IN THE MATTER	**of applications pursuant to the Resource Management Act 1991**
BY	**Weston Lea Limited**
FOR	**land use and subdivision consents for a large scale residential development and associated land use activities and sites works at Peacocke, Hamilton**

STATEMENT OF EVIDENCE (Ecology)

GERARDUS HENRICUS ANTHONIUS KESSELS

2 April 2019

INTRODUCTION

1. My name is Gerardus (Gerry) Henricus Anthonius Kessels.

2. I hold a Bachelor of Science degree majoring in zoology (completed in 1988) and a Master of Resource and Environmental Planning (completed in 1999), both from Massey University.

3. I have 29 years of experience in the fields of ecology and resource management planning as follows:

   (a) My initial role was with the Department of Conservation ("DOC") as a Conservation officer at Mount Bruce Wildlife Reserve and then as a Conservation Officer – Protected Species with the Waikato Conservancy.

   (b) From the end of 1994 until the end of 1999 I worked for the Hamilton and Napier offices of Works Consultancy Services/Opus International Consultants as an ecologist.

   (c) I was then the managing director and principal ecologist of Kessels & Associates Ltd (trading as Kessels Ecology - KE) from 1999 to 2018.

   (d) I am currently an independent contractor, retained as Principal Ecologist for Tonkin and Taylor Limited.

4. I am a member of the Freshwater Sciences Society of New Zealand, the New Zealand Ecological Society, the Ornithological Society of New Zealand, the Waikato Botanical Society and an affiliate member of the New Zealand Planning Institute.

5. I am a generalist ecologist with experience in assessing the conservation significance of natural habitats, assessing the ecological effects associated with infrastructure, policy development relating to the potential ecological implications of land use, and biodiversity offsetting. I have a broad background of relevant experience in threatened species management, ecosystem monitoring/evaluation and conservation management. I have been assessing flora and fauna habitats since 1990, including:

   (a) Undertaking threatened species captive breeding management/research;

   (b) assisting with offshore island pest eradication programmes;

   (c) assisting with the capture, translocation and tagging of a number of threatened species, such as kakapo, North Island kokako and long-tailed bats;

   (d) completing surveys for threatened fish/lizards/bats; ecological restoration and management plans; and

   (e) undertaking significant natural area ("SNA") assessments.

6. I have also been undertaking ecological impact assessments and assisting with policy development pertaining to indigenous flora and fauna and their habitats and biodiversity under the Resource Management Act 1991 ("RMA") for a wide variety of development and biodiversity enhancement projects. I have undertaken this work for a number of organisations, including the NZ Transport Agency, DOC, local authorities, rural landowners,

rural and residential subdivision companies, non-profit conservation organisations and infrastructure companies.

Work with Territorial Authorities

7. Since the early 1990s I have been involved in assessing SNAs and assisting in biodiversity policy and regulation analysis/development for territorial authorities, primarily under the provisions of section 6(c) and sections 30 and 31 of the RMA. Local authorities that I have assisted in this process since 1993 include: Hauraki District Council; Franklin District Council; Papakura District Council; Ruapehu District Council; Waikato Regional Council ("WRC"); Auckland Regional Council; Auckland City Council; Auckland Council; Kapiti Coast District Council; Waipa District Council; Waitomo District Council; Waikato District Council; Central Hawkes Bay District Council; Thames-Coromandel District Council and Hamilton City Council ("HCC").

Work in Hamilton City

8. I have undertaken a large number of ecological surveys and assessments in HCC throughout my professional career, including the following examples:

   (a) I am principal ecologist retained to provide ecological advice for the construction of the Hamilton section of the Waikato Expressway;

   (b) I was principal review ecologist retained by HCC for the HCC designation and WRC consenting phase for Southern Links arterial roading project;

   (c) I have undertaken ecological assessments, mitigation and monitoring of many large and small residential subdivisions in Hamilton, including Somerset and St James Park,

   (d) I have been involved in integrated catchment planning, specifically related to zoning for Rotokauri Industrial Park;

   (e) I have reviewed the ecological aspects of the Ruakura Development Plan on behalf of HCC during the consenting phase.

   (f) I was retained by HCC to assist with ecology aspects of policy and rule development and responses to submitters for the Operative Hamilton District Plan ("ODP");

   (g) I have project managed and been involved in numerous bat surveys throughout Hamilton, as well as project managing two city-wide bat surveys on behalf of HCC, WRC and DOC, since 2007; and

   (h) I provided ecological advice to HCC for the Peacocke Structure Plan in 2009.

9. I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and have complied with that Practice Note in preparation of this evidence. I agree to comply with it in presenting evidence at this hearing. The evidence that I give is within my area of expertise, except where I have stated my reliance on other identified evidence. I have considered all material facts that are known to me that might alter or detract from the opinions that I express in this evidence.

SCOPE OF EVIDENCE

10. I have been retained by HCC to provide a technical review of the terrestrial ecology components relating to the consent applications by Weston Lea Limited ("the applicant") for the Amberfield Subdivision Development, situated within the Peacocke Structure Plan ("PSP") area.

11. I have undertaken a review of the pertinent background literature, aerial maps and conducted a site walk over on 5 June 2018.

12. My evidence covers the following:

    (a) Review and assessment of the applicant's terrestrial ecology assessment including an assessment against relevant statutory provisions;

    (b) Response to submissions;

    (c) Consideration of the outcomes of ecological expert caucusing;

    (d) Recommended conditions; and

    (e) Summary.

13. In preparing this evidence I have reviewed the following documents:

    (a) Floyd, C. & Dekrout, A. 2009. HCC– Proposed Peacocke Development: Review of submissions to proposed variation No. 14 – Peacocke Structure Plan. Kessels & Associates, Ltd.

    (b) Assessment of Environmental Effects prepared by Merestone Ltd ("AEE");

    (c) Amberfield – Peacocke Structure Plan: Terrestrial Ecological Assessment prepared for Weston Lea Ltd by Boffa Miskell Ltd May 2018 (Appendix G to the AEE) ("TER");

    (d) Amberfield Open Space Framework, Peacocke, Hamilton prepared for Weston Lea Ltd by Boffa Miskell Ltd 11 May 2018 (Appendix F to the AEE);

    (e) Preliminary Engineering Drawings prepared by Harrison Grierson (Appendix W to the AEE);

    (f) Section 92 response received 17 August 2018;

    (g) Amberfield "Ecology Caucusing Information Package", received 15 February 2019;

    (h) Additional maps including Staging Plans, East-West Shelterbelt Plans, Gully Hazard and Significant Natural Area Plans and Ecological Constraint Plan, received 27 March 2019.

    (i) Amberfield – Ecology Joint Witness Statement ("JWS"), 18 February 2019, **attached** as **Appendix 1** to my evidence;

    (j) Amberfield: Ecological Assessment Addendum. 20 February 2019. Report prepared by Boffa Miskell Limited for Weston Lea Ltd, received 26 February 2019, ("**AEAA**");

(k) AECOM. 24 January 2019. Bat roosts identified during radio tracking completed in January, March and December 2018;

(l) Davidson-Watts Ecology (Pacific) Ltd. 2018. Long-tailed bat trapping and radio tracking baseline report: Southern Links, Hamilton. Prepared for AECOM; and

(m) Preliminary Southern Links Long-tailed bat survey roost location mapping and results 2019, Prepared for HCC and NZ Transport Agency by AECOM, dated 12 March 2019; **attached** as **Appendix 2** to my evidence.

14. The primary focus of this evidence is to provide the commissioners with my opinion pertaining to effects of the Amberfield applications on terrestrial ecology. I have read and considered all of the relevant information provided on behalf of the applicant's and submitters' ecological experts as it pertains to these ecological matters. In considering that evidence, I have provided the section 42A report writer with my recommendations regarding consent conditions to be imposed, should the commissioners be minded to grant resource consent. I have not re-traversed in any detail matters already dealt with in the applicant's TER or responses to further information requests.

SUMMARY OF EVIDENCE

15. The applicant's TER provides: an assessment of terrestrial ecology which identified areas of terrestrial ecological importance and values within and adjacent to the site; an assessment of the likely effects of the proposed development on areas of ecological importance and on indigenous fauna and their habitats; and identification of ecological constraints and enhancement opportunities, as well as opportunities and strategies to avoid, remedy and mitigate any potential adverse effects on the terrestrial ecology of the area. This assessment is expanded on in further analyses, and consideration of amended and additional mitigation measures, primarily pertaining to long-tailed bats (*Chalinolobus tuberculatus*) as presented in the AEAA.

16. Overall, the desktop and field survey methods undertaken by the applicant to identify the ecological values and effects in the project area are consistent with best practice.

17. The Amberfield Development site, and the northern extent of the site in particular, is used by long-tailed bats for commuting, periodic foraging and potentially opportunistic roosting. The margins of the Waikato River (particularly around 'The Narrows', Hammond Park, Stanford Park, Hamilton Gardens, the Mangakotukutuku Stream Gully systems, and the Mangaharakeke Gully system), are all vital habitats for long-tailed bats. The variety of inter-connected, habitats in this southern part of Hamilton mean this is the most valuable and significant locality for long-tailed bats within Hamilton City. The project is located within these mosaic of valuable habitats.

18. There are scheduled significant natural areas (SNAs) in the ODP which are located within the river margin of the Amberfield site. No works are proposed with the SNA, apart from one sub-soil drain. However, these SNAs relate to an assessment of indigenous vegetation values only. I have applied the Waikato Regional Policy Statement ("WRPS") criteria for determining ecological significance to, and adjacent to, the Amberfield Development. This application of the WRPS criteria also addresses indigenous fauna. In this regard, I consider the site ecologically significant with respect to the WRPS criteria, including pastureland and treeland habitats, and hence section 6(c) of the RMA. This is because criterion 3 applies where long-tailed bats use the habitat within, and adjacent to, the site for commuting, foraging and roosting. In addition, criterion 11 applies as the River margin, shelter belts, pasture areas and

gully systems are also deemed to be ecologically significant because they, in combination with other similar areas, provide ecological buffers, linkages and corridors which are necessary to protect sites identified as significant under criteria 1-10 from external adverse effects.

