

**BEFORE THE 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 landuse consent  
for the Amberfield development pursuant to the Act

**APPLICANT** Weston Lea Limited

**CONSENT AUTHORITY** Hamilton City Council

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**SUPPLEMENTARY STATEMENT OF EVIDENCE  
(Terrestrial Ecology)  
GERARDUS HENRICUS ANTHONIUS KESSELS**

**Dated: 16 August 2019**

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## INTRODUCTION

1. My name is Gerardus (Gerry) Henricus Anthonius Kessels.
2. My qualifications, experience and role in this hearing are detailed in my evidence in chief (“EIC”).
3. In this supplementary statement of evidence I address the key outstanding matters I consider relevant, having reviewed the matters raised in the evidence of the ecological experts for the submitters – Ms Pryde, Dr Barea, Dr Borkin, Dr Stirnemann and Dr Clarkson, as well as the reply evidence of Ms Cummings, Dr Parsons, Mr Blayney and Dr Flynn. I also considered the matters covered in the expert ecologist Joint Witness Statements (“JWS”), and the additional evidence lodged by Mr Kessner regarding light effects<sup>1</sup>. Since preparing my EIC I have also attended the second ecology expert witness conferencing held on 14 May 2019 and the third conferencing held on the 10<sup>th</sup> and 11<sup>th</sup> of June 2019. I understand that the JWS for both of these conferencing sessions have been provided to the Commissioners.
4. Following the adjournment of the hearing, I have had several meetings and/or discussions with Applicant’s ecological experts including Dr Flynn, Ms Cummings and Dr Parsons, focussed particularly on the issue of short-term adverse effects on bats which I consider will be present until such time as the proposed avoidance and mitigation measures are established. While I have always held the opinion that there will be such an effect (which I have also referred to as a ‘residual effect’), I note that the Applicant’s experts consider there to be a “risk” of an effect. Nevertheless, the concept I proposed in my EIC is applicable and remains relevant.

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<sup>1</sup> Evidence in Chief of Mark Kessner dated 24 May 2019

5. Following on from the last joint witness caucusing, I further explained my rationale to the Applicant's ecological experts regarding addressing adverse short-term/time lag effects on long-tailed bats through an 'upfront' offset fund. I understand that the Applicant's ecological witnesses are amenable to the concept which is consistent with my recommendation's in my EIC and further expressed in my contributions to the ecology expert witness conferencing three JWS. This approach will, in effect, replace the Applicant's proposal for an "adaptive management" approach to assessing and/or responding to the (risk) of short-term/time lag adverse effects. This 'offset/compensation' fund, and the methodology for it, is discussed further below.
6. In light of this, I note that I rely on and/or refer to the following consequential information which has been provided by the Applicant since the adjournment:
  - (a) Cover letter (Merestone) dated 12 August 2019;
  - (b) Updated stating & Scheme Plans;
  - (c) Proposed Early Planting Outside of Earthworks Extent;
  - (d) North Eastern Terrace Concept Plan; and
  - (e) Risk Mitigation Offset Memo dated 22 July 2019.
7. 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**

8. My reply evidence covers the following matters:

- (a) Determining Ecological Significance of the Site;
- (b) Summarisation of ecological effects on long-tailed bats;
- (c) Adequacy of the revised mitigation package offered by the Applicant; and
- (d) Recommendations to the condition set.

#### **DETERMINING ECOLOGICAL SIGNIFICANCE OF THE SITE**

9. On review of the evidence briefs, my opinion regarding ecological significance of the Amberfield site has not materially changed since I prepared my EIC. That is, if a habitat is regularly utilised by a 'Threatened' or 'At Risk' species as an integral component of that species lifecycle, then that habitat is likely to be of section 6(c) significance<sup>2</sup>. This is regardless of the distributions, relative abundance or viability of the individuals or sub-populations found within the said habitat. However, I have further considered my opinion regarding the relative significance of the pasture areas which I explain further in the following section.
10. Pastureland spaces within the Amberfield site are likely to facilitate movement from roosts to foraging resources, provide for foraging and by their very nature form 'dark zones' in this landscape, hence aiding movement across the landscape by bats. However, studies to date indicate that bats preferentially disperse and feed along linear vegetation edges, tend to roost in mature clusters of trees rather than in isolated trees in paddocks, and tend to use open pasture less for foraging (as pointed out by Ms Cummings in her EIR: paragraph 17).
11. In my EIC I referred to the application of the criteria in section 11A for determining ecological significance in the Waikato Regional Policy Statement ("WRPS"). I consider it helpful to revisit that matter to better explain my position set out above and to provide context for why I am

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<sup>2</sup> Resource Management Act 1991.

comfortable with the current proposed mitigation measures for the development. In particular, the additional mitigation actions proposed by the Applicant which is discussed further below.

*WRPS criteria for “significance”*

12. Section 2 ‘General Interpretation’ of the WRPS ‘Reader’s guide’ states that:

unless otherwise specified, items included in bulleted or numbered lists are provided in no order of priority and all factors should be considered equal.

13. This is the case with section 11A. To be identified as significant an area needs to meet one or more of the criteria in Table 11-1. The direction in section 11A reads:

The following criteria [Table 11-1] are to be used to identify areas of significant indigenous biodiversity and their characteristics as they exist at the time the criteria are being applied. Criteria may be specific to a habitat type including water, land or airspace or be more inclusive to address connectivity, or movement of species across habitat types. [emphasis added].

14. There is no discretion to consider other additional or alternative criteria for assessing whether an area is a significant natural area (“SNA”). Assessing significance under the WRPS criteria is a binary process. A site either is, or isn’t, ecologically significant in the context of the list of criteria. Meeting one of the criteria would make a site significant (aside from Criterion 1 and 2). Meeting several criterion will not make a site more significant, but could indicate that a site is more important. However, based on the direction/introduction to Table 11-1, all significant criteria are equivalent; no criterion should be treated as more important than another.

