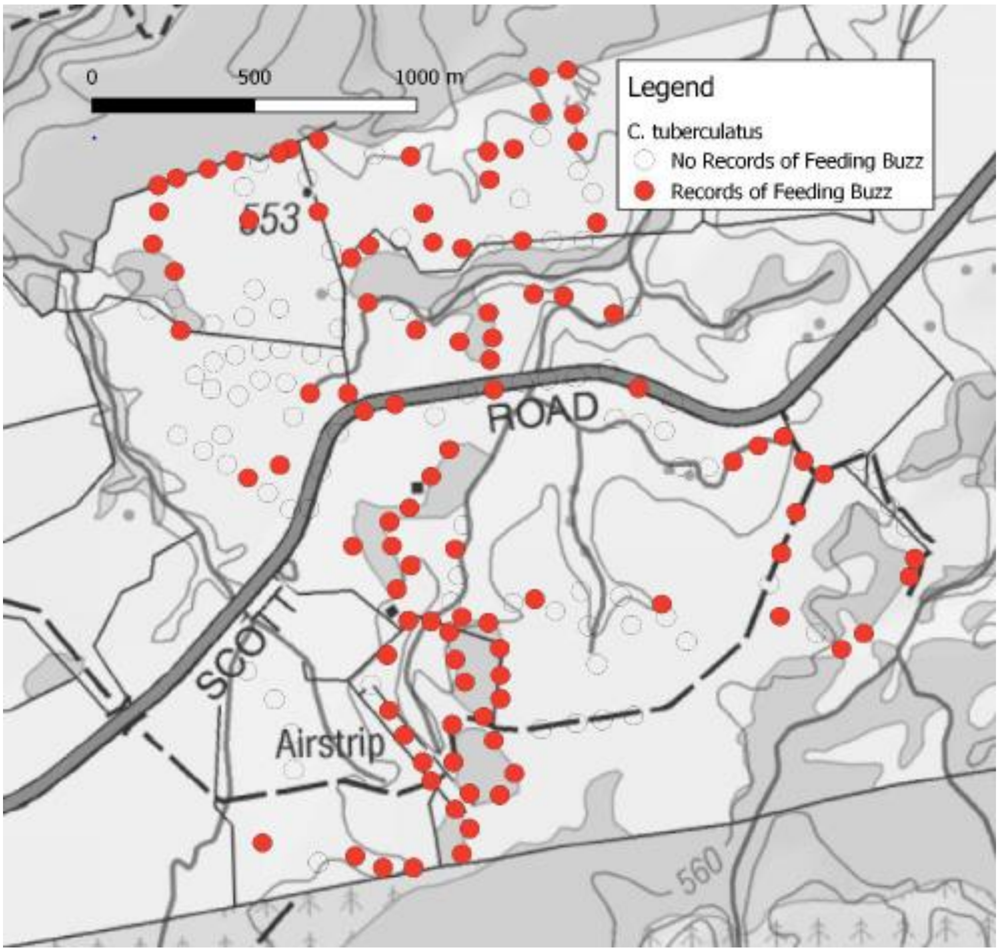

Figure 1.

7.7 Vegetation and gullies are particularly important habitat features for bats in Hamilton. Gullies are important for foraging, roosting and commuting.[18] The presence of hedgerows and trees is also important to allow bats to move through more open habitat.[19] Figure 2 shows bat records illustrating the use of hedgerows (blue dots are records of long-tailed bat presence, from DOC NZ Bat Distribution database).

[17] Bennett R. 2019. Understanding movement and habitat selection of the lesser short-tailed bat to infer potential encounters with nearly anticoagulant bait. Masters Thesis. Massey University.

[18] Dekrout A.S. 2009: Monitoring New Zealand long-tailed bats (*Chalinolobus tuberculatus*) in urban habitats: ecology, physiology and genetics. *Unpublished PhD thesis*. University of Auckland, Auckland, New Zealand. 168 pp.

[19] Crewther and Parsons 2017. Predictive modelling of long-tailed bat distribution in the Hamilton area. Walkingbats Consultancy.

Figure 2

7.8 Bats leave day roosts and use commuting routes to access foraging areas. Large home ranges are needed so bats can find enough resources for roosting, drinking and foraging (a home range is the habitat that an animal occupies).