19. 2.6 ha of vegetation is proposed to be removed during the construction phases. This vegetation is generally of low botanical value and the impacts of this activity on indigenous flora values is low. In addition, the proposed replanting of 18.5 ha of mainly indigenous trees and shrubs on the Amberfield site will mitigate the losses of the vegetation removed.

20. Adverse effects on indigenous avifauna, terrestrial invertebrates, lizards, and their habitats are likely to be short-term and minor, provided a range of suitable avoidance, remediation and mitigation measures are undertaken. These measures include pre-construction surveys and translocation procedures, as well as recreation and enhancement of habitats onsite, along the river margin and within the main gully.

21. The adverse effects of the development on terrestrial indigenous vegetation, avifauna, invertebrate and lizards and their habitats is likely to be low with the application of a range of suitable avoidance, remediation and mitigation measures, as I have broadly outlined in my evidence beginning at paragraph 77.

22. I agree with and support the proposed mitigation measures to address the adverse effects on long-tailed bats of the Amberfield Development associated with the permanent reduction in access of bats to roosting, foraging and commuting habitat through the newly created urban area. However, even with that mitigation in place there will still be a time lag between when the planting is carried out and when it is established to a level which it will provide effective mitigation.

23. I do not consider these residual effects to be so significant that avoidance is the only option available. However, if these residual effects on bats are not addressed, I consider that the Amberfield Development will create adverse effects in the short to medium term which could be significant and potentially result in a loss of habitat utilisation and a reduction of the long-tailed bat population within southern Hamilton.

24. To address these residual effects, I consider it necessary and appropriate for the applicant to provide for the implementation of a range of off-set mitigation or compensation measures. These measures could include pest management, enhancement of bat habitat directly adjacent or near the site by replanting and weed control, creation of artificial roosts and planting of trees bats prefer to roost in, within the locality. In my opinion, due to the uncertainty of the extent of the residual effects, and time lag for onsite mitigation measures to take effect, it would be reasonable for the off-set and/or compensation measures to be in place for a period of 10 years, commencing at granting of consent.

REVIEW OF APPLICANT'S TERRESTRIAL ECOLOGY ASSESSMENT

25. This section provides a summary of the main conclusions of the original TER supporting the application, the subsequent s92 response, and additional modifications made to the proposal layout during caucusing.

26. The review and assessment of the applicant's terrestrial ecology assessment included an assessment against relevant statutory provisions (RMA, ODP, and the WRPS). The review

considered the following provisions of the ODP with respect to the actual and potential effects of the proposal on terrestrial ecology:

(a) 20.2 Objectives and Policies: Natural Environments;

(b) 21.2 Objectives and Policies: Waikato River Corridor and Gully Systems; and

(c) 23.2 Objectives and Policies: Subdivision.

27. In terms of the Waikato River and associated gully systems, the policy focus of the ODP relates to restoring and protecting the ecological, amenity, landscape and cultural values of the river corridor and gully system. Policies that seek to achieve this include:

(a) Controlling development and activities that have significant impacts on landform particularly the clearance of vegetation and filling of gullies;

(b) Restoring and protecting ecological functions of waterways by minimising the modification of natural watercourses and riparian margins;

(c) Avoiding the loss or disruption of corridors or connections provided by the Waikato River corridor and gully systems which link indigenous ecosystems and habitat fragments; and

(d) Maintaining the connectivity and protective buffering of indigenous ecosystems provided by the Waikato River Corridor and gully system.

28. The review also considered the following provisions of the WRPS with respect to the actual and potential effects of the proposal on terrestrial ecology:

(a) 11.1.2 Adverse effects on indigenous biodiversity;

(b) 11.1.3 Avoidance, remediation, mitigation and offsetting (for indigenous biodiversity that is not significant); and

(c) 11A Criteria for determining significance of indigenous biodiversity.

29. The applicant's TER provides:

(a) An assessment of terrestrial ecology which identified areas of terrestrial ecological importance and values within and adjacent to the site;

(b) An assessment of the likely effects of the project on areas of ecological importance and on indigenous fauna and their habitats; and

(c) Identification of ecological constraints and enhancement opportunities, as well as opportunities and strategies to avoid, remedy and mitigate any potential adverse effects on the terrestrial ecology of the area.

30. The assessment of ecological effects used the Ecological Impact Assessment ("EcIA") guidelines produced by the Environment Institute of Australia and New Zealand ("EIANZ")[1].

[1] Roper-Lindsay, J., Fuller, S. A., Hooson, S., Sanders, M. D., & Ussher, G. T. (2018). Ecological impact assessment (EcIA). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems (2nd ed.). Melbourne: EIANZ.

Overall, the desktop and field survey methods undertaken by the applicant to quantify the ecological values and effects in the project area are consistent with best practice.

Terrestrial Ecology Values

31. The primary terrestrial ecology values for the Amberfield Development site are discussed below and I have relied on, or referred to, the relevant parts of sections 6 and 7 of the TER in describing the values.

32. Vegetation – The site itself comprises of largely exotic vegetation, primarily pasture, with exotic trees and shelter belts interspersed. A gully in the southern portion of the project is dominated by pasture and treeland/scrub consisting mostly of exotic tree and shrub species. The boundary of the site abuts a riparian margin of exotic and indigenous vegetation along the Waikato River. There is one small stand of planted kahikatea on the site. Table 7 (p18) of the TER describes the key vegetation communities, aside from pasture, and quantifies the extent of these.

33. Avifauna – The TER summarises bird species and their habitats as follows:

> *The Amberfield site has a diverse avifauna (25 species) comprised of 13 native species and 12 exotic species which includes both terrestrial species, and species associated with wetland/water habitats. This reflects its location directly adjacent to the Waikato River. In terms of abundance, the avifauna assemblage is dominated by naturalised introduced species which are common in the agricultural landscape surrounding Hamilton such as common starling, house sparrow, and European goldfinch. The native species present are all widespread and common species such as silvereye and pukeko. No threatened or at-risk species were detected in any surveys or observations. The riparian vegetation along the river may be utilised by the at-risk shag species for roosting and/or nesting, but there is no suitable habitat for New Zealand dabchick onsite. Like other rural and urban parts of the Hamilton area, kākā may visit the site when dispersing during winter, or as a short visit, but are unlikely to inhabit the area for long periods.*

34. Herpetofauna - Potential habitat for copper skink is found throughout the site. Habitat features preferred by copper skink including leaf litter, natural and artificial debris, areas of long grass, and areas of dense vegetation is variable across the site. It is unlikely that any native gecko or any threatened or at risk herpetofauna species are present.

35. Terrestrial invertebrates – No survey or assessment of terrestrial invertebrates has been carried out by the applicant's ecologists. However, I consider that no significant habitats for terrestrial indigenous invertebrates are present or adjacent to the project site.

36. Long-tailed bats – As the AER states "*the site as a whole, and the northern extent of the site in particular is used by long-tailed bats for commuting, periodic foraging and potentially opportunistic roosting*"[2]. Based on the survey results presented in the TER and in **Appendix 2**, the pasture, treeland, and gully system areas throughout the site are all utilised for foraging, with treelands and shelter belts likely being used for commuting references to varying degrees. Exotic trees in the site appear to be used for roosting.

37. The margins of the Waikato River (particularly around 'The Narrows', Hammond Park, Stanford Park, Hamilton Gardens, the Mangakotukutuku Stream Gully systems, and the Mangaharakeke Gully system are all known habitats for long-tailed bats. The variety of inter-connected, habitats in this southern, peri-urban part of Hamilton mean this is the most

[2] At p 37.

valuable and significant locality for long-tailed bats within Hamilton City (for example, Le Roux & Le Roux, 2012[3]). The project is located within these mosaic of habitats (**Figure 1**).