15. However, in applying the criteria, ecologists will need to apply professional judgment, and review literature and data, so that they can meaningfully apply the thresholds set out in the criteria when determining if an area is “significant” (or an SNA). In that regard, Criterion 1 is a simple binary decision based on legal status (and contingent on others being triggered) and does not require ecological analysis. Criteria 4, 5, 6, 7 require a high level of information in order to assess a site, and in some cases, qualifying thresholds to determine if a site is an ecologically functional habitat or indigenous vegetation community.
16. In practice this information is usually incomplete or absent at a local, regional, and national level, so professional judgment is often needed. Criteria 3, 8, 9, and 11 require expert understanding of matters such as the transitory nature of mobile fauna and the ecological context and functionality of a site. Again, information is often absent or incomplete, so professional judgement is required. The literature supports this approach. *Maseyk and Gerbeaux (2015)*<sup>3</sup>, discuss how inclusion/exclusion thresholds can be applied, and that matters such as sustainability, viability, buffering, threats (such as landuse change) and management matters can be useful in determining the overall ecological value and context of a SNA in the wider landscape.
17. Given the transitory nature of mobile species, consideration of ecological context requires assessment of the values of the site in a landscape context and an understanding of the species which use a multitude of functional (or partially functional) habitats within that landscape. Ecological context is an important factor to be considered in this application and can be defined as:

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<sup>3</sup> Maseyk F.J.F. and Gerbeaux P. 2015: Advances in the identification and assessment of ecologically significant habitats in two areas of contrasting biodiversity loss in New Zealand. *New Zealand Journal of Ecology* 39(1). 116-127.

The extent to which the size, shape, and position of an area within the wider environment (land, fresh water or marine) contributes to the maintenance of indigenous biodiversity. Ecological context has two main attributes: the characteristics that help maintain indigenous biodiversity at the site (such as size, shape and configuration); and the contribution the site makes to protection of indigenous biodiversity in the wider landscape (such as by linking or buffering other sites, providing 'stepping stones' of habitat, or maintaining ecological and hydrological processes)." (NPSIB 2018)<sup>4</sup>

18. In this case, I have determined that at least two criteria of the WRPS assessment criteria are triggered because long-tailed bats utilise a variety of habitats within the Amberfield site: as roosting and foraging habitat, as well as migratory pathways to other habitats within their home range in the wider locality. These are Criterion 3<sup>5</sup> and Criterion 11<sup>6</sup>.
19. Despite remaining tree/shrub habitats being largely exotic in composition, and in some cases likely less than 50 years old, the riparian margins of the Waikato River, exotic tree stands and shelterbelts are likely to be the most important or highest value components of habitat with the Amberfield site for bats.
20. Ms Pryde points out, (p7.14 of her EIC and p24 of her EIR), both the acoustic studies and the radio tracking studies for the Southern Links Project (Davidson-Watts 2018/2019)<sup>7</sup> undertaken to date, aren't necessarily robust enough to show significant differentiation between

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<sup>4</sup> Biodiversity Collaborative Report, 2018. Report of the Biodiversity Collaborative Group. Biodiversity (Land and Freshwater) Stakeholder Trust. Wellington, New Zealand.

<sup>5</sup> 3. It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: • classed as threatened or at risk, or • endemic to the Waikato region, or • at the limit of their natural range.

<sup>6</sup> It is 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.

<sup>7</sup> Davidson-watts Ecology Ltd. 2019. Long-tailed bat trapping and radio-tracking baseline report 2018 and 2019. Southern Linking, Prepared form Aecom NZ Ltd.

the differing habitats (onsite), but in general that agricultural land is used by bats to feed and flyover and least important habitats are urban and industrial. However, the pasture areas of Amberfield are contented to be of lower ecological value by Dr Parsons (p89 of his EIC and p21-24 of his EIR) and Ms Cummings (p17 of her EIR).

21. In my opinion, Dr Parsons provides robust evidence from previous studies indicating that pasture areas tend to have lower levels of bat activities than other habitat types (p24 of his EIR). He also discusses the limitations in interpreting radio telemetry data presented as minimum convex polygons (p25-28 of his EIR). As such, having considered Dr Parson's evidence on this point, I accept that the pasturelands within in Amberfield, which are not directly buffering high value areas (such as shelterbelts and the riparian margin of the Waikato River), are of 'low value'. Given the broad nature of the WRPS criteria, some degree of professional judgement needs to be applied when assessing the site under section 6(c) of the RMA for mobile species where it is unlikely to have absolute certainty of the species' use of these areas.

#### **PROPOSED AVOIDANCE AND MITIGATION MEASURES**

22. In the second JWS (14 May 2019) the experts tabulated and listed what they considered to be the key unmitigated effects of the development on long-tailed bats. All agreed that the unmitigated effect on bats is 'very high.' Following on from that, in the third conferencing (10-11 June 2019) the JWS (14 June 2019) tabulated the potential adverse ecological effects on bats and listed the opinions of the experts in terms of the adequacy of the proposed mitigation measures along with alternative measures available and required to adequately avoid, remedy or mitigate the effects of the development. Matters where there was disagreement between the experts were also noted.
23. One of the matters discussed was the merits of an 'adaptive management' approach to addressing adverse effects on bats (whether

actual, potential or a risk of an effect). This was covered in the JWS of 14 May 2019. I had significant reservations about the applicability of such an approach because of the inability to “adapt” in the context of a large-scale subdivision (for example, once titles have issued and have been sold to purchasers, there is limited ability to respond to effects identified through adaptive management monitoring). Furthermore, I was concerned that any monitoring regime would struggle to quantify any adverse effects associated with the specific subdivision from other factors affecting bats in the landscape. The Applicant’s experts had not presented sufficient evidence that this could be addressed before development commenced.

24. Another key aspect where I differed in opinion from the Applicant’s experts was their view that there was a low risk of an adverse effect occurring once all the on-site avoidance and mitigation measures were implemented. As per my EIC, I remain of the view that there is a short-term adverse effect (which I describe as a temporary residual effect elsewhere) during the time lag between commencement of development and the planting etc., becoming established.
25. To assist the commissioners, I have attached to my supplementary evidence a table which sets out the list of effects identified at the expert caucusing, the current (updated) proposed avoidance, remediated and mitigation of those effects (as proposed by the Applicant) and my opinion on the adequacy of those measures (Attachment 3). This table:
  - (a) summarises the key potential adverse effects on long-tailed bats (arising from the expert conferencing (and various statements of evidence));
  - (b) lists the measures the Applicant is proposing to avoid, remedy, mitigate and monitor these effects;
  - (c) sets out my determination if these measures are adequate or not; and

- (d) lists the key concerns of the submitter experts and if their concerns have been addressed or not.