7.9 In and around Hamilton two studies have estimated long-tailed bat home ranges. Dekrout followed 11 male long-tailed bats and observed home ranges from 25.9ha to 871ha, and 0.8 to 7.3km across.[20] Davidson-Watts followed 24 bats in the southern Hamilton area and observed home ranges from 134ha to 1609ha, and 2.5 to 7.0km across.[21] Because of the relatively short timeframe over which these studies took place, it is likely that they will not have captured the entire home ranges of the bats, and because only a small number of bats were sampled relative to the entire population, other bats may have larger home ranges than those sampled. For the Grand Canyon long-tailed bat population in the King Country (a fragmented landscape with larger forest nearby) the range span was 12km (DOC, unpublished data), and in the fragmented landscape of South Canterbury was up to 9km.

[20] Dekrout A.S. 2009: Monitoring New Zealand long-tailed bats (*Chalinolobus tuberculatus*) in urban habitats: ecology, physiology and genetics. *Unpublished PhD thesis*. University of Auckland, Auckland, New Zealand. 168 pp.

[21] Davidson-Watts Ecology (Pacific) Ltd. 2019 Long-tailed bat trapping and radio tracking baseline report. Southern Links, Hamilton. Report for AECOM, Auckland.

7.10 Long-tailed bats tend to space themselves using different parts of the landscape to reduce competition.[22] Therefore the home range of the population will cover a much wider area than the home range of an individual bat.

7.11 Long-tailed bats have high fidelity to their home range. Even when large parts of individual bats' home range has been lost due to tree felling they are unlikely to move to an entirely new area.[23]

8. LONG-TAILED BATS IN THE WAIKATO DISTRICT

Mapping Bat Zones

8.1 The s42A Report considers that, because the Waikato District Council has not been provided with any spatial data for bat habitat that it would be difficult and therefore inappropriate to include provisions.[24] Mr Riddell addresses this further in his evidence. I will, however, discuss the spatial data that is available for long-tailed bats in the Waikato District.

8.2 Long-tailed bats are widely distributed throughout the Waikato District. Appendix 1 maps the known distribution of bats in the District. This information is from DOC's national bat database, which attempts to collate all known bat records. These points are where bats have been detected using acoustic recorders; the points will be located within a larger bat home range. Areas on the map which do not show bats does not necessarily mean that bats are not present, but that no one has surveyed for bats in those areas, or that DOC has not obtained survey results.

8.3 The map shows bat populations at Hamilton, Raglan, Huntly/Ngaruawahia, Hunua Ranges and Pukekohe/Waiuku, and provides spatial data on which bat zones could be based.

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22 O'Donnell CFJ 2001. Home range and use of space by *Chalinolobus tuberculatus*, a temperate rainforest bat from New Zealand. Journal of Zoology (London) 253: 253-264. Dekrout A.S. 2009: Monitoring New Zealand long-tailed bats (*Chalinolobus tuberculatus*) in urban habitats: ecology, physiology and genetics. *Unpublished PhD thesis*. University of Auckland, Auckland, New Zealand. 168 pp.

23 Borkin K.M. and Parsons S. 2014: Effects of clear-fell harvest on bat home range. PLoS ONE 9(1): e86163 doi:10.1371/journal.pone.0086163

24 Section 42A Report at [300].

8.4 Hamilton is one of the few cities in New Zealand which hosts a population of long-tailed bats. This population straddles the Waikato, Hamilton City and Waipa Districts.

Significant Natural Areas (SNAs)

8.5 Under the Waikato Regional Policy Statement areas of bat habitat meet the criteria for areas of significant indigenous biodiversity under criteria 3, that is, they are "vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are...classed as threatened" or "at risk". [25]

8.6 Appendix 2 shows bat records since 1990 overlaid with currently mapped SNAs. Bats are very likely to have wider distribution than shown here, however there are many places that haven't been surveyed for bats. Despite this gap in knowledge, the maps show that many bats use areas outside currently mapped SNAs.

8.7 Figure 1 is from a study in south Hamilton[26] and identifies important bat habitat for foraging and roosting (red circles), and commuting routes (black lines) for 24 long-tailed bats which were followed in this area. The illustration highlights that bats are highly mobile in the landscape and will be using areas both within and outside of SNAs.

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[25] Waikato Regional Policy Statement, Table 11A.