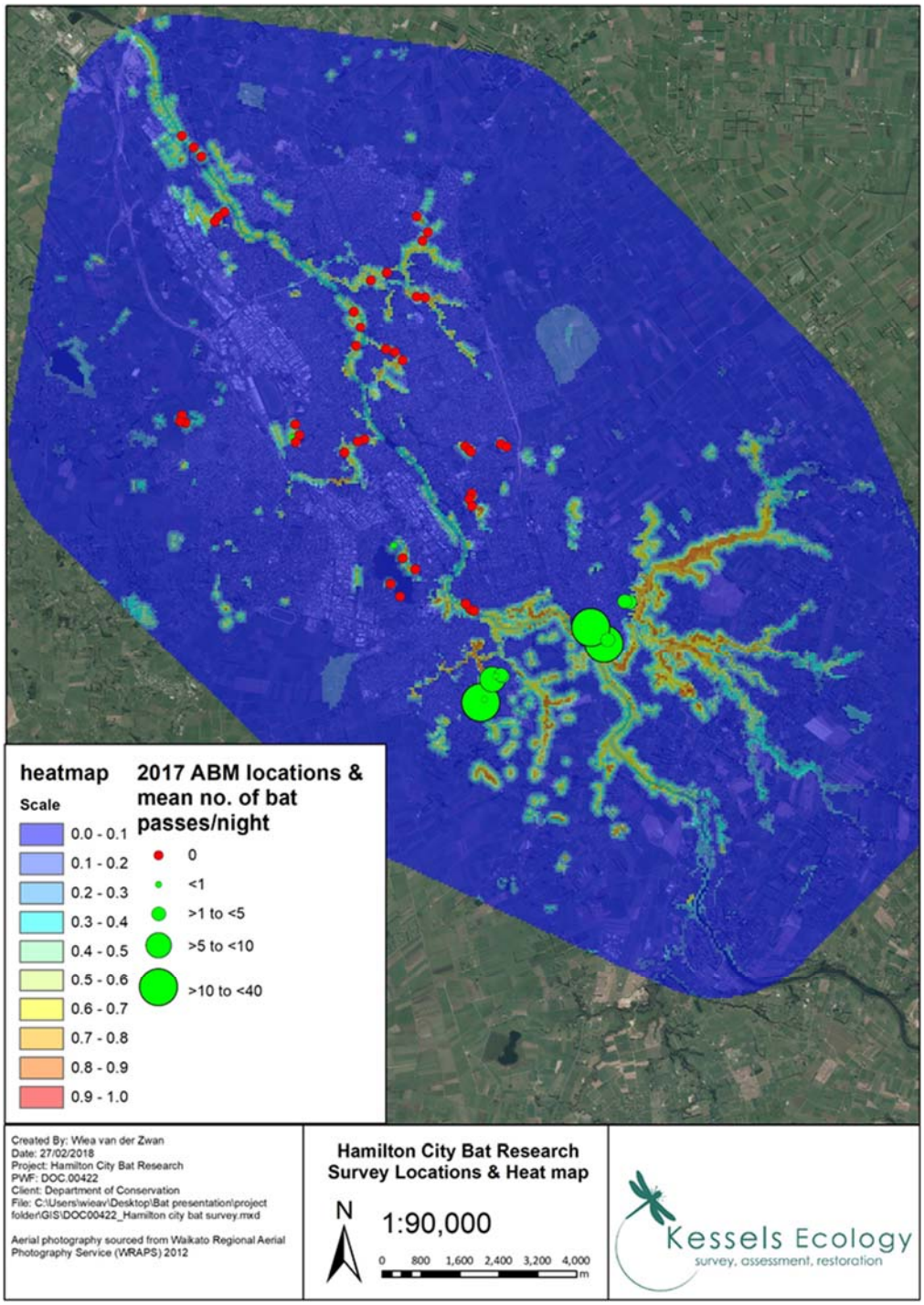

Figure 1: Heat map of Hamilton City bat habitat, using habitat prediction model of Crewther & Parsons (2017)[4] overlaid by the survey results of 2017 City wide acoustic monitoring (from Mueller et al., 2017)[5].

[3] Le Roux, D. & Le Roux, N. 2012. Hamilton City Bat Survey. Kessels Ecology, Hamilton.

[4] Crewther, K & Parsons, S. 2017. Predictive modelling of long-tailed bat distribution in the Hamilton area. Unpublished report prepared for Project Echo by Walkingbats Consultancy, August 2017.

[5] Mueller, H., Ulrich, C., Purcell, A. 2017. Hamilton City Long-Tailed Bat Survey 2016 – 2017. Client report prepared by Kessels Ecology for Project Echo.

Assessment of Ecological Significance

38. The ODP has a policy direction that seeks to protect, maintain, restore and enhance the City's SNAs within which adverse effects of development should be avoided.

39. In addition, the policy direction of the ODP in relation to the Peacocke Structure Plan area also seeks to protect and enhance SNAs while protecting the physical integrity and ecological and stormwater function of the Mangakotukutuku Gully and Waikato River margins.

40. The WRPS outlines the criteria to be used to identify areas of significant indigenous biodiversity (SNAs) and their characteristics (s11A). To be identified as significant, an area needs to meet one or more of the criteria identified in Table 11-1. In particular, Criterion 3 states that vegetation or habitat for indigenous species or associations of indigenous species that are:

    (a) Classed as threatened or at risk; or

    (b) Endemic to the Waikato region; or

    (c) At the limit of their natural range;

    is ecologically significant.

41. In addition, criterion 11 states that:

> "*…an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse effects. Areas of significant indigenous biodiversity may comprise several habitat types, including water, land and airspace."*

42. Areas of significant indigenous biodiversity may thus comprise several overlapping and connected habitat types, including exotic vegetation dominated shelter belts or riparian margins, pasture land, and airspace over these areas.

43. As presented in the TER, there are two scheduled SNAs within the ODP which are potentially affected by the Amberfield Subdivision – SNA 54 and SNA48[6].

44. However, these SNAs relate to indigenous vegetation values only. As Cornes et al (2011)[7] state: "*As with past reports, the significance of a site was based on the ecological significance of vegetation and excluded significant fauna or cultural values of a site*" (my emphasis).

45. I have applied the WRPS criteria for determining ecological significance to, and adjacent to, the Amberfield Subdivision. This application of the WRPS criteria also addresses indigenous fauna. In this regard, I consider the site ecologically significant with respect to the WRPS criteria, including pastureland and treeland habitats, and hence section 6(c) of the RMA. This is because criterion 3 applies where long-tailed bats use the habitat within and adjacent to the site for commuting, foraging and roosting. Long-tailed bats are listed by DOC as

[6] **TER, Table 11, p 49.**

[7] Cornes, T. S.; Thomson, R. E.; Clarkson, B. D. 2011: Key Ecological Sites of Hamilton City Volume II. CBER Contract Report 121. Client report prepared for Hamilton City Council by Centre for Biodiversity and Ecology Research, The University of Waikato.

'Threatened – Nationally Critical' (O'Donnell et al 2018)[8], which is the highest threat status that can be assigned to an indigenous species (Townsend et al 2008)[9].

46. In addition, criterion 11 applies as the Waikato River margin, shelter belts, and gully systems are also deemed to be ecologically significant because of their supporting ecological buffer, corridor and linkage functions for bats.

47. The TER is consistent with my assessment of ecological significance in relation to Criteria 3 and 11 of the WRPS ecological significance criteria. Almost all areas surveyed within the Amberfield site detected long-tailed bats, a threatened species. Consequently, all areas of the site that could be considered habitat for this species meet criteria 3 of the WRPS criteria for an SNA.[10] In particular, Table 12 shows the entire site is ecologically significant because it is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are threatened or at risk, namely long-tailed bats.

Assessment of Ecological Effects

48. The key potential and actual adverse effects on indigenous fauna and flora of the Amberfield Development which require assessment are summarised as:

(a) Fragmentation and isolation of indigenous ecosystems and habitats;

(b) Reduction in the extent and quality of indigenous ecosystems and habitats;

(c) Loss of corridors or connections linking indigenous ecosystems and habitat fragments or between ecosystems and habitats;

(d) Loss of, or disruption to, migratory pathways in water, land or air;

(e) Loss of buffering of indigenous ecosystems;

(f) Loss of ecosystem services;

(g) Loss, damage or disruption to ecological processes, functions and ecological integrity;

(h) Changes resulting in an increased threat from animal and plant pests;

(i) Effects which contribute to a cumulative loss or degradation of indigenous habitats and ecosystems;

(j) Noise, visual and physical disturbance on indigenous species, particularly within the coastal environment; and

(k) Loss of habitat that supports or provides a key life-cycle function for indigenous species listed as 'Threatened' or 'At Risk' in the New Zealand Threat Classification System lists.

[8] O'Donnell, C.F.J.; Borkin, K.M.; Christie, J.E.; Lloyd, B.; Parsons, S.; Hitchmough, R.A. 2018: Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21. Department of Conservation, Wellington. 4 p

[9] Townsend, A.J.; de Lange, P.J.; Duffy, C.A.J.; Miskelly, C.M.; Molloy, J.; Norton, D.A. 2008: New Zealand threat classification system manual. Department of Conservation Wellington, New Zealand. 35 p.

[10] **Section 8.3, p 48, Table 12 p 49.**

49. An assessment of ecological value and level of effect by the applicant's ecologists have been undertaken using EIANZ guidance criteria outlined in Table 4 of the TER[11] and refined further in the AEAA.[12]

50. The terrestrial ecological effects of the proposed Amberfield development (are summarised as follows:

Vegetation

51. The applicant has identified that the proposed activity has the potential to create adverse ecological effects by removing approximately 2.6 ha primarily comprising exotic shelterbelts, ornamental trees, and small areas of planted native vegetation from within the development site.[13] This vegetation is generally of low botanical value and the impacts of this activity on indigenous flora values is low.

52. There is a small, as yet to be quantified, area of vegetation proposed to be removed within a scheduled SNA by a subsurface drain and outlet structure. Although the extent of this clearance has yet to be quantified by the applicant, if it is less that 500m^2 and replanted immediately after installation, I consider that the overall effects of this activity will be minor.

53. Originally a small portion of high ecological value vegetation (0.019 ha) was proposed to be removed. I assume that revisions to the site layout now means this area will be avoided, based on the February 2019 amendments as assessed in the AEAA. While this vegetation and pasture land is not mapped or quantified, and it has low botanical value, it provides habitat for indigenous fauna, particularly bats. I discuss the implications of that below.

54. There are potential risks in terms of introducing ecological pathogens (such as Myrtle Rust), and weeds, such as alligator weed, to the site without suitable biosecurity control during the construction, restoration planting and maintenance phases. Suitable conditions will be required to minimise the risk of this occurring.

Fauna

55. The vegetation removal will result in indirect effects on native herpetofauna, long-tailed bat and avifauna communities because it is likely to have an impact on either their feeding, roosting, migrating or breeding habitat, or behaviours.

56. The main effects of the project pertaining to terrestrial ecology have been appropriately articulated by the applicant in section 9.2 of the TER, and consist of the following issues:

    (a) Permanent increases of anthropogenic disturbance (lighting, vibration, roading, and residential housing). This could render the site to be effectively impermeable to long-tailed bats, preventing foraging, commuting, and potentially roosting in areas currently utilised by long-tailed bats;

    (b) This could also lead to direct effects on long-tailed bats such as mortality, injury, abandonment of roosts, and/or total avoidance of areas;

    (c) Development in the project area also has the potential to indirectly impact on high value long-tailed bat commuting corridors and habitats adjacent to the site by way of

[11] Section 5.7.1.
[12] Section 3.3.
[13] AEAA, section 3.2.2, p 11.

lighting and noise disturbance reaching beyond the development footprint and boundary, effectively disrupting or cutting of existing migratory/commuting pathways; and

(d) For all fauna present (long-tailed bats, copper skink and non-threatened bird species) there is potential for construction activities to directly disturb, injure or kill individuals present.

57. I agree with the TER[14] that the ecological value of the site of the project on herpetofauna and birds is 'Low' (in accordance with the definitions outlined in the EIANZ (2018) guidelines). Adverse effects on indigenous avifauna, terrestrial invertebrates, lizards, and their habitats are therefore likely to be short-term and minor, provided a range of suitable avoidance, remediation and mitigation measures are undertaken.

58. There is a risk that copper skinks and indigenous birds could be harmed or killed by the development, and thus preconstruction surveys and translocation procedures are required to minimise the risk of this occurring. Suitable consent conditions will be required to ensure this occurs, and I discuss this further below.

