<u>IN THE MATTER</u>	of the Resource Management Act 1991
<u>AND</u>	
<u>IN THE MATTER</u>	of the Proposed Waikato District Plan (Stage 1) – Hearing 22 - Infrastructure

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

29 SEPTEMBER 2020

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1. INTRODUCTION

Qualifications and Experience

1.1 My full name is Tertia Thurley.

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

1.3 I have been employed by the Department of Conservation since 1996, working on threatened species protection and monitoring.

1.4 My work has included establishing a short-tailed bat monitoring project at Pureora Forest which I continue to be involved with. I also established, participated in and had oversight over a long-tailed bat monitoring project at Pureora which ran from 2011 to 2017.

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

1.6 Since September 2019 my role in the Department of Conservation has been Technical Advisor, Ecology; and includes providing bat advice to Department of Conservation internal staff and externals.

1.7 I am certified as a "Trainer" (Class E level) by the Department of Conservation'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.

1.8 I currently lead the Department of Conservation Bat Recovery Group.

1.9 I am engaged by the Director-General to provide evidence on Provision 14.6.2 Restricted Discretionary Activities Small-scale and community-scale wind farms. The Director-General has commented that wind farms, even those of smaller scale, have the potential to have significant ecological impacts, particularly on avifauna and bats; and has requested additional matters of discretion to address these impacts. My evidence is limited to the potential effects of small-scale and community-scale wind farms on bats.

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 the effect of small scale and community windfarms on bats. My evidence will cover:

(a) New Zealand bats – overview;

(b) The conservation status of long-tailed bats;

(c) Long-tailed bats in the Waikato District;

(d) The effects of windfarms on bats;

(e) The effects of Small Wind Turbines on bats;

(f) Small wind turbines in the context of Waikato and currently mapped Significant Natural Areas (SNAs).

3.2 Key documents considered are referenced in the body of my evidence. Those documents include:

(a) Department of Conservation bat distribution database;

(b) Published scientific papers.

3.3 There have been few studies on the effects of small-scale windfarms, and none in New Zealand. I therefore present evidence on what is known from overseas studies about the effect wind farms on bats in general before presenting what is known about the effects of small-scale wind farms, based on evidence from the UK.

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 populations of long-tailed bats and it is highly likely that more will be discovered. Those present in urban and rural landscapes are very vulnerable because of the limited suitable habitat in these areas, and pressures from tree clearance and development further restrict habitat.

4.3 Internationally, large numbers of bats are killed by wind farms using large turbines. There is a paucity of studies of the effects of small wind turbines. However, studies in the UK show that, despite bats generally avoiding small wind turbines, small wind turbines do kill bats. Avoidance behaviour by bats means that small wind turbines operating in bat habitat reduce the habitat area available for bats.

4.4 Applying this to long-tailed bats in the Waikato, in my opinion, there is a risk that long-tailed bats will be killed by operating small wind turbines. In urban and rural parts of Waikato, where bat habitat is already limited, small wind turbines could further restrict valuable bat habitat, especially if placed along bat commuting routes, foraging areas or near roost trees.

4.5 In my view, the best approach to minimise this risk is by not allowing wind turbines in known bat habitat and, in the absence of information, requiring bat surveys to determine bat presence/absence prior to installation.

4.6 Long-tailed bats are known to occur outside of currently mapped Significant Natural Areas (**SNAs**),[1] therefore the SNA layer at it currently exists does not provide adequate protection for long-tailed bats. Matters of discretion referencing 'values' need to be applied to all of the habitat that these bats need to function (roosting, foraging and commuting).

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1 Appendix 2 provides records of long-tailed bats in Hamilton and Huntly, overlaid on SNAs.

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 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 Department of Conservation 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.

6.3 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] This is due to predation by ship rats, possums, stoats and cats and habitat loss, degradation and fragmentation through forest clearance.[4]

6.4 The long-tailed bat is classed as Nationally Critical, the highest threat category for a New Zealand species.[5] 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.

7. LONG-TAILED BATS IN THE WAIKATO DISTRICT

7.1 Long-tailed bats are widely distributed throughout the Waikato District. Appendix 1 maps the distribution of bats in the District; however, this map is incomplete due limited knowledge. Ongoing surveys are very likely to expand the known distribution of bats.