[26] AECOM 2019. Long-tailed bat trapping and radio tracking baseline report 2018 and 2019, Southern Links, Hamilton.

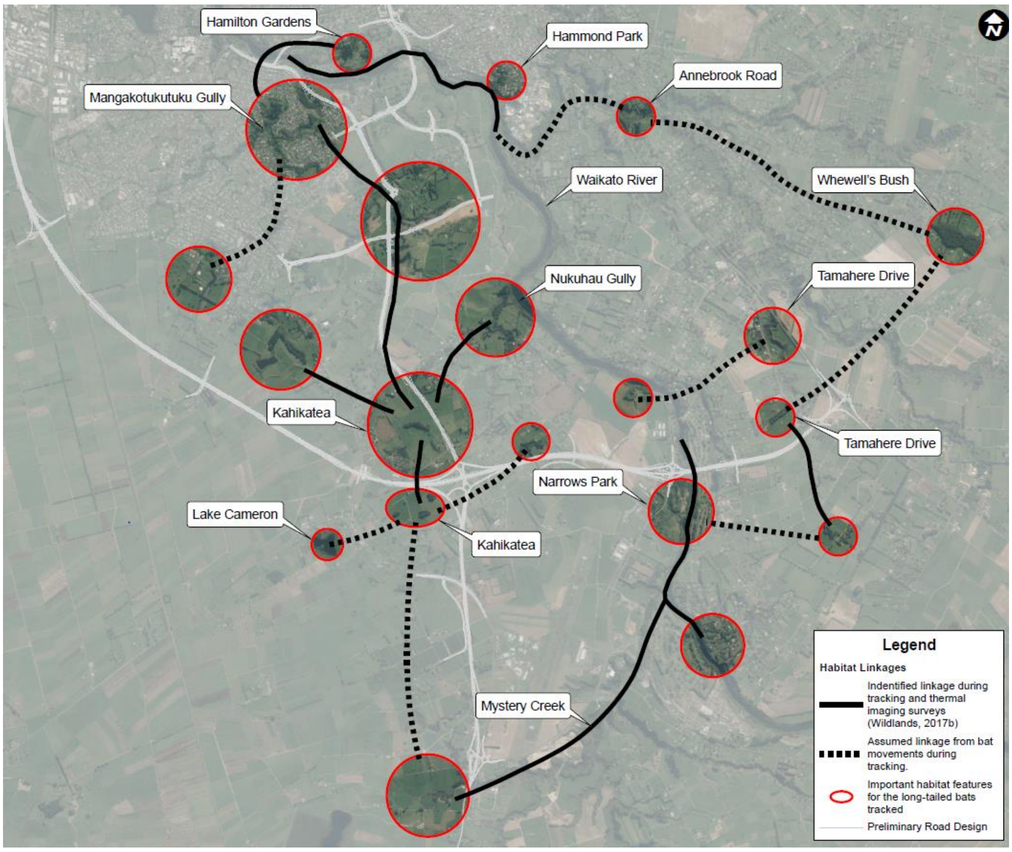

Figure 1. Important bat habitat and linkages in south Hamilton.

9. THE CONSEQUENCES FOR BATS OF REMOVAL OF TREES

Loss of Roost Trees

9.1 The magnitude of effect of tree removal depends on whether bats are roosting in the tree at the time of felling, whether the tree is a roost tree, the extent to which the area has previously been modified by the removal of bat habitat, and the importance of the particular tree/s in providing foraging and/or commuting sites.

9.2 Bats are at risk of being killed and injured if the trees they are roosting in are felled. This is because they often go into a state or torpor during the day and can take a minimum of 15 minutes to wake up, even when disturbed. Thus, they are unlikely to be able to wake up in time to leave when trees are felled.

9.3 The presence of suitable roost trees with specific thermal properties is critical to the persistence of long-tailed bats in the Waikato. If roost trees are felled bats cannot just go somewhere else. Roost trees are already rare, and long-tailed bats habitually use specific roost trees. Known roost trees in Hamilton range from 15.5cm to 300cm DBH[27].

9.4 The loss of roost trees leads to reduction in survival and fitness because bats will be forced to use less-preferred, poorer quality roosts.[28] Poorer quality roosts have less stable thermal properties and therefore require bats to expend more energy keeping warm. This is especially important for raising young. I consider that, due to roost trees already being so limited in urban and rural Waikato landscapes, that it is likely survival rates are already lower than within intact indigenous forest.