Potential adverse effects on long-tailed bats

59. The potential impacts on long-tailed bats of the Amberfield Development would remove, hinder or prevent:

(a) The use of foraging habitats and/or the ability to disperse to foraging habitats;

(b) The ability of long-tailed bats to commute across the landscape to forage and/or utilise other known or potential roosting habitats (such as Day Roost 32 or Maternity Roost 8 as mapped in Appendix 2) nearby to the site; and

(c) The ability of juvenile long-tailed bats to disperse away from maternal roost sites to preferred habitats within the southern Hamilton locality.

60. In addition, the proposal will affect known "Day Roosts" as mapped in the Preliminary Southern Links long-tailed bat survey roost location mapping for 2019 (refer to mapped locations for Day Roost' 47, 55, 54 - **Appendix 2**).

61. Lighting and noise disturbance, if left unmitigated, would extend into key roosting habitats of long-tailed bats in Hamilton (i.e. the nearby known roosting site Hammond Park), and has the potential to alter roost emergent timing and behaviour, disrupt social interactions, and as noted above, the avoidance of valuable habitats.

62. Without appropriate buffering, the increased light spill (and noise disturbance) from the development will impact feeding, commuting and roosting habitat of bats in the high-value

[14] Section 9.2.2, p 52; Section 9.2.3, p 53.

long-tailed bat commuting corridors and habitats adjacent to the site, including the known important roosting site at Hammond Park, the Mangakotukutuku Gully, and Stanford Park.

63. Le Roux (2010)[15] reported that urban sites surrounded by roads, lighting, and medium density housing were not found to support bats.

64. The reproductive cycles of bats are affected by light levels and illumination periods (Stone 2015)[16]. Artificial lighting can affect bat feeding behaviour and bats may be deterred from normal commuting behaviours by increased artificial light levels (Longcore and Rich 2004)[17]. Bat movement through the landscape may be compromised, leading to injury and direct mortality, and increased exposure to predation.

65. The TER and AEAA have appropriately assessed the ecological value of bat habitat on the Amberfield Development site as 'Very High' noting the TER states, that:[18]

> *….although based on the activity results reported above, the site as a whole, and the northern extent of the site in particular is used by long-tailed bats for commuting, periodic foraging and potentially opportunistic roosting*.

This includes the pasture area. This is further supported by recent survey results supplied by the Southern Links project which indicate that the Amberfield site is being used by bats for roosting, as well as a likely migratory corridor between the river and the Mangakotukutuku gully system.

Level of adverse effects on bats after application of mitigation

66. I agree with the TER in that the:[19]

> *Magnitude of effect, combined with an ecological value of 'Very High' means that without mitigation, the overall level of the ecological effect of the project on long-tailed bats is 'Very High'. This represents a high level of effect on ecological or conservation values and warrants avoidance and/or extremely high intensity mitigation and remediation actions. Offsite mitigation and/or biodiversity offsetting should be considered where these adverse effects cannot be avoided as described in Section 5.7.3.*

67. There is insufficient information at present to understand how the site is being utilised in its entirety by long-tailed bats. However, the development proposal will likely remove areas of foraging which are located nearby to known high habitat value areas and temporary roosting habitat. This will potentially disrupt commuting corridors along the river and across the site and wider landscape to the known high value habitats.

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[15] Le Roux, D.S. 2010. Monitoring long-tailed bat (Chalinolobus tuberculatus) activity and investigating the effect of aircraft noise on bat behaviour in a modified ecosystem. Unpublished MSc thesis, Waikato University.

[16] Stone, E.L. (2013) Bats and Lighting: Overview of current evidence and mitigation guidance. University of Bristol.

[17] Longcore, T. and Rich, C. (2004) Ecological Light Pollution. Frontiers in Ecology and the Environment, 2, 191-198.

[18] At p 37.

[19] TER, Section 9.2.1, p 52.

68. A range of avoidance, remediation and mitigation measures have been proposed by the applicant, as presented in the TER and AEAA, to address these 'Very High' potential adverse effects on long-tailed bats in accordance with the EIANZ guidelines. The AEAA purports that:[20]

> *The effects assessment on long-tailed bats has shifted from 'Very High' in the original Assessment of Effects to a 'Moderate' level of effect. This shift reflects the additional habitat creation on the NE Terrace which will provide certainty around the avoidance of light spill into Hammond Bush and the Waikato River. It also reflects the maintenance of connectivity through the site via the retention and enhancement of the E-W shelterbelt which was the key outstanding impact. Further to the above, the advice from the lighting specialist has provided more certainty that the setbacks and buffer originally proposed will be adequate to avoid light spill from road corridors into adjacent habitats.*

69. I do not accept the conclusion in the AEAA in section 3.3.2[21], that the magnitude of effect of the proposed development on the long-tailed bat population will be 'Low' because of the widening of the river buffer and the creation of the E-W shelter belt. I do not consider that there is sufficient scientific evidence presented to reach this conclusion. In addition, there is no certainty or evidence supplied in the AEAA to justify the conclusion that there "*will then become a positive effect in the long-term (20 plus years) as the restoration plantings reach maturity*".[22]

70. Referring to Figure 1 above, available research (Dekrout 2009; Le Roux and Le Roux 2012[23]) suggests that urbanisation as a consequence of the Amberfield Development may effectively remove bat utilisation from this locality. Dekrout et al (2014)[24] conclude that bat activity was negatively correlated with housing and street light density and positively correlated with topographical complexity. While bats are still utilising Hammond Bush and Stanford Park, which are within and adjacent to urban areas, tracts of semi-rural lands along the true left side of the Waikato River, where the Amberfield Development is proposed, are likely allowing movement of bats along the river and across land to the upper reaches of the Mangakotukutuku gully system. The development will remove existing habitat, create an urban environment on both sides of the Waikato River, and likely disrupt movement and utilisation of habitat for this nationally critically threatened species to known high value roosting areas (such as Hammond Park and Stanford Park). I thus conclude, using the EIANZ guidelines, that the magnitude of effects of the Amberfield Development on long-tailed bats is 'Moderate', referring to the EIANZ criteria shown in Table 1 below.

71. When mitigation is applied, based on the EIANZ guidelines, I consider that the overall level of effects of the project on long-tailed bats is likely to be 'Very High' ('Very High' ecological value x 'Moderate' magnitude of effects – referring to Table 2 below). In my opinion the application of the EIANZ guidelines provides some degree of guidance as to the level of adverse effect on bats as a consequence of the development. Applying the direct mitigation as proposed by the applicant should largely address those adverse effects. However, there will be a residual effect during the time when the mitigation planting becomes fully established. It is that

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[20] Section 3.3.3, 15.

[21] At p 13.

[22] Section 3.3.2, p 13.

[23] Dekrout, A. 2009. Monitoring New Zealand long-tailed bats (Chalinolobus tuberculatus) in urban habitats: ecology, physiology and genetics. Unpublished PhD thesis, University of Auckland.
Le Roux, D. & Le Roux, N. 2012. Hamilton City Bat Survey. Unpublished report prepared for Project Echo by Kessels & Associates, Hamilton.

[24] Dekrout, A.S., Clarkson, B.D. and 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 Zoology, 41(4), pp.285-295.

temporary residual effect that is difficult to quantify, but in my opinion warrants a biodiversity offset or compensation response. This approach aligns with the original position in the TER. I have not received any evidence from the applicant's technical expert that would lead me to conclude that offset/compensation is not required.

Table 1: Criteria for describing magnitude of effect (from EIANZ 2018)

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature

72. Table 2: Criteria for describing level of effect (from EIANZ 2018)

Magnitude	Ecological Value: Very High	High	Moderate	Low	Negligible
Very High	Very High	Very High	High	Moderate	Low
High	Very High	Very High	Moderate	Low	Very low
Moderate	Very High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

73. Regardless of a divergent conclusion reached that a 'Moderate' level or a 'Very High' level of effects, there are likely to be residual adverse effects on long-tailed bats remaining despite the on-site avoidance, remediation and mitigation offered by the applicant. I discuss this further in paragraphs 74 to 77 below and paragraphs 94 to 109 of my evidence.

74. The AEAA discusses the efficacy of the river buffer and East-West ("EW") shelterbelt, which are the primary mitigation measures proposed by the applicant to minimise adverse effects on bats. There is a delay for the buffer planting to grow to a height and density which will provide effective corridor functions.[25] The buffer vegetation will take 10-25 years to begin to perform its buffer and corridor functions. The AEAA states that it will be 5-10 years before the proposed buffer and gully plantings are well established.[26] As the AEAA states that it will take 25 plus years for tall stature vegetation to mature into preferred bat habitat[27], which I agree with. The AEAA states that a 7x multiplier, associated with the replanting of vegetation to replace the loss of vegetation, will account for this time lag. I do not agree that this approach addresses the time lag matter.

75. Housing setbacks proposed by the applicant may reduce urbanisation effects on bats while the vegetation matures[28] but as identified in paragraphs 97 and 98, the river buffer and setback widths may not be sufficient as there are other variables affecting bat behaviour response to urbanisation aside from lighting, which includes roading and residential housing. The current design states that one lot is within 50m of the river edge, and is described in section 3.1.3 of the AEAA referring to the vegetative buffer shown in Drawing Number A17134_054 Revisions H[29]. However, unlike the AEAA suggests[30] there is evidence to suggest that effects on bats of lighting, housing and roads can be up to 100m (refer to paragraph 95 below). I am unclear from the map provided where intrusions are to this 100m ideal corridor buffer width. However, it appears on review of the Ecological Constraints Plan, that the 100m

[25] Section 3.2.3, p 11-12.
[26] Section 3.2.1, p 10.
[27] Section 3.2.3, p 12.
[28] AEAA, section 2.6, p 5.
[29] Page 10.
[30] Section 3.1.4, p 9.

width is being achieved opposite Hammond Park, at the minor gully confluence and at the southern gully confluence. In other parts it is not.