- 26. As explained in my original evidence, the most appropriate response is to avoid significant adverse effects in the first instance and deal with any remaining residual effects or risk of effects as part of an offset mitigation or compensation package. This will 'head off' the potential for the species to be compromised beyond what has been predicted, rather than wait to see whether bat habitat has been compromised by anthropogenic and animal pests. Responding 'after the fact' makes it more difficult to achieve no net loss. Where species or habitats of higher priority to conserve are involved, the preferred response is the avoidance of effects. Avoidance presents the least risk to losing biodiversity or conservation values; anything other than avoidance increases the risk that, despite robust remedy, mitigation or offset, un-avoided adverse effects run the risk of becoming permanent habitat losses within the landscape. In my consideration of the revised Applicant's package of bat related measures, I have always been mindful of this point.
- 27. As the JWS's indicate, in caucusing the experts did not reach broad consensus on the ability of the design of the development, as well as the range of amelioration measures presented by the Applicant to minimise them. However, my opinion has been consistent throughout the process and has not materially changed. That is, that the design and/or conditions imposed needed to ensure that the adverse effects on bats within high value areas are avoided as far as possible, particularly for flyways so that connectivity with other known high value bat habitats in the home range of this population are maintained. I was also aware that there would be a loss of both high and low value bat habitat, and this needs to be avoided as much as possible.

28. Notwithstanding these points, I consider that total avoidance of these high value habitat areas for bat areas is not required as long as connectivity is maintained, and that habitat lost is replaced or mitigated in some form in the long term. Even short-tailed bats show some degree of behavioural plasticity that allows them to adapt to different landscape mosaics and exploit alternative habitat<sup>8</sup>. My observations of long-tailed bats in the peri-urban Hamilton landscape suggest to me that long-tailed bats show a reasonable amount of resilience and behavioural 'plasticity' to landscape change. In my view, as long as these changes are relatively small and discrete from a wider ecological context perspective (and in this case after application of a range of avoidance, remediation and mitigation measures), and don't isolate bats from key high value foraging habitats, they are likely to adapt to them over time. Without a doubt, intensive urbanisation will reduce the distribution patterns of bats as the landscape changes from open pasture. But as the data suggest, where connectivity still exists, bats will likely continue to utilise mature trees, river and gully habitats within urban areas (such as Stanford Park).
29. Re-creation of about 9.5 ha of gully habitat was a core aspect of the Applicant's mitigation package, but there were concerns raised by the submitters and myself, that residual effects on bats were still likely. Initially the Applicant proposed an 'offset' or compensation package comprising of a fund to be used by some form of trust to compensate for any potential adverse residual effects of the development on bats. Appendix 7 of the Terrestrial Ecological Effects Assessment outlines the ecological parameters for a 'bat mitigation trust'<sup>9</sup>. Following consultation and through the hearing and conferencing processes, the

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<sup>8</sup> Toth, C.A.; Cummings, G.; Dennis, E.T.; Parsons, S. 2015. Adoption of Alternative Habitats by a Threatened, "Obligate" Forest-Dwelling Bat in a Fragmented Landscape. *Journal of Mammalogy* 96(5), 927-937

<sup>9</sup> Amberfield – Peacocke Structure Plan: Terrestrial Ecological Assessment prepared for Weston Lea Ltd by Boffa Miskell Ltd May 2018 (Appendix G to the AEE)

Applicant changed the proposed approach whereby the compensation package was taken 'off the table'. Instead the Applicant focused on a number of design, staging and mitigation measures to address adverse effects as far as possible onsite through a number of measures including:

- (a) Buffer vegetation composition designed to be fast growing and effectively capture light and planted as early as is practicable between the subdivision and the river and gully margins;
- (b) Lot deferrals tied to performance criteria of the buffer vegetation, so edge habitat is functionally maintained while the buffer vegetation is establishing;
- (c) Set-back from the river margin and lighting restrictions in addition to the lot deferrals to ensure that the river corridor will not be impacted while the buffer vegetation is establishing;
- (d) Changes to the development staging to increase, as much as practicable, the time lag between buffer planting and house construction close to the river edge; and
- (e) Restrictions on outdoor lighting.

30. However, as the Applicant's experts have since acknowledged there is: 'some risk that there will be short-term effects on the bats while the onsite mitigation becomes established'<sup>10</sup>. I consider this not to be a risk of an effect but an actual adverse short-term residual effect associated with time-lag. As explained in my EIC, the key outstanding issue is the likely adverse effects on bats which will be present during the "time lag" between commencement of works and when the proposed buffer and other mitigation planting become established and functional. Bats will likely take some time to adjust and adapt to the relatively rapid land use

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<sup>10</sup> Boffa Miskell Offset calculation memo – 22 July 2019

changes associated with this project and building resilience of remaining habitats will assist them in adapting to this change.

31. There are three broad time related effects of this development on long-tailed bats: short-term (1-10 years); medium term (10-25years) and long-term (25 years plus). In my EIC, I also expressed my view that an offset/compensation package would be the most appropriate response to address the residual effect during the time lag (refer to Figure 1 below – which is a generic diagram and not related to the site).