7.2 Habitat suitable for long-tailed bats is rare in urban and rural landscapes compared to forested landscapes. Long-tailed bats require shelter, roost sites, foraging sites, drinking sites and commuting sites. Shelter and roost sites are almost always in trees. Roosting cavities have very specific thermal requirements and are generally very rare in the landscape even when in forest.[6] Suitable roost trees are even rarer in urban and rural landscapes given

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

6 Sedgeley JA; O'Donnell CFJ 1999b. Roost selection by the longtailed bat, *Chalinolobus tuberculatus*, in temperate New Zealand rainforest and its implications for the conservation of bats in managed forests. Biological Conservation 88:261–276.

the paucity of trees. Foraging sites are typically around tree and forest edges and above canopies of trees,[7] though they do feed over pasture as well.[8]

7.3 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.

7.4 It is likely that bats in the Waikato are declining due to the threats listed in 6.3. Bats in urban and peri-urban landscapes are under increasing pressure from roading and housing development.[9]

7.5 Bats in a rural environment are likely to face greater threats than those in large intact forest. A population in South Canterbury was estimated 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. This was a greater rate of decline than found in a large intact forest where predation was the only pressure.[10]

7.6 In the context of wind farms, even a small number of bat deaths is a high-risk situation given the threat status of long-tailed bats.

8. THE EFFECT OF WIND FARMS ON BATS

8.1 There have been many studies internationally showing that wind farms kill significant numbers of bat species.[11] One study found that tree bats and

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7 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.

8 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.

9 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.

10 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.

11 Barclay RMR, Baerwald EF, Gruver JC 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology 85: 381-387. Kunz TH, Arnett EB, Erickson WP, Hoar AR, Johnson GD, Larkin RP, Strickland MD, Thresher RW, Tuttle MD 2007. Ecological impacts of wind energy development on bats: questions, research needs and hypotheses. Frontiers in Ecology and the Environment 5: 315-324. Cryan PM, Barclay RMR 2009. Causes of bat fatalities at wind turbines: hypotheses and predictions. American Society of Mammalogists. Rydell J, Bach L, Dubourg-Savage M, Green M, Rodrigues L, Hedenstrom A 2010. Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12(2): 261-274.
Grodsky SM, Behr MJ, Gendler A, Drake D, Dieterle BD, Rudd RJ, Walrath NL 2011. Investigating the causes of death for wind-turbine- associated bat fatalities. Journal of Mammalogy 92: 917-925. Georgiakakis P, Kret E, Carcamo B, Doutau B, Kafkaletou-Diez A, Vasilakis D, Papadatou E 2012. Bat fatalities at windfarms in North-Eastern Greece. Acta Chiropterologica 14: 459-468. Roscioni F, Russo D, Di Febbraro M, Frate L, Carrnaza ML, Loy A 2013. Regional scale modelling of the cumulative impact of wind farms on bats. Biodiversity and Conservation 22: 1821-1835. Arnett EB, Baerwald EF 2013. Impacts of wind energy development on bats: Implications for Conservation. In Bat Evolution, Ecology and Conservation: 435-456. Sowler S, Stoffberg S, MacEwan K, Aronson

migratory bats were most affected,[12] another in northwestern Europe found that bats adapted for open-air foraging were most affected.[13] New Zealand's long-tailed bats are both tree roosting and open-air foraging. These studies have focused on larger-scale windfarms.

8.2 Death is through direct collision or barotrauma.[14] Barotrauma is caused by rapid air-pressure reduction near moving turbine blades resulting in lung damage.[15]

8.3 Other impacts include roost disturbances, destruction of foraging habitat, displacement of bats from their foraging habitat and barriers to commuting routes or severance of foraging habitat.[16]

9. THE EFFECT OF SMALL WIND TURBINES ON BATS

9.1 There is a small body of research on the effects of small wind turbines on bats. This comes from studies in the UK.

9.2 Mortality rate of bats at small wind turbines (turbines with hub heights 4.0-26.4m and rotor diameter 0.9-15.0m) in the UK has been evaluated as low (0.008-0.169 bats per turbine per year), but does occur.[17]

9.3 Small wind turbines are installed in a much wider range of habitats than large turbines, so may present different risks.[18]

9.4 There is evidence that some bat species avoid single small wind turbines (6-18m hub height), with reduced bat activity <25m from the turbine.[19] The

J, Ramalho R, Forssman K, Lotter C 2016. South African good practice guidlelines for surveying bats at wind energy facility developments – pre-construction: 4th Edition. South African Bat Assessment Association.