9.5 Artificial roost boxes have been used to replace felled natural roost trees. As mentioned, bats have very specialised requirements of roosts and if forced to roost in artificial boxes with sub-optimal thermal properties this would negatively affect the ability of bats to reproduce successfully.

9.6 Uptake of roost boxes by bats has been low in New Zealand. In Hamilton three roost boxes have been used from more than 28 installed.[29]. In Canterbury, installation of approximately 100 roost boxes showed <5% of uptake, use was not regular,[30] and it was not long term.[31]

9.7 Artificial roost boxes require ongoing maintenance that rarely occurs. This can result in boxes falling off trees, trees containing roost boxes being felled[32] and birds filling boxes with nesting material.[33]

9.8 Therefore, the provision of artificial roost boxes is currently unlikely to be a suitable replacement for loss of roost trees.

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27 AECOM 2019. Long-tailed bat trapping and radio tracking baseline report 2018 and 2019, Southern Links, Hamilton. Dekrout A.S. 2009: Monitoring New Zealand long-tailed bats (*Chalinolobus tuberculatus*) in urban habitats: ecology, physiology and genetics. *Unpublished PhD thesis*. University of Auckland, Auckland, New Zealand. 168 pp.

28 Sedgeley JA, O'Donnell CFJ 2004. Roost use by long-tailed bats in South Canterbury: examining predictions of roost-site selection in a highly fragmented landscape. New Zealand Journal of Ecology 28(1):1-18.

29 Andrew Styche pers comm.

30 Moira Pryde pers. Comm.

31 Colin O'Donnell pers comm.

32 Gollin J 2019. Long-tailed bat annual monitoring 2019. Waikato Aggregates. Prepared for Bloxam Burnett and Oliver Ltd.

33 Smith D, Borkin K, Jones C, 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. NZ Transport Agency research report 623.

9.9 I consider that the ongoing loss of roost trees in urban and rural landscapes in the Waikato District could be catastrophic for bat populations. This includes exotic as well as native trees.

Loss of trees for foraging and commuting

9.10 Loss of trees does not only mean loss of roosts. Trees are also needed for foraging and commuting, both essential for bat survival.

9.11 A recent study of bats in the Hamilton surrounds showed the importance of trees as bat habitat. Davidson-Watts reported highest bat activity in native and exotic tree habitat. The use of parkland and pasture areas was also likely associated with trees being present, including treelines and isolated trees.[34]

9.12 Removal of vegetation along which bats travel may lead to severance of flight paths, which in turn would lead to fragmentation of social groups. These smaller groups would be more vulnerable to extinction because of their small size and loss of genetic diversity.

9.13 To maintain genetic diversity of bats in the Waikato and wider region it is important to maintain connectivity in the landscape so social groups and populations can move across the landscape. Genetic diversity is important so that the species has the capacity to adapt to a changing environment.

10. THE EFFECT OF ARTIFICIAL LIGHTING AND ROADS ON BATS

10.1 Bats, being nocturnal, are extremely sensitive to artificial light at night. Overseas studies have shown that light can make bats more vulnerable to predation, alter foraging and commuting routes and fragment bat habitat.[35]

10.2 The information on the effect of artificial lighting specific to long-tailed bats is limited, however, in Hamilton lower levels of bat activity are associated with higher housing and street light density.[36]

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[34] Davidson-Watts Ecology (Pacific) Ltd. 2019 Long-tailed bat trapping and radio tracking baseline report. Southern Links, Hamilton. Report for AECOM, Auckland.

[35] Voigt, C.C, C. Azam, J. Dekker, J. Ferguson, M. Fritze, S. Gazaryan, F. Hölker, G. Jones, N. Leader, D. Lewanzik, H.J.G.A. Limpens, F. Mathews, J. Rydell, H. Schofield, K. Spoelstra, M. Zagmajster (2018): Guidelines for consideration of bats in lighting projects. EUROBATS Publication Series No. 8. UNEP/EUROBATS Secretariat, Bonn, Germany, 62 pp.

[36] DeKrout AS, Clarkson BD, Parsons S 2014. Temporal and spatial distribution and habitat associations of an urban population of New Zealand long-tailed bats (Chalinolobus tuberculatus). New Zealand Journal of Ecology 41(4):285-295.