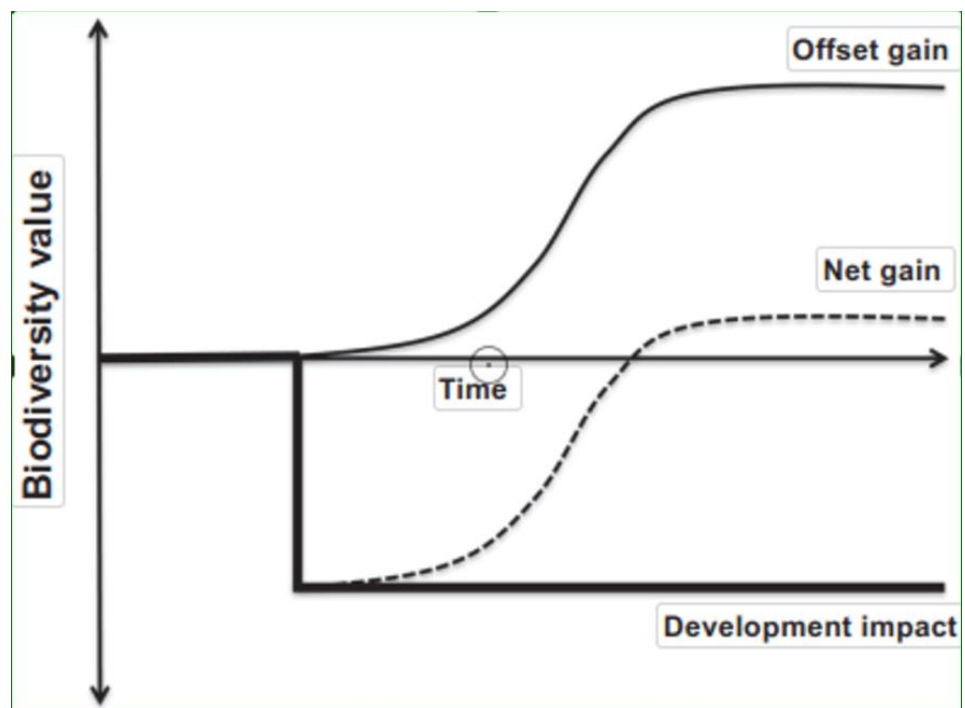


Figure 1: Conceptual diagram of Time lag effect and benefit of applied offset mitigation. Biodiversity loss at impact site (thick line) versus biodiversity gain through an enhancement offset such as invasive species control at an offset site that is degraded at the start of enhancement management (thin line). The dashed line indicates net gain after taking into account the development impact. Because the biodiversity gain per unit area through invasive species control is usually less than the biodiversity loss due to development impact and because of the time taken to achieve the biodiversity gain, the

offset area will almost always be substantially larger than the impact area (Norton & Warburton 2014).<sup>11</sup>

32. It was this concept that I discussed with the Applicant's ecological experts during the adjournment of the hearing and post-caucusing. I understand from those discussions that the Applicant's experts now understand my position on this issue. This is illustrated by the current condition set for bat ecology which does not include an 'adaptive management' approach. That is because after the proposed suite of designs, installation of artificial roost boxes and buffer and mitigation planting has been established, the medium to long term adverse effects on bats are expected to be addressed.
33. The short term or "time lag" adverse effects are proposed to be addressed through a monetary contribution as an offset/compensation to be used to fund direct actions that are designed to manage, protect and/or enhance the resilience of the long-tailed bat population across the known extent of the home range of long-tailed bats affected by the Amberfield development ("home range area"), including, without limitation, co-ordinated pest control in high-value habitat including roosting sites and high activity areas identified across the home range area of the Hamilton South population.
34. A draft consent condition has been developed for the purpose of:  
  
    ..funding direct actions that are designed to manage, protect and/or enhance the resilience of the long-tailed bat population across the known extent of the home range of long-tailed bats affected by the Amberfield development ("home range area"), including, without limitation, co-ordinated pest control in high value habitat including

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<sup>11</sup> Norton, D.a. & Warburton, B. 2014. The Potential for Biodiversity Offsetting to Fund Effective Invasive Species Control. Conservation Biology, Vol 29, No.1, pp 5-11.

roosting sites and high activity areas identified across the home range area.<sup>12</sup>

35. I support this condition (and those designed to give effect to it)<sup>13</sup>. It is a robust mechanism to ensure that funds are appropriately allocated to a range of targeted bat enhancement measures in order to address the short-term time lag effects.
36. This condition reflects the concept I originally proposed in my EIC. I understand based on the discussions with the Applicant's experts during the adjournment that they accept the concept in principle. However, a methodology needed to be developed to determine the quantum of the offset/compensation. This is referred to in the consequential information sent to HCC by the Applicant (memo from Boffa Miskell dated 24 July 2019).
37. There has been some debate between the experts for the Applicant and myself as to what the methodology should be to determine the relevant 'multipliers' and associated costings to produce an overall quantum. This debate has continued up to the point at which I have completed this supplementary evidence. Against that background, I now explain the position I have reached on this issue.
38. In general terms, the objective of the methodology is to determine suitable areas of high-quality bat habitat (likely outside of the Amberfield Subdivision site but within the home range of this population of bats) which would require pest control over a specified number of years. This is in effect a proxy method to quantify the effort required to satisfactorily address the short-term residual effects within the context of effects of the overall development.

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<sup>12</sup> Draft consent condition 121

<sup>13</sup> Draft consent conditions 120, 122, 123.

39. One of the issues arising is the question of whether this is an “offset” or “compensation” mechanism. I have previously discussed my view of how biodiversity offsetting relates to this application in paragraphs 78 – 90 of my EIC. While I understand there is case law on these terms, I have based my view on the current literature which differentiates the terms and their meanings from an ecological science perspective (for example, Maseyk et al 2018)<sup>14</sup>. I also note that the draft National Policy Statement for Indigenous Biodiversity seeks to introduce definitions which are broadly aligned with the literature I have relied on (NPSIB 2018)<sup>15</sup>.
40. In simple terms, because we are unable to measure the exact extent of the short-term residual effects on bats and balance these against measurable gains resulting from the targeted pest control/habitat enhancement, this package sits between being an intended offset and compensation package. Regardless of whether this is described as ‘offset’ or ‘compensation’, my consideration of the context of the development as a whole, is that, from an ecological effects perspective, I am satisfied that the effects are acceptable based on the recommended ecological conditions.

*Boffa Miskell memo dated 24 July 2019 re: offset calculation*

41. The memo presents an approach by determining a range of multiplier for the various residual (risk) temporary effects associated with time-lag for physically lost and functionally retained bat habitat. I support the approach of the memo insofar that it clearly defines and maps relative high and low quality habitat for long-tailed bats and how it has characterises the various habitats associated with the time-lag effect

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<sup>14</sup> Maseyk, F; Ussher, G; Kessels, G; Christensen, M; Brown, M. 2018. Biodiversity Offsetting under the Resource Management Act – A Guidance Document. Prepared for the Biodiversity Working group on behalf of the Bio-Managers Group, Local Government NZ.

<sup>15</sup> Biodiversity Collaborative Report, 2018. Report of the Biodiversity Collaborative Group. Biodiversity (Land and Freshwater) Stakeholder Trust. Wellington, New Zealand

(which it deems to be a risk). However, the process Boffa Miskell have used to arrive at the multipliers and hence overall area required for pest control for a period of ten years is a unique approach which I have not encountered previously.