12 Cryan PM, Barclay RMR 2009. Causes of bat fatalities at wind turbines: hypotheses and predictions. American Society of Mammalogists.

13 Rydell J, Bach L, Dubourg-Savage M, Green M, Rodrigues L, Hedenstrom A 2010. Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12(2): 261-274

14 Cryan PM, Barclay RMR 2009. Causes of bat fatalities at wind turbines: hypotheses and predictions. American Society of Mammalogists.

15 Baerwald EF, D'Amours GH, Klug BJ, Barclay BMR 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18: 695-696.

16 Sowler S, Stoffberg S, MacEwan K, Aronson J, Ramalho R, Forssman K, Lotter C 2016. South African good practice guidelines for surveying bats at wind energy facility developments – pre-construction: 4th Edition. South African Bat Assessment Association.

17 Minderman J, Fuentes-Montemayor E, Pearce-Higgins JW, Pendlebury CJ, Park KJ 2014. Estimates and correlates of bird and bat mortality at small wind turbine sites. Biodiversity and Conservation. doi:10.1007/s10531-014-0826-z.

18 Minderman J, Gillis MH, Daly HF, Park KJ 2017. Landscape-scale effects of single- and multiple small wind turbines on bat activity. Animal Conservation 20:455-462.

19 Minderman J, Pendlebury CJ, Pearce-Higgins JW, Park KJ 2012. Experimental evidence for the Effect of Small Wind Turbine Proximity and Operation on Bird and Bat Activity. PLoS ONE 7(7):e41177. Doi:10.1371/journal.pone.0041177.

implication of this is that small wind turbines can reduce availability of habitat, especially where there is more than one turbine.[20]

9.5 Disturbance to bats when small wind turbines are placed near linear features (e.g. hedgerows and tree lines) can have an effect for at least 60m along the feature.[21] As these features are important to bats for commuting and foraging, such an effect could be detrimental where suitable foraging and roosting habitat is limited and fragmented, and linear features suitable for commuting between habitat fragments are already rare.

10. SMALL WIND TURBINES IN THE CONTEXT OF WAIKATO AND CURRENTLY MAPPED SIGNIFICANT NATURAL AREAS

10.1 In my opinion long-tailed bats may avoid the area surrounding operating small wind turbines or they may not, but neither option is likely to be absolute. It is plausible that while most long-tailed bats will avoid the turbines, some will not and die as a result of collision.

10.2 Long-tailed bats use linear features (e.g. hedges, forest margins) to travel along,[22] and typically forage along margins of trees. Gullies can be important for foraging, roosting and commuting. Therefore, wind turbines placed at and near these areas present a higher collision risk to bats.

10.3 Numerous studies show that long-tailed bats also feed or commute in open habitats,[23] making them also vulnerable to collision with wind turbines in this habitat.

10.4 Through much of the Waikato, habitat suitable for bats to roost, forage and commute through is scarce, and therefore valuable. It is unknown, but plausible in my opinion, that long-tailed bats would largely avoid small wind

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20 Minderman J, Gillis MH, Daly HF, Park KJ 2017. Landscape-scale effects of single- and multiple small wind turbines on bat activity. Animal Conservation 20:455-462.