76. I have also reviewed the Staging Plans supplied by the applicant which show the various stages where construction will commence from Stages 1 to 30 (received 27 March 2019). I am unclear from the information supplied when construction of each stage is planned to commence and when each stage, including the roading network, becomes 'operational'. If the applicant is able to clarify timing of these matters I would be able to provide more certainty on the likely extent of residual effects on bats. These staging matters are not discussed in any detail in the TER or AEAA.

77. The effects of the subdivision on long-tailed bats and their habitats start when construction commences and then continues with erection of residential dwellings and associated infrastructure. These effects will continue unmitigated until the planting is mature enough to provide it ecological functional purpose. Some effects may be mitigated with the setbacks, and others may be mitigated to some degree after 10 years, and then greater mitigation achieved after 25 years. However, in the intervening period the proposed planting will not deal with these immediate and short-term effects. During this time, the bat population in this locality may be at such risk that, as research suggests, bats may be discouraged or even effectively removed from the habitat before the benefits of the mitigation takes effect, no matter how large or widespread the onsite planting is. I discuss this matter further at paragraphs 94 to 108 of my evidence below.

MITIGATION AND MANAGEMENT

Offsetting or compensating for residual adverse effects on terrestrial ecology

78. Measures to avoid, remedy, mitigate and monitor adverse ecological effects are outlined in the TER, the s92 response and AEAA. I support these measures in principle. However, I do have specific concerns regarding the efficacy and time lag implications of some of these mitigation measures as they relate to long-tailed bats.

79. By way of background to my opinion expressed in paragraphs 59 to 77 above, without prejudice meetings were held between the specialists representing HCC, the applicant and the key submitters, to discuss the 'Biodiversity Management Framework' study for the PSP area before expert caucusing. Tonkin and Taylor have been commissioned by HCC to undertake this work which aims to facilitate cohesive ecological management and mitigation across the whole PSP area. The framework includes trialling of biodiversity compensation models. The objective of the study is to inform development design and mitigation across the various sites being individually developed that comprise the PSP area.

80. The development of the Biodiversity Management Framework is still in its early stages. However, on a without prejudice basis, the applicant and submitter experts were presented with working draft inputs and outputs for a draft biodiversity offset model for the PSA. In addition, an ecological constraints map was presented. However, it was not my intention, especially after my re-consideration of the wider implication of the proposal (especially in light of the subsequent expert caucusing, and by the Southern Links research), that application of this constraints map alone would be sufficient to address all the potential adverse effect on bats. Further, the modelling exercise has not been applied further in this study due to the difficulty of obtaining sufficiently robust input data for long-tailed bats and thus it is still subject to further trialling and review. While I support the inclusion of the E-W corridor, this

measure, even when combined with the widening of the northern river corridor, is still not sufficient to address the residual adverse effects on long-tailed bats.

81. These residual effects will require some form of biodiversity offset or compensation package additional to the measures proposed by the applicant to ensure there is no net loss of biodiversity values associated with the Amberfield Development. Figure 2 is a graphic representation of this scenario.

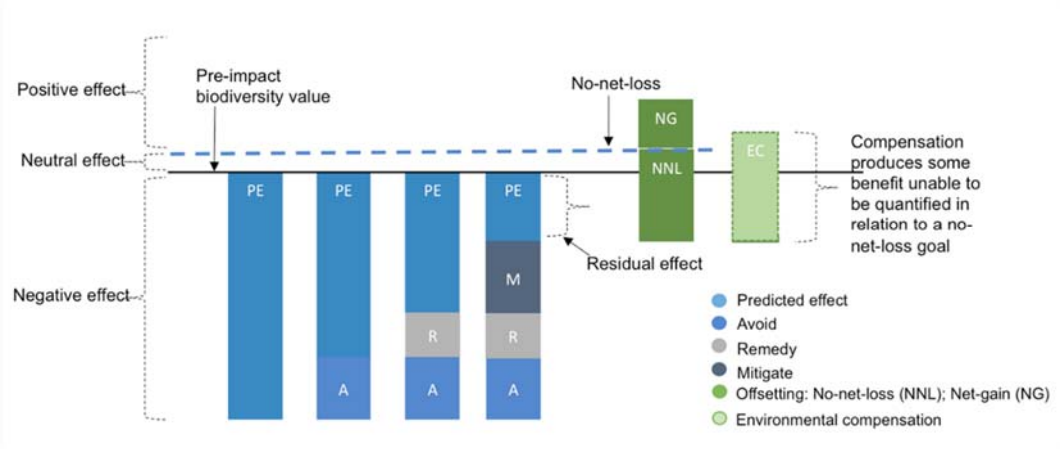

Figure 2: Conceptual illustration of the effect management hierarchy. The no net loss line is above the pre-impact biodiversity value as more gains than losses are required to achieve no net loss when accounting for uncertainty and time-lags (Maseyk et al 2018) [31]

82. Reflecting on Figure 2 above, I consider it important that an appropriate biodiversity off-set/compensation mitigation package is required to be developed, finalised and agreed upon by the applicant, HCC and key stakeholders, in addition to those measures already offered by the applicant to avoid, remedy, and mitigate adverse effects on long-tailed bats (and other ecological matters) onsite. The biodiversity off-set/compensation mitigation measures would be in addition to those conditions and corridor widening and buffering measures proposed by the applicant to date.

83. In the difficulty in quantifying residual effects on long-tailed bats at this site, agreed multipliers will likely have to be the approach for determining suitable offset/compensation mitigation packages. Alternatives to using agreed compensation and multipliers include employing more rigorous methods for calculating biodiversity losses and gains, using multiple and complementary field-tested biodiversity currencies and 'biodiversity accounting models' which are relatively widely adopted approaches overseas (e.g. Gibbons et al. 2009)[32].

84. The Business and Biodiversity Offsets Programme ("BBOP 2012") draws upon a considerable amount of literature and research to discuss the case for the use of multipliers (BBOP 2012)[33].

[31] Maseyk, F., Ussher, G., Kessels, G., Christensen, M., Brown, M. 2018 Biodiversity Offsetting under the Resource Management Act. A guidance document. The Catalyst Group, for the Biodiversity Collaborative Group (a stakeholder-led group that was established by the Minister for the Environment to develop national level policy for indigenous biodiversity)

[32] Gibbons, P., Briggs, S., Ayers, D., Seddon, J., Doyle, S., Cosier, P., McElhinny, C., Pelly, V., Roberts, K., 2009. An operational method to assess impacts of land clearing on terrestrial biodiversity Ecological Indicators 9.

[33] Business and Biodiversity Offsets Programme (BBOP). 2012. Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets. http://bbop.forest-trends.org/guidelines/Resource_Paper_NNL.pdf

DOC and Local Government New Zealand have published guidance to good practice on biodiversity offsetting in New Zealand[34].

85. Yet in practice, measuring the residual effects on habitat of highly mobile fauna with complex life cycles, particularly in landscapes that are subject to landuse changes, where there are many confounding and cumulative factors affecting the population, is difficult. In the absence of sound scientific data, determining the extent of the residual effect of this proposal on long-tailed bats will require subjective (expert) interpretation. In addition, where uncertainty is high, multipliers may need to be large if they are to provide adequate protection against failure to deliver no net loss (Moilanen et al. 2009)[35].

86. BBOP (2012) reminds us of these challenges: "*Many offsets involve certain biodiversity losses in exchange for uncertain, spatially and temporally disjunct gains…... Careful consideration of areas of uncertainty is therefore important, as is identifying best-practice approaches to minimising risk and delivering defensible biodiversity offsets that have a good chance of achieving no-net loss.*"

87. However, in my view this uncertainty and 'subjectiveness' in the determination of the scale of residual effects and the extent of mitigation required to achieve no net loss does not mean the principles of this approach should not be applied at all. Rather, in the case of the Amberfield Development, given the uncertainty surrounding the magnitude of the ecological effects on long-tailed bats, the use of some form of agreed approach is an appropriate response when developing a robust and defensible offset/compensation mitigation package.

88. To minimise the disadvantages of using an agreed, non-quantified compensation approach to biodiversity offsetting, it is important to select a larger, more varied portfolio of offset sites and management activities, rather than say, simply propose to replant a large area of land and 'hope' that will deal with all of the extremely complex, interconnected lifecycle requirements and ecologically functions involved, including disjunct temporal issues. This is especially important to do when there are significant risks of offset failure. The key aspects of this approach are determining an agreed compensation multiplier for a bat habitat enhancement programme to compensate for the removal of bat habitat. I discuss this further in paragraphs 94 - 108 below.

89. BBOP (2012) also recognises that long-term monitoring and funding is needed to provide assurance in offset/compensation delivery.

90. I have provided expert input to the development of a set of conditions to address this matter. I understand that the conditions will be presented in the Council officer's s42A report.

Restoration of indigenous vegetation onsite

91. The applicant has proposed 18.50 ha of buffer and amenity planting. This is depicted in the 'Gully and Reserve Vegetation Strategy' supplied by the applicant (revision version H - 14 February 2019).

92. In my opinion, the recommended species for plantings are generally appropriate, however the current species palette is small and additional appropriate species should be considered. I do not support the planting of some of the proposed exotic species and proposed meadow

[34] http://www.doc.govt.nz/about-doc/policies-and-plans/guidance-on-biodiversity-offsetting/

[35] Moilanen, A., van Teeffelen, A.J.A., Ben-Haim, Y., Ferrier, S., 2009. How Much Compensation is Enough? A Framework for Incorporating Uncertainty and Time Discounting When Calculating Offset Ratios for Impacted Habitat. *Restoration Ecology 17*, 470-478

plantings (dominated by exotic trees and grasses). In my view, this requires review. Preparation of an Ecological Restoration Management Plan post is advised, outlining species, plant spacings and long-term management and protection requirements.

93. With suitable revegetation and with a rigorous maintenance programme as generally proposed by the applicant, the degraded gully and pastureland adjacent to the river margin will result in measurably higher biodiversity values and be more resilient to the threats of plant and animal pests over time, thus further reducing the need for high multipliers in the case of revegetation. However, this planting will take 10 to 25 years to become functional and begin to achieve its mitigation purpose (especially in relation to bats), thus creating a time lag, which I discuss further in paragraphs 95 to 109 below.