42. In practical terms, I note that the memo does not include what I consider to be accurate costs for the proposed pest control programme(s) – i.e., cost per hectare – which were not based on the specific requirements of this proposal, which are unique and require targeted actions. I have included an estimate of the likely actual costs for the purpose of determining a suitable offset/compensation figure based on costs of an experienced local pest control contractor (Attachment 1).

*Assessment and testing of methodology set out in Boffa Miskell memo of 24 July 2019*

43. To test the appropriateness of the Boffa Miskell calculation within the context of the overall avoidance/mitigation measures for the development, I asked Dr Matt Baber to run a Biodiversity Accounting (“BDO”) model for the proposal as **attached** (Attachment 2). Dr Baber details the applicability, purpose, key mechanisms and constraints, and outputs of the model in his letter.
44. I considered such a test of the Applicant’s offset/compensation was necessary because I consider this approach consistent with best practice in terms of meeting the principles of biodiversity offsetting and no net loss (“NNL”), as I have discussed previously in my EIC (paragraphs 81-89). I prefer this approach to the Boffa Miskell calculations as it is consistent with current national and international best practice for biodiversity offsetting and determination of NNL, it has been developed through DOC, local government NZ and published literature, the assumptions underlying the model are transparent and it provides

consistency and applicability to other development proposals within the Peacocke Structure Plan Area.

45. As indicated in paragraph 79-80 of my EIC, Dr Baber and I are using this model as part of the development of a Biodiversity Management Framework, which will recommend the measures required to achieve no net loss within the Peacocke Structure area ("PSPA"). Using the same model to assess the likelihood of NNL outcomes for bats associated with the Amberfield subdivision will enable a like for like assessment in this regard. This is important to ensuring that effects on bats and corresponding offsetting measures for achieving NNL outcomes across the entire PSPA are addressed in a clear, consistent, and coordinated manner.
46. It is also important to note that the BDO model cannot be run for just the short-term residual effects. Rather, the whole proposal was considered to predict whether it would be likely to achieve a NNL overall.<sup>16</sup>
47. As Dr Baber states in his letter, consideration of 'limits to offsetting' also plays a key part in considering of any offset/compensation package, as it relates to determination of a suitable threshold by which an ecologist determines if such an approach is appropriate as opposed to avoidance. Factors I have considered in my determination on this matter are the severity and scale of effects on bats, will the bats adapt to change, is the habitat lost replaceable, and when considering the overall avoidance and mitigation package of this application, will the flyways for bats be maintained should the development proceed.

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<sup>16</sup> To undertake the offset calculation in this model appropriate manner requires an assessment of all potential impacts on bats and the suite of proposed offsets to address residual effects. It is not appropriate to assess only a selected impact and corresponding offset type as this has the potential to generate potentially misleading conclusions and outcomes that neither align with the policies and objectives in the WRC, nor their intent to protect significant fauna from significant adverse effects.

48. Consideration of the BDO model and those matters I have discussed above in relation to biodiversity offsetting have assisted me with determining appropriate “multipliers” for the methodology set out in the Boffa Miskell memo in relation to which I had concerns (as discussed above). The outcome of that “test” process is that I am satisfied that the methodology proposed in the Boffa Miskell memo will provide a suitable quantum, provided the accurate contractor costs are applied.
49. My opinion on the appropriate quantum for this package, based on the estimate presented in Attachment 1 is \$202,163.00 (excluding GST):  
[(Year One set up costs – \$200x155.51ha = \$31,102)+((cost per ha per year - \$110/yr)x(area of control- 155.51ha)x10 years = \$171,061)].
50. It will be extremely difficult and time consuming to obtain a dataset to run a quantitative offset model, given the complexity of bat behaviour in this environment, and the wide and changing other landscape changes, such as other development and infrastructure being built during that time and predation. These factors would confound the causality effects links of this proposal on bats compared to these other effects on this local population and the wider bat meta-population. Consequently, I consider that the residual adverse effects are not so great that expert opinion is an unreasonable approach to use when populating attributes and predicted gains or losses over time into a model, as long as they are transparent, which in this case they are, as outlined in Dr Baber’s letter.
51. I do not think it reasonable, practical or necessary to have absolute scientific certainty about every predicted aspect inputted into a biodiversity offset model where the level of residual adverse effects are relatively low. I do consider that this uncertainty needs to be explicit and the uncertainty, expressed as the risk of failure, or partial success, needs to be addressed, which can be done both within a model and by means other than a model. Expert opinion is thus an appropriate, but a

less desirable means than having absolute data, but it does create a greater level of uncertainty in the predicted outcomes that would have occurred if site specific quantitative scientific data was available for running an offset model. However, in the case of the use of a model for the Amberfield Subdivision for bats it is likely that many years of intensive in-situ studies would be required to validate and populate the model, which as I have stated above, is not considered necessary for this specific case.

52. As stated in my EIC 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, the use of some form of agreed and explicitly documented approach is an appropriate response when developing a robust and defensible offset/compensation package. As also stated in my EIC, 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 to reduce the risk of failure or partial success if only one restoration/habitat enhancement method is used, as I have previously discussed in my EIC (for example paragraph 105).

#### **DESIGN OF THE AMBERFIELD DEVELOPMENT AND EFFECTS ON BATS**

53. In addition to the direct avoidance and mitigation measures presented up to and during the hearing, the Applicant has provided consequential information which includes, for example: clarification and extent of deferred staging of the subdivision (now increased); targeted lot deferral for lots adjacent to bat flyway corridors; lighting restrictions within the site; and set-backs within the east-west shelterbelt and additional/amended fast growing buffer planting in Southern Gully to

provide for higher vegetation while the vegetation matures. These are outlined in the Applicant's covering letter to HCC dated 12 August 2019.