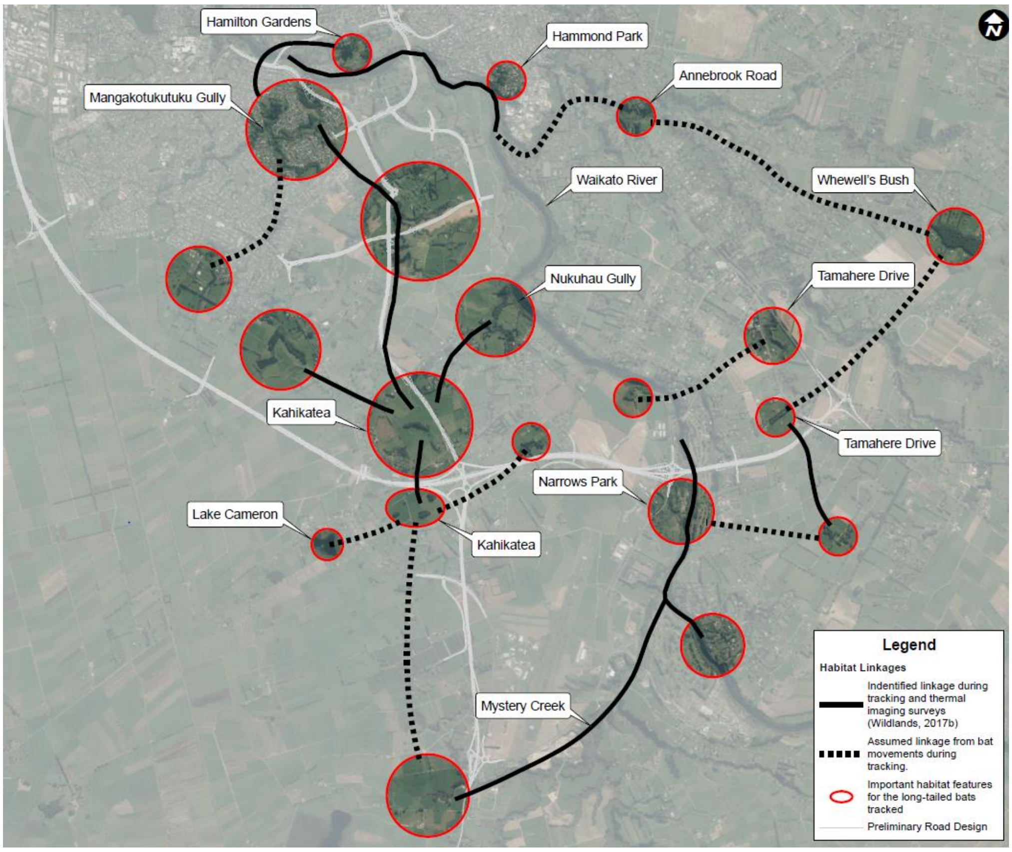
21 Tatchley C 2015. Wildlife impacts of and public attitudes towards small wind turbines. PhD thesis. University of Stirling.

22 Crewther K. and Parsons S. 2017: Predictive modelling of long-tailed bat distribution in the Hamilton area. *Walkingbats Consultancy report.* Prepared for Project Echo (a collaboration between Hamilton City Council, Department of Conservation, Waikato Regional Council, and Riverlea Environment Society Inc.).

23 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.
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.

turbines when they are in operation. If so, wind turbines placed alongside roosts could cause these roosts to be abandoned. If placed along commuting pathways, e.g. gullies, hedges and forest edges, these pathways may be blocked, preventing bats travelling between roosting and foraging areas. If turbines are placed within foraging areas, this habitat also becomes unavailable to bats.

10.5 Figure 1 is from a study in south Hamilton[24] and identifies important bat habitat for foraging, roosting and commuting routes for long-tailed bats in this area. This was done by attaching radio transmitters to bats and following their movements. The illustration highlights the importance of areas outside of currently mapped SNAs for bat foraging and movement.



10.6 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

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

knowledge, the maps show that many bats use areas outside currently mapped SNAs.

10.7 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]

10.8 Given the paucity of trees in the urban and rural landscape, and the importance of trees for roosting, foraging and commuting, any vegetation clearance associated with the construction of small-scale wind farms in bat habitat is likely to negatively impact bats.

10.9 In my opinion, there will be a cumulative effect on bats of multiple wind turbines, whether there are single turbines at multiple sites of multiple turbines at one site.

10.10 Negative effects on bats from small wind turbines could be greatly reduced by not allowing wind turbines in known bat habitat and, in the absence of information, requiring bat survey to determine bat presence/absence prior to installation.

10.11 Failing this, potential options include stopping small wind turbines from running during the night (sunset to sunrise), or operating turbines only at wind speeds and temperatures that bats are unlikely to be active. The latter would require the collection of local data to determine suitable wind speeds and temperatures.

11. CONCLUSION

11.1 Given the high threat status of long-tailed bats nationally, and the particular vulnerability of the species in urban and rural landscapes, the risk posed to bats by wind turbines needs to be considered throughout their habitat, including their roosting, foraging and commuting routes.