10.3 With increasing roading and housing in the Waikato District there is increasing artificial light.

10.4 In the absence of more data on the effects of light on long-tailed bats a cautious approach is prudent. European guidelines have been developed for consideration of bats in lighting projects[37], and include methods to minimise and mitigate the effect of artificial lighting.

10.5 In my opinion, bat zones, if developed, should include lighting which follows European guidelines. In the absence of bat zones, a precautionary approach should be taken with new lighting projects in the District following the European guidelines.

10.6 There is less long-tailed bat activity with increasing overnight traffic on roads.[38] In two Hamilton studies bat activity decreased when road density increased.[39]

11. RESPONSE TO DISTRICT PLAN REVIEW, TECHNICAL RESPONSES TO SUBMISSIONS RELATING TO ECOLOGY, SECTION 2. BATS

11.1 This review of bats in the Waikato district recognises that felling trees can cause injury or death to bats, however does not consider the importance of tree removal in removing a critical resource for bat survival, for example, trees used for roosting, foraging and commuting.

11.2 The review identifies that SNAs provide one mechanism for protection. However, as I have said above, bats occur outside of currently mapped SNAs, and given the threat status of bats, and the rarity of trees in parts of the Waikato

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Le Roux D, Le Roux N 2012. Hamilton City Bat Survey Unpublished report prepared for Project Echo by Kessels and Associates, Hamilton Wildland Consultants 2018: Baseline acoustic monitoring of long-tailed bats for the Southern Links roading project, Hamilton: 2017 and 2018. *Wildland Consultants Ltd Contract Report No. 4192d*. Prepared for Aecom, New Zealand. 37 pp.

37 Voigt, C.C, C. Azam, J. Dekker, J. Ferguson, M. Fritze, S. Gazaryan, F. Hölker, G. Jones, N. Leader, D. Lewanzik, H.J.G.A. Limpens, F. Mathews, J. Rydell, H. Schofield, K. Spoelstra, M. Zagmajster (2018): Guidelines for consideration of bats in lighting projects. EUROBATS Publication Series No. 8. UNEP/EUROBATS Secretariat, Bonn, Germany, 62 pp.

38 Borkin K.M, Smith D.H. V., Shaw W.B. McQueen J.C. 2019. More traffic, less bat activity: the relationship between overnight traffic volumes and *Chalinolobus tuberculatus* activity along New Zealand highways. Acta Chiropterologica, 21(2): 321–329.

39 Le Roux D.S. and Le Roux N.S. 2012: Hamilton City Bat Survey 2011-2012. Report prepared by Kessels & Associates Ltd for Project Echo (project partners: Waikato Regional Council, The University of Waikato, Hamilton City Council, Department of Conservation, Waikato Tree Trust). 22 pp. Document Ref: \\server files\Hamilton City Council\Bat survey city wide\city wide survey report_240512. Wildland Consultants 2018. Baseline acoustic monitoring of long-tailed bats for the Southern Links roading project, Hamilton: 2017 and 2018. *Wildland Consultants Ltd Contract Report No. 4192d*. Prepared for Aecom, New Zealand. 37 pp.

which are essential to bat survival, I do not consider the currently mapped SNA network adequate to ensure population survival.

11.3 I agree that while the Draft Timaru District Planning map shows only one bat zone, more than this is required for the Waikato District due to bats being more widely distributed.

11.4 I agree that "there is no district wide comprehensive data set that would allow accurate mapping of bat protection zones". However, the mapping shown in Appendix 1, is adequate to define some bat zones, and further survey would assist in defining others.

11.5 I agree that mapping bat zones requires definition of what constitutes an important bat zone. Based on the maximum observed home range span of bats in the Waikato, I consider that a 7.3km buffer around each bat observation is appropriate to identify the location of bat zones. A map is provided in Appendix 3.

12. CONCLUSION

12.1 Long-tailed bats are critically threatened. While predation is the main threat to long-tailed bats in large indigenous forest, bats in urban and rural parts of the Waikato District are under additional threat from vegetation clearance and development. I consider that bat populations will not persist in these areas without further protection measures.

12.2 The long-tailed mapping data provided could form the basis on which to develop "bat zones". The mapping data could be improved with further survey effort outside of currently known bat distribution.