94. Legal protection and ongoing management of these areas is essential to ensure that these additional benefits are secured and maintained over time. A management plan will be required to give practical effect to the implementation of this Gully and Reserve Vegetation Strategy.

Addressing residual effects on long-tailed bats

95. As discussed above, there are likely to be residual effects on long-tailed bats associated with the Amberfield Development. Until such time that the on-site planting becomes effective (a period of 10-25 years) these effects on bats could be significant and may hinder or prevent this critically endangered species migrating to (and hence utilising), known important habitats along the Waikato River, such as within Stanford Park and Hammond Park.

96. Studies in Hamilton suggest that vegetated buffer widths need to be in the vicinity of 100m wide to be an effective corridor and buffer for long-tailed bats. Le Roux and Le Roux (2012) found that 87.5% of the confirmed bat habitats were classified as 'riparian margins' (43.75%) or 'major gullies' (i.e. situated between 0-100m from the Waikato River or a major gully which feeds into the Waikato River). Overall, referring to Figure 5 below, they found that bat activity was highest at habitats that were allocated the lowest scores (1) for roading, street lighting, and housing density (the three anthropogenic variables assessed). For street lighting and housing, bat pass rate decreases of 70% and 42% were observed in this study.

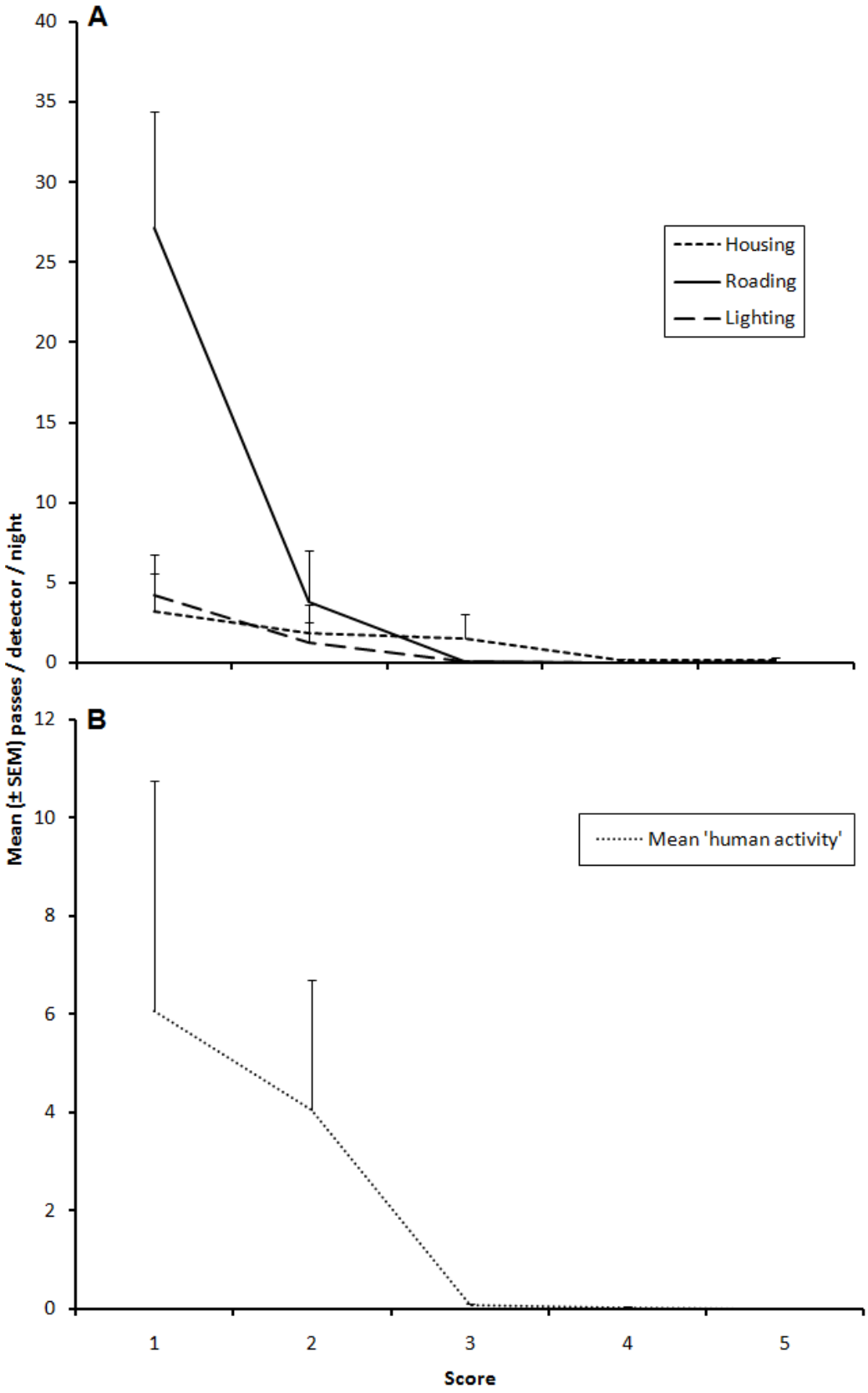

Figure 3: Mean passes (± SEM) /detector /night for each score (1-5) allocated for all three anthropogenic variables (A) as well as the mean 'human activity' score (B). All 62 surveyed sites are considered (from Le Roux & Le Roux 2012).

97. Dekrout (2009)[36] concluded that bat presence was positively correlated with the topographical complexity associated with gullies and negatively correlated with housing and street light density. Crewther and Parsons (2017), in their modelling study of bat habitat distribution in Hamilton City, concluded that:

> *Whilst gullies and vegetation have been shown to be the key predictors of bat presence, the likelihood of presence is also influenced (positively and negatively) by nearby land cover types and reduced in areas where housing and street lighting are most dense. Recorded presence data shows most detections occurring in clusters on the periphery of urban Hamilton, predominantly in the south and southeast, and only extending north to the east of the city in areas of pasture containing linear features such as hedges, and where housing and street lighting density is very low*.

98. Section 10.2.1.1 of the TER originally outlined a relatively narrow buffer width alongside the Waikato River, especially in the northern portion of the project site. Through informal caucusing the applicant widened the buffer as shown in the Gully and Esplanade reserve Strategy maps (Revision H). In addition, the applicant has also offered an "East-west shelterbelt Planting Strategy" in an attempt to facilitate and maintain movement of long-tailed bats across the project site once development has occurred. This is presented in the "Indicative shelterbelt planting strategy plan" (revision D, dated 27 March 2019). I support the inclusion of these buffers but do not consider that they completely address all of the adverse residual effects associated with the project on long-tailed bats.

99. The research to date shows a virtual absence of bat utilisation in intensively urbanised areas of Hamilton, despite extensive gully and river riparian margins throughout. I do consider, however, that the Waikato River corridor will likely be partially effective in its purpose once established. I am less confident in the efficacy of the E-W corridor, given its narrow width, the road crossings associated with Southern Links and the uncertainty that future PSP developers will continue the E-W corridor through to the Mangakotukutuku gully system.

100. Bat sensitive lighting design should be employed, where street and building lighting should be minimised to avoid light spill. Sports field and roading lighting spill into the gully and the river margin should be avoided. A lighting design strategy should be developed (incorporating street, and recreational space lighting) adjacent to the Waikato River, in the proposed E-W corridor link, and the gully in the south. I note that the applicant has employed a light specialist to ensure the development minimises light spill in vicinity to the river edge, the E-W shelterbelt crossings, and the minor gully corridor. I support this. It is important to note, though, that as research shows, light is not the only variable which may prevent or hinder long-tailed bat utilisation of Hamilton's urban areas (as discussed in paragraphs 96 and 97above).

101. One method to significantly increase the 'net present biodiversity value' of the mitigation package in terms of delivering notable biodiversity gains in advance of the adverse effects of bat habitat removal and disturbance occurring is by commencing planting along the river margin and gully as soon as possible and ideally before construction commences. If the planting was mature well in advance of construction commencing, the residual adverse effect on bats would be less and would negate the need for a large multiplier.

102. If this planting in advance of development is not implemented, in the context of the Amberfield Development, there will be larger residual adverse effects on bats and their habitats, which will in turn, require a larger offset/compensation package to ensure that there

[36] Dekrout, A. 2009. Monitoring New Zealand Long-tailed Bats in Urban Habitats: Ecology, Physiology and Genetics. University of Auckland, Auckland.

is not net loss of biodiversity values. This enhanced package of measures will require compensation that involves a large multiplier factor as determined by a consensus of bat ecologists (as opposed to a 'quantitative' multiplier determining by an offset accounting model).

103. The AEAA discusses planting phase[37] (section 2.6, p4-5). I agree that conditions are required to specify establishing the riparian buffer as early as practicable across the site to ensure a well-established buffer along the margin of the Waikato River, ideally well in advance of construction across the entire extent of the site.

104. I assume earthworks will start over the site well in advance of building houses, so that the landscape will be disturbed, and vegetation removed, then houses and associated infrastructure will be built. This will result in a time lag, residual effect on bats and their habitats in this south-west part of Hamilton which will require offsetting or compensation while the mitigation planting is still maturing.

105. Offsetting or compensation for this time lag effect could involve a range of measures including targeted animal pest control, which is likely to have a positive response in terms of increased adult and juvenile survival rates within the population. If this pest control is targeted on key predators/competitors and focussed on known roost sites, it could provide a rapid mitigation response for any potential short and medium term residual adverse effects. In addition, compensation measures could also include creating more habitat within or adjacent to the development, including artificial roost boxes, and legal protection and ongoing habitat enhancement by planting suitable cavity bearing trees in other known important sites for bats. Undertaking weed control and replanting with suitable cavity bearing trees within the vegetated riparian margin, between the site property boundary and the river edge, would also be a suitable offset or compensation measure

106. Biodiversity offset or compensation actions should ideally begin before construction commences in order to achieve as much gain in 'net present biodiversity value' as possible.