54. Environmental performance standard monitoring is required and this has been incorporated in the draft condition set presented by HCC in the section 42a report. This compliance monitoring includes, for example, inspection of the buffer planting to ensure it reaches suitable vertical plane canopy closure and heights (draft consent condition 77), and certification of the relevant ecology related management plans (draft consent condition 89).
55. The submitter's experts are not in alignment with the Applicant's expert's view in terms of the efficacy of the design, staging or amelioration measures. I understand that one of the key matters of concern to the submitter experts is that the fundamental layout of the subdivision needs to be re-designed to minimise potential adverse effects on bats. Dr Barea, Dr Stirnemann and Dr Clarkson in particular, seek re-design of the subdivision layout. The range of submitter expert concerns are summarised Table 1 (Attachment 3) to my evidence. I present my reasons below why the current design and mitigation measures offered by the Applicant are now sufficiently developed and detailed to address my original concerns in relation to these.
56. At the outset, I would have preferred to see that the river and gully buffer corridors being 100 m in width. This was consistent with data on bat habitat preferences and with the review and recommendations originally presented to Council in the ecological review of the PSP by Kessels Ecology (Dekorut 2009)<sup>17</sup>. I am convinced that the data presented in my EIC, and supported by evidence of Dr Borkin and Ms Pryde, confirm the fact that further than about 100 m out from the edge of gully and river habitats in Hamilton, bat activity drops off, and this

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<sup>17</sup> Dekorut, A. 2009. Monitoring New Zealand Long-tailed Bats in Urban Habitats: Ecology, Physiology and Generics. University of Auckland, Auckland

trend is statistically significant. My deduction from this and following this hearing process, after analysis of the measures proposed by the Applicant with supporting evidence, is that a minimum 100 m buffer is appropriate where there are no bespoke measures in play to reduce the adverse effects associated with urbanisation.

57. However, through the hearing process, the Applicant has modified the design and staging of the subdivision and offered additional mitigation measures which now satisfy me that a lesser width is acceptable provided these measures are enforced maintained and monitored on an ongoing basis through suitable consent conditions. The subdivision design does not have a consistent 100 m width buffer along the river margin nor does it indicate that the 'east-west buffer corridor' is particularly wide. Rather the package now offered by the Applicant incorporates a number of bespoke design, deferral staging and lots, and mitigation measures. It has largely been developed as the hearing has progressed, and is supported by evidence presented by the Applicant's ecologists as well as that presented by the Applicant's lighting expert.
58. In addition, the Applicant's decision to widen the northern river margin width opposite Hammond Park was instrumental to ensuring the risk of how the adverse effects of the subdivision would affect Hammond Park roosts, and perhaps more importantly, detract bats from moving along the river to Mangakotukutuku and Stanford Park should they show less preference to moving east to west as the development proceeds.
59. Another adverse effect on bats that has not been adequately addressed at the time of the adjournment of the hearing, was a matter raised by Dr Clarkson, concerning the two southern gully crossings – a bridge and a culvert. This is especially important given any structures, which reduce the functionality, or ability of bats to fully utilise the restored gully habitat, reduces the overall efficacy of the restoration and hence increases the level of outstanding residual adverse effects on bats as

well as the time-lag effect. I have noted that the draft consent condition relating to the Vegetation Management Plan provides for specific design measures for gully planting around these gully crossing to facilitate bat movement across these roads. In addition, the Applicant has also offered early buffer planting and staging of house construction adjacent to these crossings to enhance the efficacy of the gully restoration to provide habitat for bats as shown in the revised early planting plan and staging plan supplied on 12 August 2019.

## RESPONSE TO SUBMITTER EXPERTS

60. My responses to the submitter experts are set out in the **attached** table (Attachment 3). However, there are some additional points I would like to discuss as follows.
61. There are relatively widespread and successful animal and weed pest control measures being undertaken in the southern portion of the City now. These measures have been proven to be successful for many indigenous species, despite being located in an urban and per-urban environment, in research undertaken by Landcare Research<sup>[1]</sup>. This is supported by Dr Parsons, who (in a personal communication email to me in relation to my expert evidence for Hamilton in relation to Southern Links Notice of Requirement, and with permission to cite his opinion) stated that:

“targeted animal pest control is likely to have positive effects 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

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<sup>[1]</sup> Biennial counts in August of bird species and numbers in urban Hamilton by Landcare Research (in partnership with the Hamilton City Council) since 2004 showed that the proportion of count stations with tūi in parks and other green areas of the city increased from around 6% to 23% between 2004 and 2010. Landcare Research state: “This was undoubtedly due to WRC’s pest control.”  
<https://www.landcareresearch.co.nz/publications/newsletters/kararehe-kino/kararehe-kino-issue-20/restoring-tui-in-hamilton>. Accessed 25 July 2019

roost sites, it should provide a suitable mitigation response for any potential short- and medium-term negative effects”<sup>18</sup>.

62. Other recent research shows that pest control can result in significant increases in bat populations where that control takes place (O’Donnell et al 2017)<sup>19</sup>.
63. However, any pest control applied at a local landscape level needs to be undertaken in a strategic way, and ideally as part of a wider habitat enhancement programme for bats, focussing on areas of high habitat value, particularly communal roost sites. The draft consent condition in relation to the offset/compensation funding allows flexibility in the application of pest control to achieve this approach.
64. The issue of a subdivision cat ban is a vexing one and where there is disagreement to the applicability of it to this site. I have been involved in several subdivision developments within or adjacent to sensitive environments where I have recommended a cat ban and consequently a cat ban has been enforced by the territorial authority as part of the consent conditions. In this case, given that the site does not appear to be part of core habitat, and given a complete cat ban in the southern portion of Hamilton is unlikely to be implemented, a cat ban seems to be impractical and largely ineffectual to me. If widespread public support was given to cat control measures, including enforcement of keeping cats indoors at night, registration of cats, and control of feral cats, I would be supportive of such measures.
65. We know now that in some instances artificial roosts are being used by long-tailed bats in the presumed absence of suitable natural roost sites in Hamilton. Installation, maintenance and monitoring of artificial roost

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<sup>18</sup> Email communication from S Parsons to G Kessels, 19 August 2014.

<sup>19</sup> Donnell, C.F.J; M.A. Pryde, M.A.; van Dam-Batesa , P. Elliot, PA. 2017. Controlling invasive predators enhances the long-term survival of endangered New Zealand long-tailed bats (*Chalinolobus tuberculatus*): Implications for conservation of bats on oceanic islands . Biological Conservation 214 (2017): 154-167.

sites in a number of legally protected sites in the home-range of this bat population, or the wider bat meta-population would be an effective measure to address medium term residual effects on bats.