12.3 It is critical that bat roosts, foraging areas and commuting areas are protected by maintaining trees and vegetation such as hedgerows. Based on Hamilton studies, potential roost trees include those trees with a DBH greater than 15cm. It is also important that lighting and other impacts that accompany housing and infrastructure projects consider bats when they are being developed.

Dated 29 October 2020

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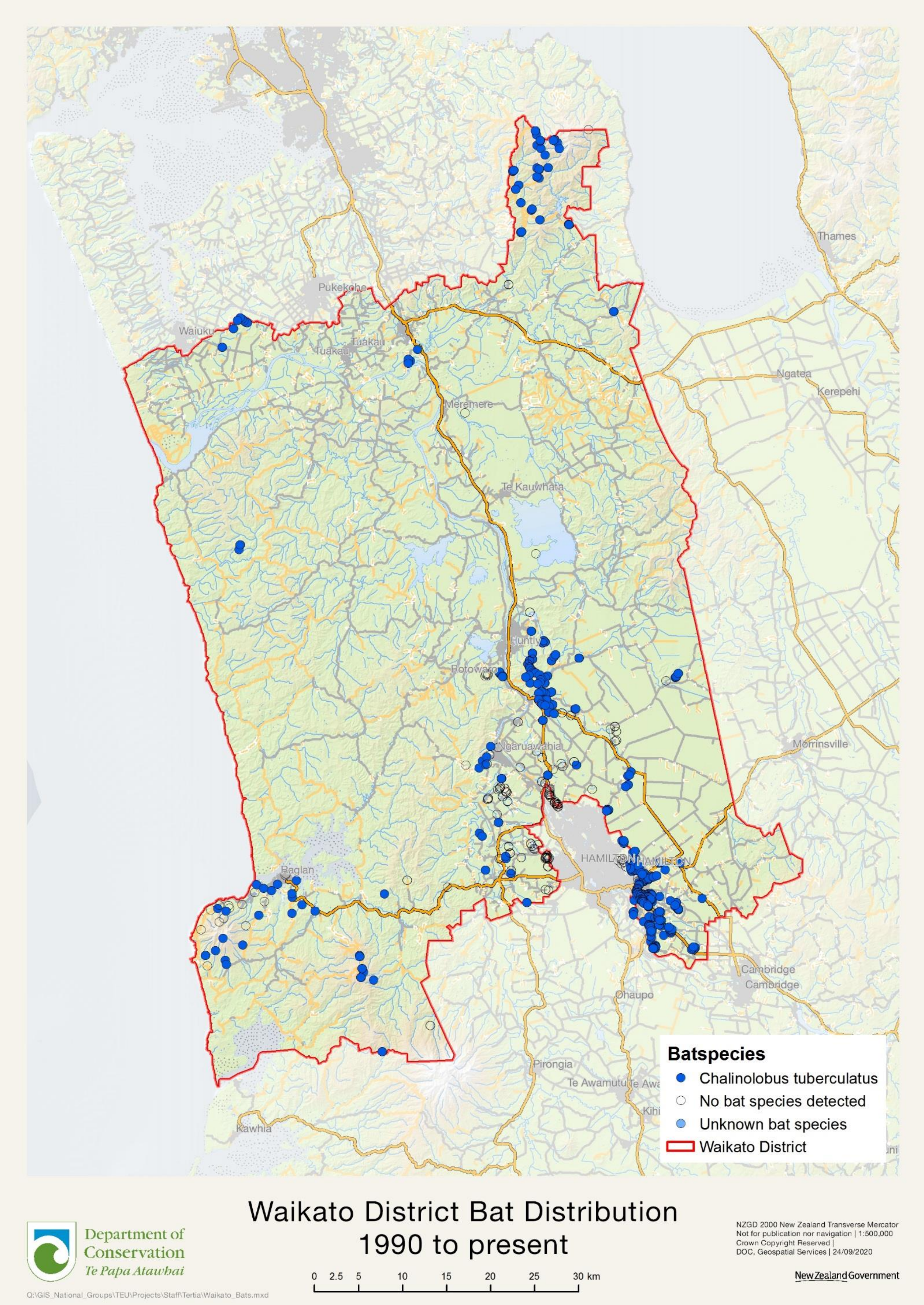
Tertia Thurley