107. The TER also recommended that a trust be established that will fund conservation activities relevant to the southern Hamilton long-tailed bat population (activities to be defined by funding parameters). The purpose of this would be to hold financial contributions from developers in a fund that would be used to mitigate those effects on long-tailed bats which cannot be managed within the development context in the PSP area as a whole. It would seek to ensure a cohesive, long-term approach to long-tailed bat conservation that will have a greater benefit than disparate and project-specific responses across the PSP area.

108. This is an appropriate approach in my view. However, at present there is not enough detail provided to be able to gauge what would be sufficient to offset the likely residual significant ecological effects of the project on long-tailed bats. The draft set of parameters provided need to be further developed, finalised and agreed by appropriate stakeholders.

109. In terms of the quantum of the compensation package, due to the uncertainty of the extent of the residual effects it would be reasonable for the offset and/or compensation measures to be in place for a period of at least 10 years.

[37] AEAA, section 2.6, p 3.

Herpetofauna

110. I agree with the approach of undertaking no active lizard salvage during construction and agree that incidental capture techniques should be applied in areas deemed as providing valuable habitat for lizards[38].

111. A Lizard Management Plan should be prepared and implemented. The Lizard Management Plan should include the following as a minimum:

(a) Appropriate incidental capture techniques (and seasonal constraints);

(b) Protocols for capture, handling and release of lizards;

(c) Protocols for relocation of lizards;

(d) Details of an appropriate lizard relocation site; and,

(e) Protocols for accidental discovery of lizards

112. The proposed vegetation strategy offers habitat enhancement for the benefit of lizards. However, as acknowledged by the applicant, the proposed plantings will offer habitat for lizards in the medium to long-term only. In the short-term, it is advisable that appropriate lizard refugia salvaged from elsewhere in the project site (during earthworks) are relocated into proposed enhancement areas.

Avifauna

113. I agree with the approach suggested by the applicant to undertake pre-construction bird surveys on the farm side of the Waikato River riparian vegetation to determine whether any at-risk bird species (e.g. shag species) are nesting onsite.

RESPONSE TO SUBMISSIONS

114. There were a large number of submissions pertaining to terrestrial ecology. These submissions included those from the Forest and Bird Society, DOC and the Riverlea Environmental Society. A summary of the key matters raised in the submissions are shown in Table 2 below. Many of these matters I have addressed in my assessment of the ecological effects of the application (refer to paragraphs 48 to 77 above). Similarly, many of the matters raised in submissions were considered and discussed in the expert ecology conferencing (refer to paragraphs 116 - 118 below). I state my opinion alongside each submission point with cross references as appropriate.

115. Table 2: Summary of Submitter Issues Concerning Terrestrial Ecology

Summary of Submitter Issue	My opinion and cross reference
i. The biodiversity values of the area, including birds such as hawks and bats, will be at risk;	Agree. Measures are required to avoid, remedy, or mitigate these potential adverse effects on indigenous fauna and their habitats.
ii. The planned river bank margins are too narrow to support an ecological corridor	Agree. During the informal and formal conferencing, the applicant has widened the

[38] TER, section 7.2, Table 10.

	that supports the habitat of local wildlife, including birds and long-tailed bats. Some were concerned that a loss of large trees would reduce the biodiversity values of the river corridor;	river corridor. This will reduce potential adverse effects of terrestrial fauna, particularly bats.
iii.	Requirement for an increased ecological buffer/conservation zone in the northern riverside section opposite Hammond Park – Malcolm St to Mangaonua Stream;	Agree. As discussed in paragraphs 96-97 above, I consider that the corridor/buffer should ideally be about 100m wide from the River's margin. This should be comprised largely of densely planted vegetation, but could also include other habitats and provisions for amenity values, such as footpaths and cycle ways. If this buffer width is not achieved, then there will likely be residual adverse effects on bats which will require a biodiversity offset/ compensation package to address this effect.
iv.	A request that the development to include bat-friendly measures (e.g. avoiding excess lighting);	Agree. The applicant has incorporated a number of bat friendly measures, which have been expanded through formal and informal conferencing. The condition set needs to ensure that these measures are implemented, managed and protected in the long-term.
v.	Ensure that mitigation measures are complied with and maintained (e.g. maintaining plantings etc);	The condition set will require provisions of a full suite of detailed maintenance and protection measures to ensure that the measures are secure and effective over the long-term.
vi.	Require a financial bond to ensure successful vegetation establishment and pest control;	Agree. This should be included in the condition set.
vii.	Request for ongoing pest control in ecological buffer zone/requested forested area;	Agree. As expressed in paragraph 104, I consider that additional weed and animal pest control is justified.
viii.	Delay development of northern bend to allow for plantings to grow;	Agree in part. I agree that there will be a time lag for the proposed riparian corridor planting to become effective. It will take 10-25 years for the planting to become ecologically effective, particularly for bats. The proposed dwelling setbacks will reduce these effects, but not completely, thus a biodiversity offset/compensation package is recommended.
ix.	Complete an SNA ecological corridor (linking with areas across the River);	Agree in part. In my view the corridor of the Waikato River is already significant in terms of section 6(c) and the Amberfield subdivision creates an opportunity to enhance and protect a portion of the Waikato River margin

		which is currently unprotected and unmanaged, thereby improving its ecological values by securing long term management and protection.
x.	Concern over lack of a green corridor between Mangakotukutuku Gully and the Waikato River;	Agree. Through conferencing the applicant has offered to create an 'E-W corridor' from the River to the end of the extent of the Amberfield subdivision. To be effective, this corridor must be extended through the rest of the PSP to the Mangakotukutuku Gully.
xi.	Concern about potential effects on copper skink and its habitat and lack of certainty of Lizard Management Plan- cannot assess proposed mitigation;	Disagree. I consider that the habitat affected is largely limited and already compromised, being largely agricultural landscape. I agree that suitable pre-construction management protocol searches for lizards, and copper sinks in particular are required. I also consider that enhancement of the gully and river margin as proposed, especially if weed and animal pest control are also implemented, will further mitigate any residual effects on lizards.
xii.	Identification of an area of bat roosting habitat and associated commuting corridors, with a legal means of protection;	Agree. There are known bat commuting, foraging and roosting habitats within the Amberfield Subdivision. Suitable provisions have been considered by the applicant, discussed at expert conferencing (see paragraphs 116-118 below). I recommend a range of measures to ensure that effects on key bat habitats are avoided, remedied or mitigated.
xiii.	Further survey work requested to identify potential bat roosting trees; and	Agree. Because the initial acoustic based surveys undertaken by the applicant's ecologists represent a point in time and are limited in their extent, I consider further surveys are required before and during construction. In addition, surveys will be required for a period after the subdivision is complete to ensure that the mitigation measures implemented are effective.
xiv.	Would like to be consulted regarding bat management plan, stream management plan, lizard management plan and suitable conditions and components of those plans.	Agree in part. I think it is appropriate that DOC is consulted with the development of indigenous fauna management plans and their implementation associated with the condition set.

EXPERT ECOLOGICAL CAUCUSING

116. Expert caucusing was untaken on the topic of terrestrial ecology on Monday 18 February 2019. The signed JWS resulting from the caucusing is **attached** to my evidence as **Appendix 1.**

117. There were a number of key outcomes of the caucusing which has shaped my opinion as expressed in my evidence. The key or outstanding matters discussed and my response to each is summarised in Table 3 below.

118. Table 3: Key Matters Outstanding from Expert Ecological Caucusing

Key or Outstanding matter	My Response
i. The AECOM data/report relating to the bat surveys for the Southern Links project is critical. Would like to review the report before preparing evidence in chief.	Preliminary data has been presented subsequent to caucusing. The data shows that bats are roosting within and adjacent to the Amberfield Subdivision, and thus the site is likely to be providing habitat, and E-W corridor functions for bats (refer to Appendix 2).
ii. The existing bat surveys do not form the baseline for an ongoing, statistically sound, monitoring plan.	Further bat surveys are required to provide a more robust baseline understanding of bat utilisation within and adjacent to the proposed subdivision.
iii. The current river side buffer width is not adequate.	Ideally the vegetated buffer width along the edge of the Waikato River should be 100m. Where it is less, additional onsite or offsite mitigation is required to offset any residual effects.
iv. The proposed meadowlands and associated planting are not suitable.	I consider the meadowlands proposal has merit, but the location and plant species proposed requires re-examination and amendment.
v. The proposed meadowlands and associated planting are not suitable.	I consider the meadowlands proposal has merit, but the location and plant species proposed by the applicant requires re-examination and amendment.
vi. Even with the works the applicant has suggested, there are time lags to put in place major mitigation for the north-south gully and east-west corridor. There may be substantial residual effects.	I agree. If planting of these buffers is not established and functional before construction, there will be residual adverse effects, which will require offset or compensation mitigation.
vii. There is no agreement on the importance of individual trees for roosting and the merits of identifying trees and protecting trees in the existing and developed environment.	Suitable consent conditions, with detailed methodology required by the recommended condition set, can be developed to minimise the effects of this aspect of the construction and operation of the subdivision.
viii. Animal pest control tying into the current WRC and HCC Hamilton Halo Project would increase biodiversity values of the site, be	I agree: this would also benefit offset/compensation mitigation required for residual effects on long-tailed bats.

	additive to other restoration projects, and is necessary for survival of restoration plantings.	

RECOMMENDED CONDITIONS

119. I have considered the draft conditions which have been developed for the purpose of the section 42A report, in the lead up to the hearing. I am satisfied that the draft conditions address all relevant ecological matters, subject to an appropriate offset/compensation condition. I further understand that it is expected that the conditions will continue to evolve and be subject to drafting refinement throughout the hearing.

120. An offset mitigation/compensation package for bats needs to be developed, quantified, finalised and agreed by HCC, the applicant and appropriate stakeholders before I am able to gauge if it is sufficient to address the residual adverse effects on bats of this subdivision.

CONCLUSIONS

121. Overall, the desktop and field survey methods undertaken by the applicant to identify the ecological values and effects in the project area are consistent with best practice and appropriate methods have been used.

122. The adverse effects of the development on terrestrial indigenous vegetation, avifauna, invertebrate, and lizards and their habitats is likely to be low with application of a range of suitable avoidance, remediation, and mitigation measures.