11.2 Threats from large wind turbines are collision or barotrauma killing bats. Threats from small wind turbines are collision killing bats, or avoidance of the

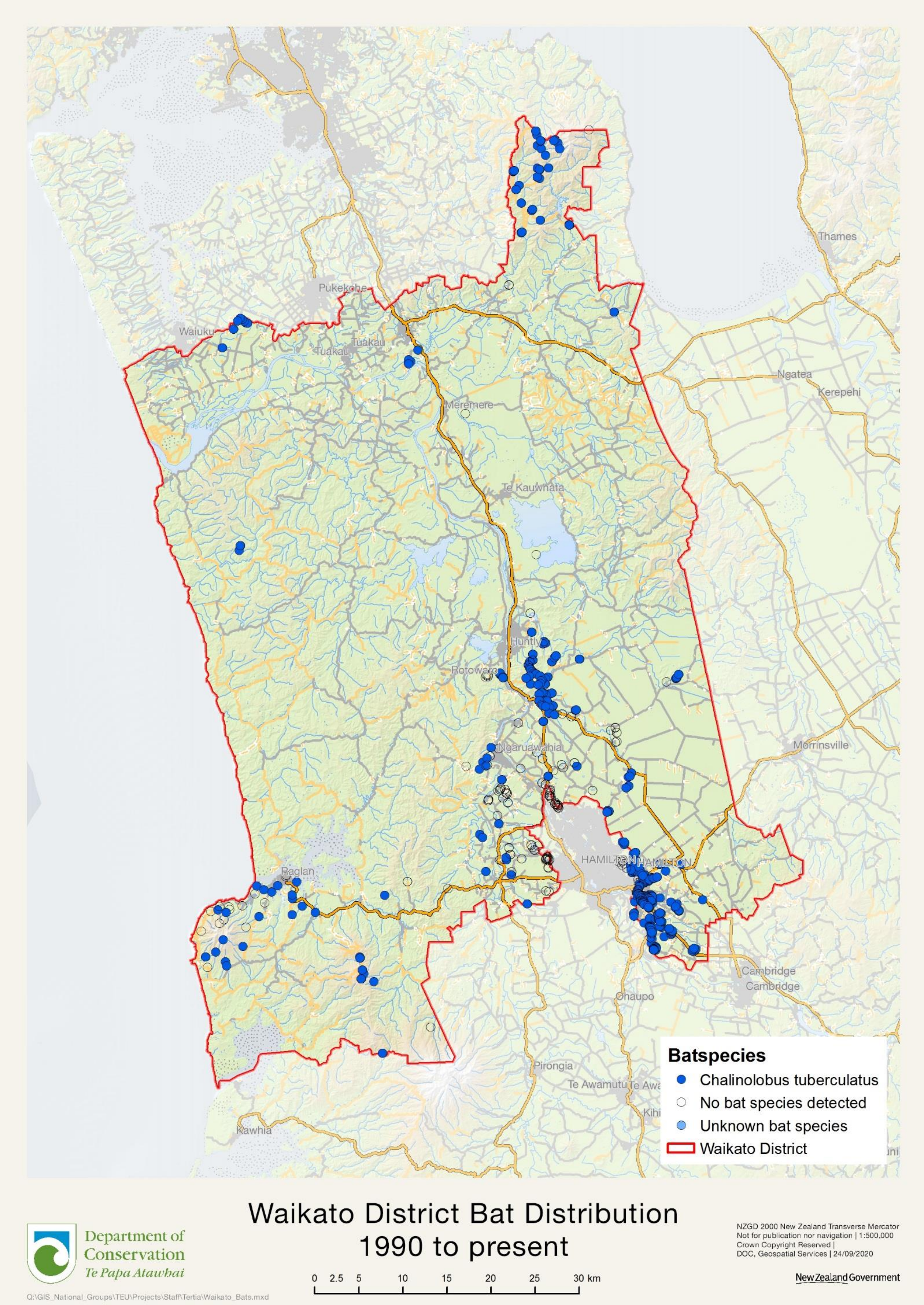
[25] Waikato Regional Policy Statement, Table 11A.

turbines by bats leading to reduced habitat being available to bats. Therefore in my opinion, placement of wind turbines should not occur in bat habitat, especially near to roost trees, commuting routes and foraging areas. Furthermore, in my opinion, because trees are relatively rare in the urban and rural habitat, and very important as bat habitat, vegetation should not be cleared for wind farm construction in bat habitat.