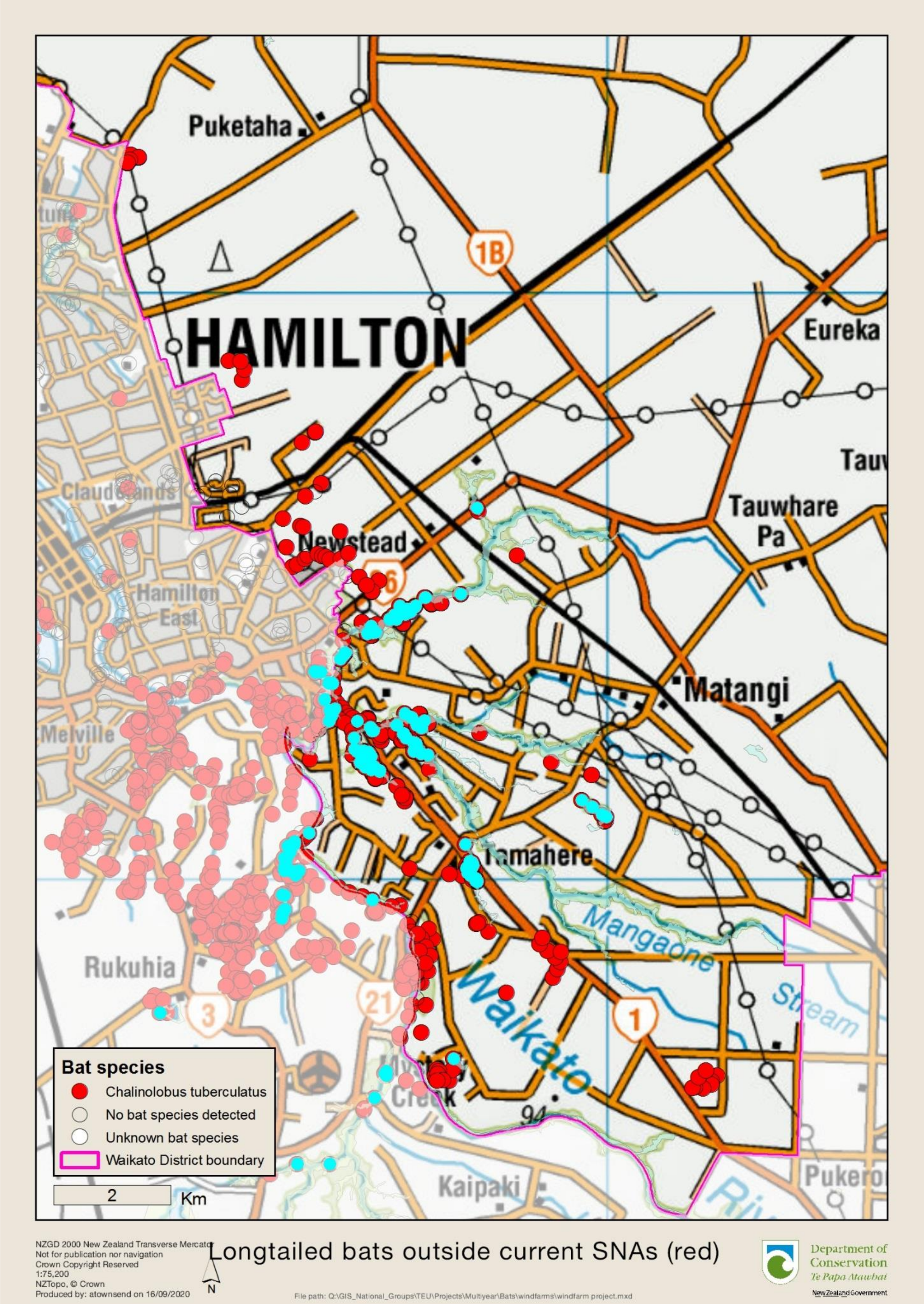
APPENDIX 1

Bat distribution in Waikato (note that much of the Waikato District remains unsurveyed for bats)



APPENDIX 2

Example areas of bat records since 1990 outside of currently mapped SNAs. Blue circles show bat records within SNAs, red circles show bat records outside of SNAs. Note that our knowledge of bat distribution is incomplete, and bats are very likely to be more widespread than shown.