123. I agree with, and support, the proposed mitigation measures to address the adverse effects on long-tailed bats of the Amberfield Development. However, even with that mitigation in place there will still be a time lag between when the planting is carried out and when it is established to a level which will provide effective mitigation.

124. I do not consider these residual effects to be so significant that avoidance is the only option available. However, if these residual effects on bats are not addressed, I consider that the Amberfield Development will create adverse effects in the short to medium term which could be significant and potentially result in a loss of habitat utilisation and a reduction of the long-tailed bat population within southern Hamilton.

125. To address these residual effects, I consider it necessary and appropriate for the applicant to provide for the implementation of a range of off-set mitigation or compensation measures. These measures could include pest management, enhancement of bat habitat directly adjacent or near the site by replanting and weed control, creation of artificial roosts and planting of trees bats prefer to roost in, within the locality. In my opinion, due to the uncertainty of the extent of the residual effects, and time lag for onsite mitigation measures to take effect, it would be reasonable for the off-set and/or compensation measures to be in place for a period of 10 years from the granting of consent.

126. My opinions are based on my current understanding and review of the evidence, literature, and caucusing referenced in my evidence brief. I reserve my final opinions subject to review of further evidence provided by other experts and any subsequent caucusing.

GHA (Gerry) Kessels
2 April 2019

APPENDIX 1: JOINT WITNESS STATEMENT OF TERRESTRIAL ECOLOGY EXPERTS

BEFORE INDEPENDENT HEARING COMMISSIONERS
APPOINTED BY THE HAMILTON CITY COUNCIL

IN THE MATTER	of the Resource Management Act 1991 (Act)
AND	
IN THE MATTER	of an application for subdivision and land use consent for the Amberfield development pursuant to the Act
APPLICANT	Weston Lea Limited
CONSENT AUTHORITY	Hamilton City Council

JOINT STATEMENT OF THE ECOLOGY WITNESSES

FEBRUARY 18, 2019

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INTRODUCTION

This report presents a record of the outcomes from the expert caucusing on the topic of terrestrial ecology.

The caucusing was undertaken on Monday 18 February 2019. Circumstances did not permit the completion and sign-off of the Joint Witness Statement (JWS) at the conclusion of the full-day session by the experts as is best practice. The JWS is dated 22 February 2019 for this reason.

Prior to commencing the formal caucus Ms Lyndsey Smith, an ecologist with Aecom made a presentation to the attendees to update the progress on the monitoring and reporting on the bat surveys underway as part of the Southern Links roading project.

Dave Serjeant, the Applicant's planner, Jacob Williams representing the Department of Conservation and Gillian Cockerell, the Council's section 42A reporting planner left the meeting on completion of Ms. Smith's presentation.

PURPOSE

This Statement is written in response to the Hearing Panel Chair's Direction that the experts should conference and document areas/topics of agreement and areas/topics of disagreement prior to the section 42A report being circulated so any matters can also be addressed in that report.

The parties were assisted with the drafting of this Statement by Murray Kivell, Hearings Commissioner and member of the Council's Hearing Commissioner Panel.

CODE OF CONDUCT

The witnesses confirm that in producing this Joint Statement they have read and complied with the Environment Court Consolidated Practice Note 2014 – Expert Witness Code of Conduct.

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ATTENDEES

Dr. Rebecca Stirnemann	(RS)	Forest and Bird / RESI	Bat Ecologist and general ecologist
Prof. Bruce Clarkson	(BC)	RESI	Ecologist
Moira Pryde	(MP)	Department of Conservation	Bat Ecologist
Dr. Laurence Barea	(LB)	Department of Conservation	Bat Ecologist
Gerry Kessels	(GK)	Hamilton City Council	Ecologist, Tonkin Taylor
Georgia Cummings	(GC)	For the applicant	Bat Ecologist, Boffa Miskell
Andrew Blayney	(AB)	For the applicant	Ecologist, Boffa Miskell
Dr. Stuart Parsons	(SP)	For the applicant	Ecologist, Walkingbats Specialist Environmental Consulting

Note:

RESI means Riverlea Environmental Society Incorporated

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Areas/topics that are in agreement

Area/topic	Points discussed and agreed	Expert witnesses
Strategic	The purpose of the ecological mitigation is to maintain or enhance the indigenous fauna and flora values across the site	All
	Timing /sequencing of restoration works to maintain landscape and food sources for the bats is important to manage as part of the overall development	All
Specialist reports	The AECOM data/report relating to the bat surveys for the Southern Links project is critical. Would like to review the report before preparing evidence in chief.	All
	Views expressed in caucusing are contingent on the findings in that report and may change.	All
	Current data not sufficient	MP, LB & RS
	Agree, but Andrea Dkrout's data helpful but not essential to determining potential adverse effects	LB
	Disagree. Have identified critical elements to mitigate. Don't believe paddocks and isolated trees have any significant value to bats	SP
Effectiveness of river riparian buffer	Consistency with the Hamilton Ecological District report and Gully Restoration guide including the updated taxonomy and eco-sourcing.	All
	The buffer management area needs to record dimensions using the fence line as a guide. It is also desirable to record measurements from the water's edge.	All
	That the design of that area is centred around bats but there is disagreement about the composition and structure of vegetation for bats and wider indigenous values.	All
Effects on bat movement across application site	The retention and functionality (type and composition of planting) of the east-west corridor and the principle of enhancement.	All

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	Habitat enhancement is important to the functionality of the north-south link (gully) We need to work together to establish the size and the design of the corridor This design needs to be adopted in the wider landscape to be effective considering effects within the Peacocke Structure Plan but we recognise that Amberfield is mitigating relative to the existing environment. One of the aims is to maintain a viable corridor for bat habitat and movements along the Waikato River corridor.	All All All All
Effects on roosting sites	Avoidance is the preferred option for maternity roosts The avoidance of all roosts is the preferred option To date there is no evidence there are bat maternity roosts on the site. Best practice tree felling protocol is to avoid cutting down the active roost trees.	All RS GC & SP All
Effects on lizards and avi fauna	Lizard management plan incorporating habitat creation within the planned planting. Avifauna management plan that considers nesting survey and avoidance of nesting shags and white-faced herons, tui, bellbirds and kaka	All All
Impact Management	Hierarchical and sequential process to deal with adverse effects. To follow the below process as a sequence: • Avoidance • Remediation Mitigation • Offset • Compensation	All All

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	Need an ongoing statistically robust monitoring programme in combination with Southern Links and other future city development projects. The existing surveys do not form the baseline for an ongoing, statistically sound, monitoring plan	All SP, LB, MP, & RS

Areas/topics that are in disagreement

Area/topic	Points discussed and no agreement	Expert witnesses
Specialist reports	The current bat survey information is not adequate to formulate avoidance, remediation and/or mitigation. The applicant's ecologists consider that surveys to date have adequately identified priority habitats and to develop mitigation. Another ABM survey over the whole site is important. What are the residual effects and the site's capacity to preserve bat habitat?	LB, & MP GC & SP GK, MP & RS
Effectiveness of river riparian buffer	Advice from their client that the Amberfield riparian buffer is half the width of what is shown on Peacocke Structure Plan (revised 2009) Current width suggested by Applicant is inadequate Information received from the applicant and HCC is that the buffer zone shown on the revised plans is now in general alignment Move in the appropriate direction but it is not known if it is adequate to avoid adverse effects Width is inadequate and there are too many points that aren't wide enough Based on comparison with riparian vegetation widths on the eastern side of the river which is already developed, the proposed width of the riparian buffer will be sufficient to avoid deterring bats from using the river corridor	BC and RS RS and MP GK and AB LB & MP RS & BC GC & SP

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	Based on my review of past surveys and knowledge of bat movement in this part of Hamilton I consider a minimum of about 100m from the water's edge will be sufficient to maintain in the presence of the proposed development, bat movements along the river.	GK
	The functioning and composition of the meadowlands: Seeking acknowledgement that the proposal is what is needed for bats Agreed that varied heights of vegetation to produce more edge could be beneficial for bats but questions species chosen	BC RS & MP
	Can we do something better than the poplars and the meadows. Not a long-term solution.	RS
	Questions whether the meadow will provide highest invertebrate abundance and replace habitat food source lost	RS
	Within the context the meadow would have high invertebrate abundance	AB
	Supports meadows but has issues with the species chosen	GK
	Even with the works the Applicant has suggested there are time lags to put in place major mitigation for the north-south gully and east-west corridor. There may be substantial residual effects	LB, MP, BC & RS
	A bond is required and the investigation of the establishment of a Trust to manage a long-term funded programme.	BC, RS, GK, LB & MP
	Establishment of a Trust can provide a mechanism for ongoing bat and other biodiversity management.	LB, MP, BC, & RS
	A commitment for all parties to come together to discuss offset or compensation if it is shown there is significant or substantial decline of bats on the site	LB, MP, BC, & RS

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Effects on bat roosting sites	Preference is to protect recognised roost trees. No agreement on the importance of individual trees and the merits of identifying trees in the existing and developed environment	RS MP
Effects on lizards and avifauna	Animal pest control tying into the current WRC and HCC Hamilton Halo Project would increase biodiversity values of the site be additive to other restoration projects and is necessary for survival of restoration plantings.	GK, RS, LB, MP & BC

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Signatures of experts who participated in this caucusing and agree to the matters as outlined above:

Dr. Rebecca Stirnemann:

Prof. Bruce Clarkson:

Moira Pryde:

Dr. Laurence Barea:

Gerry Kessels:

Georgia Cummings:

Andrew Blayney:

Dr. Stuart Parsons:

Date: 22 February 2019

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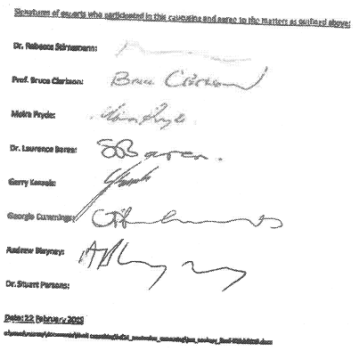

APPENDIX 2: SOUTHERN LINKS PRELIMINARY MAPPED ROOST SITES AS AT 12 MARCH 2019 -