66. Further habitat protection and enhancement options for addressing residual effects can be integrated with Hamilton City's biodiversity strategy framework and the biodiversity enhancement measures being developed for the revised PSP. I am confident, given my role and input into both of these programmes, that there are opportunities for a range of measures to be implemented as part of the Amberfield offset funding which will create suitable synergies with the overall biodiversity enhancement objectives being developed by HCC and Waikato Regional Council through implementation of the 'Local Indigenous Biodiversity Strategy – Hamilton City Pilot Project' (2018)<sup>20</sup> as part of the Local Indigenous Biodiversity Strategy initiative.

#### *Lighting*

67. Based on the lighting expert evidence that the lighting effects of the development, both street lighting and from adjacent housing development<sup>21</sup>, I am satisfied that this will not result in a significant adverse effect on bats. The evidence shows that even without the buffer planting in place the lux levels are below detectable levels above ambient. In particular I find the diagram in Mr Kessner's statement in response to questions of the Hearing Panel raised in Direction 9 helpful in my assessment of this matter. Consequently, and when taking into account the recent revisions (as presented by the Applicant on 12 August 2019), I consider that the river and east-west corridors will continue to provide corridor habitat for bats without interruption from light from the development. This is further implemented by the

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<sup>20</sup> Vare, M & Rolfe, P. 2018. Local Indigenous Biodiversity Strategy – Hamilton City Pilot Project. Hamilton City Council & Waikato Regional Council.

<sup>21</sup> Evidence in Chief of Mark Kessner for Weston Lea Ltd, 24 May 2019 and his statement in answer to questions of the hearing panel raised in Direction 9 dated 24 July 2019

deferred staging of the subdivision in the adjoining areas until the canopy height and vertical canopy cover is well established. This now also applies to the southern gully area. Furthermore, exterior lighting within the residential lots within the deferred stages will be subject to consent notices which control the light levels.

**GHA (Gerry) Kessels**

16 August 2019

**ATTACHMENT 1: Cost Estimate for Animal Pest Control in Southern Hamilton (Mr Kevin Christie, Business Manager, EcoFX)**

25 July 2019

Gerry Kessels  
Tonkin + Taylor  
PO Box 9544  
Hamilton.

Dear Gerry

**Re: Proposed Amisfield Bat Protection Programme**

Thank you for inviting EcoFX to submit an estimate for the proposed bat protection programme with the development of part of the Peacocke Structure Plan as per our conversation 24 July 2019.

Based on the information provided by yourself, I have used the following assumptions as the basis for the costing of this project.

There is 150-300 ha of new subdivision with the following habitat types as discussed.

- Riverine Habitat adjacent to the Waikato River
- Gully Habitat
- Planted areas.
- Bush stands existing 2 (1 ha and 2 Ha)

The target pests are Rodents, Possums Mustelids.

The methodology has to be suitable for urban and peri urban areas i.e. high public use with domestic residences nearby.

The purpose of the Pest Control Programme is to protect Long Tailed Bat roosting areas of which there may be multiple roosting sites.

**Methodology: Rodent Control**

- Good Nature A24 Infrastructure (100 estimated)
- 100 Philproof Bait Stations using Pindone, Diphacinone and Bromodiolone as extruded pellets or hard rodent blocks. Note: Long tailed Bat populations are susceptible to poisoning when using soft bait formulations containing rodenticides.

**Methodology: Possum Control**

- 10 Good Nature A12
- 50 Trapinator Kill Trap key habitat areas. We may use rodent Philproof stations with Brodifacoum bait in targeted areas to control possums.

**Methodology: Mustelid Control**

- 10 Doc 250 Traps and Covers using Erayz dehydrated rabbit long life baits. Stoats and Weasels.
- 5 Doc 200 Traps and Covers using Erayz dehydrated rabbit long life baits. Ferrets.

**Phases of Control:**

The first visit would be to set up infrastructure and control programme with a second visit required within 2-4 weeks and third visit within 4-6 weeks for year 1.

For the following years Bi-annual control should take place between September to October and phase two during December to January.

The first years control would be a first visit consisting of the infrastructure set up and control at an estimated rate of \$200/ha and with the two follow up visits at an estimated rate of \$55/ha per visit.

Then the subsequent bi-annual visits for ongoing years would be at the estimated rate of \$55/ha per hectare per visit.

| Project                                                | Price            | \$ per ha |
|--------------------------------------------------------|------------------|-----------|
| Amisfield Year 1 Set up                                | \$ 60,000        | \$ 200    |
| Amisfield Follow up phase Year 1 2 <sup>nd</sup> Visit | \$ 16,500        | \$ 55     |
| Amisfield Follow up phase Year 1 3 <sup>rd</sup> Visit | \$16,500         | \$55      |
| <b>Total</b>                                           | <b>\$ 93,000</b> |           |

Note: Prices are based on the stated infrastructure over an area of 300 hectare. If the area was reduced, inputs would reduce along with phase costs but it is likely that per hectare rates will increase.

Please note that all costs are GST exclusive.

If you would like to discuss this proposal or have any queries, please do not hesitate to contact me on 0274 957316.

Yours faithfully,



Kevin Christie  
**EcoFX Business Manager**

**ATTACHMENT 2:      Amberfield Development Subdivision - Assessment of  
proposed bat habitat offsetting multipliers (Dr Matt  
Baber, Tonkin & Taylor, 15 August 2019)**

Hamilton City Council  
Private Bag 3010  
Hamilton 3240

Attention: Gillian Cockerell

Dear Gillian

## **Amberfields Subdivision - Assessment of Applicant's proposed bat habitat offsets**

### **1 Report purpose and scope**

The purpose of this letter report is to test the Weston Lea's proposed offset measures for the Amberfield Development subdivision against the principles of biodiversity offsets and the Biodiversity Accounting Model (herein the 'model')<sup>1</sup>. This is intended to also assist with the finalisation of a proposed offset/compensation formula which addresses the short-term residual (i.e. time lag) effects on bats, as described in Mr Gerry Kessels' evidence on the proposal.

The overarching objective is to determine the likelihood that a No Net Loss (NNL) or preferably Net Gain (NG) in long-tailed bat values affected by the project will be achieved in the long-term.