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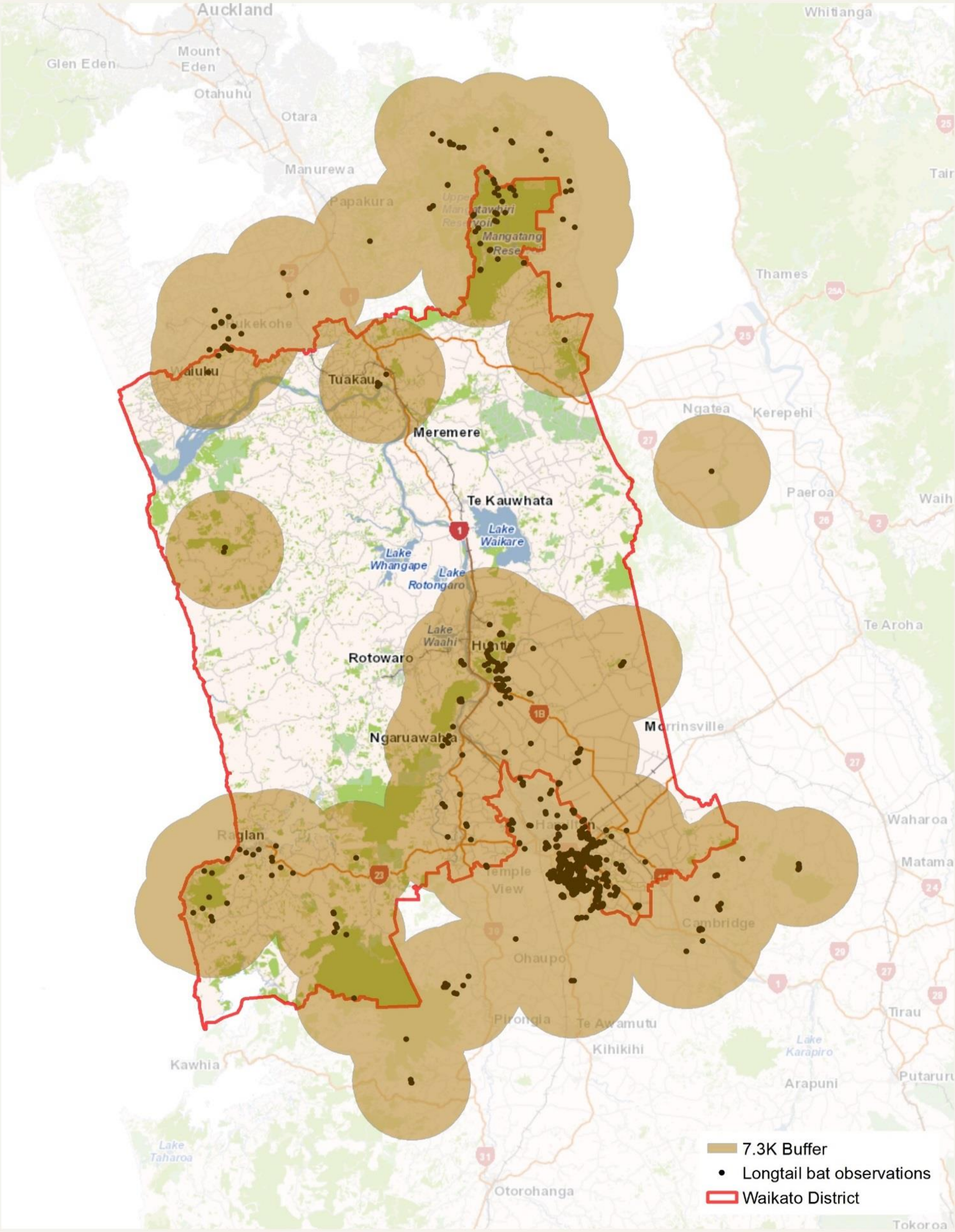
Longtailed bats outside current SNAs (red)

Department of Conservation
Te Papa Atawhai
New Zealand Government

File path: Q:\GIS_National_Groups\TEU\Projects\Multiyear\Bats\windfarms\windfarm project.mxd

Appendix 3

Long-tailed bat distribution with 7.3km buffer



Bat Distribution Waikato District

New Zealand Government

Department of Conservation
Te Papa Atawhai

0 5 10 20 30 40 km

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