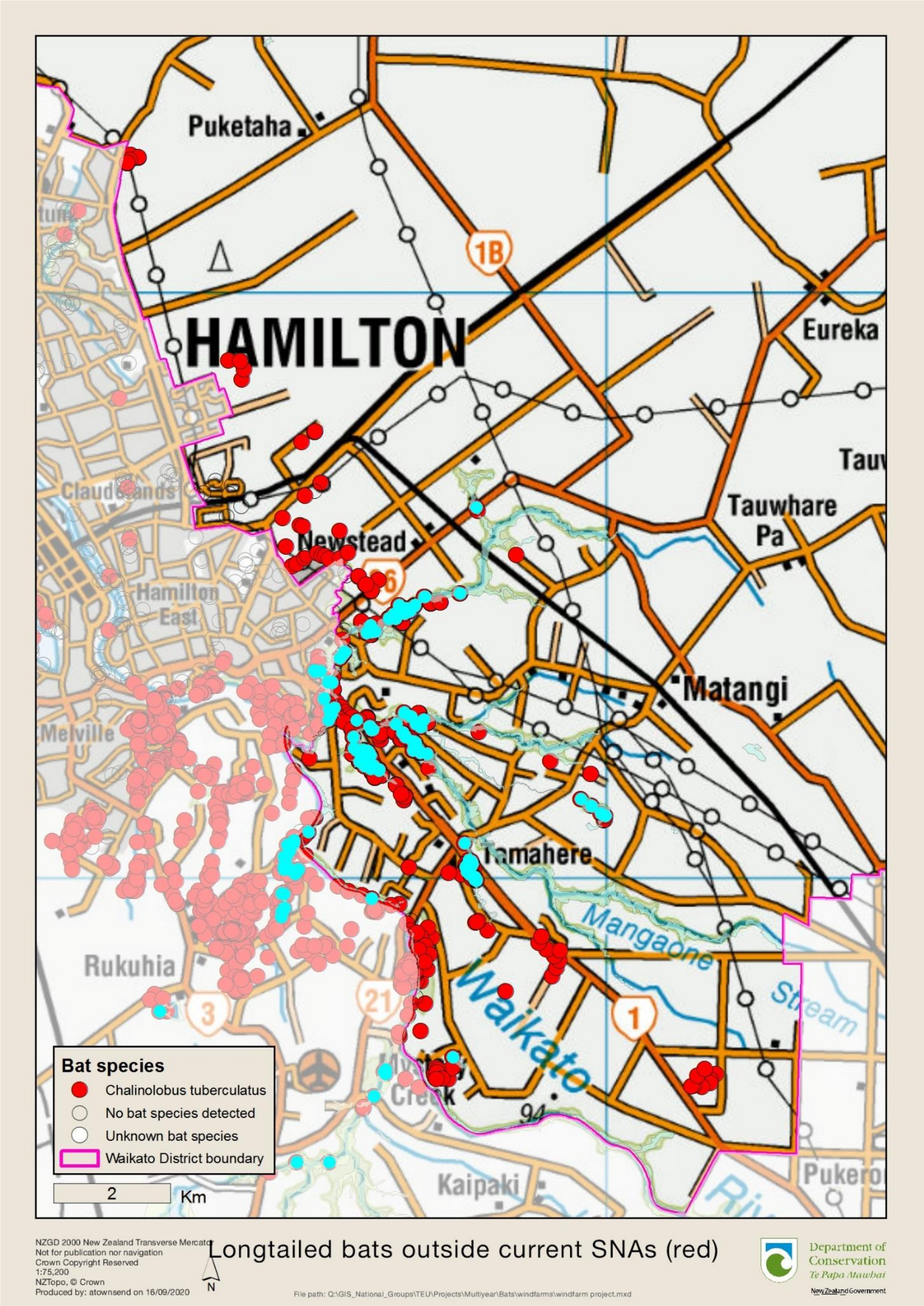
Tertia Thurley

29 September 2020

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)

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Department of Conservation
Te Papa Atawhai
New Zealand Government