My understanding of residual adverse effects and proposed offsets associated with the proposed subdivision is based on:

- The memo prepared by Boffa Miskell dated 22 July 2019 entitled 'Offset calculation to manage risk related of short-term effects on long-tailed bats (risk mitigation offset)';
- The complete avoidance and mitigation package proposed by the applicant; and
- The expert opinion of Mr Gerry Kessels, Principal Ecologist, representing Hamilton City Council for the Amberfield subdivision consent application.

Importantly, the model I am using to test the proposed offset measures for the Amberfield subdivision is the same model that will be used to assist Hamilton City Council with the determination of offsetting requirements for the Peacocke Structure Plan Area (PSPA)<sup>2</sup>. Using the same model to assess the likelihood of NNL outcomes for bats associated with the Amberfield subdivision will enable a like for like assessment in this regard. This is important to ensuring that effects on bats and corresponding offsetting measures for achieving NNL outcomes across the entire PSPA are addressed in a clear, consistent, and coordinated manner.

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<sup>1</sup> This letter has been prepared in accordance with the terms and conditions set out in Schedule 2 of the Framework Agreement (the "Agreement") dated 1 August 2014 between Hamilton City Council (HCC) and Tonkin & Taylor Limited, (T+T).

<sup>2</sup> Peacocke Structure Plan Area Effects Management Framework (in prep). Technical report prepared for Hamilton City Council.

## 2 Methods

### 2.1 Offsetting principles

The proposed offsetting approach was tested against a set of key biodiversity offset principles. For this project, the key principles are taken from the New Zealand Government Guidance on Good Practice Biodiversity Offsetting in New Zealand (2014). Adherence to key principles means that the proposed offset must:

- Recognise that some residual effects cannot be offset (i.e. 'limits to offsetting') due to the:
  - Irreplaceability or vulnerability of the biodiversity value(s); and/or
  - Degree of uncertainty around the significance of the effect and/or
  - Technical feasibility to secure gains (at offset sites) within acceptable time frames.
- Achieve NNL or preferably NG outcomes;
- Consider landscape context;
- Be additional (achieve outcomes that are above and beyond results that would have occurred if the offset had not taken place);
- Result in long-term outcomes (preferably in perpetuity);
- Be 'like for like' (biodiversity values being achieved through the offset are the same or similar to those being lost); and
- Adhere to a mitigation hierarchy (be considered only after efforts to avoid, remedy and mitigate for adverse effects).

### 2.2 Offsetting model

Biodiversity offset models calculate the biodiversity losses at impact sites and the biodiversity gains at offset sites to determine if NNL/NG outcome has been achieved for each biodiversity value or attribute that is being measured.

The Biodiversity Accounting Model (herein 'the model') has been developed by the Department of Conservation, the Catalyst Group and the University of Queensland<sup>3</sup>. It is the most commonly applied model in New Zealand and the model user guide and accounting system can be downloaded from the Department of Conservation website<sup>4</sup>.

The model is intended to provide an accessible, transparent, flexible and structured means of assessing an offset proposal. Based on data inputs, the model calculates whether a NNL/NG outcome will be achieved, accounting for uncertainty and time lag between losses occurring at impact sites and gains being generated at offset sites. In summary, the model:

- Accounts only for 'like for like' biodiversity trades aimed at demonstrating NNL/NG outcomes (the model does not address 'like for unlike' exchanges);
- Calculates net present biodiversity value (NPBV) (biodiversity value in the present in contrast to some future value) to estimate whether NNL/NG is achieved;
- Incorporates the use of a time discount rate (which factors in the time lag between when biodiversity is lost at the impact sites and when gains occur at the offset site(s)); and

<sup>3</sup> Maseyk et al. (2015). A Biodiversity Offsets Accounting Model for New Zealand. Contract report prepared for the Department of Conservation, Hamilton Service Centre, Private Bag 3072, Hamilton, New Zealand

<sup>4</sup> <https://www.doc.govt.nz/about-us/our-policies-and-plans/guidance-on-biodiversity-offsetting/biodiversity-offsets-accounting-system/>

- Adjusts for uncertainty of success (the degree of confidence) regarding the proposed offset actions.

### 2.3 Application of the model for the Amberfield project

The model has been used to test the likelihood of achieving NNL/NG outcomes for bats based on:

- Information provided by the applicant on the amount of habitat that will be adversely affected at impact sites and the amount of habitat that is likely to benefit from offsetting measures at offset sites;
- Information provided by the applicant and expert assessment of the quality of habitat that will be adversely affected at the impact sites and the quality of habitat that will be subject to offsetting measures at the offset sites; and
- Assessment of the potential benefits on biodiversity associated with proposed offsetting measures at offset sites based on information provided by the applicant, a literature review, and expert assessment, in regards to:
  - The areal extent of each habitat type within the proposed offset site(s);
  - The expected benefit attributed to the proposed offset actions after a pre-determined time period;
  - Assigned percentage confidence (i.e. 50 to < 75 %, 75 to < 90 % and ≥ 90 %) that those offset actions would achieve the expected benefit; and
  - Assigned time discount rate of 3 % to account for the time lag between when an impact is likely to occur and when the offset benefit is likely to be achieved.

It is key to note that while the model is considered to be a useful tool, the model outputs are indicative only due to the coarse/high-level nature of data inputs. The models limitations are commensurate with the accuracy of the data inputs noting that data inputs are based on professional opinion rather than a comprehensive data set.

As necessitated by the project (and effects management) cycle, application of this model will be a staged process. As such, confirmation of NNL/NG outcomes is dependent on further bat surveys within the Amberfield site and in combination with any wider southern Hamilton surveys being undertaken while the implementation of any management actions resulting from the applicant's offset package are underway.

The tables below set out the data inputs into the model. Specifically Table 2.1 describes data inputs into the impact model and Table 2.2 describes data inputs into the offset model.

Table 2.1: Data inputs into the Impact model

| Model inputs                  | Explanation (Maseyk et al., 2017)                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Application for the Amberfield project                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Biodiversity Type</b>      | <i>Biodiversity Type describes the key biodiversity features of concern found at the Impact Site and can include ecosystems, habitats, or species. Examples include: Vegetation types or Threatened species</i>                                                                                                                                                                                                                                                                         | 'Bats' have been used as our biodiversity type                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Biodiversity Component</b> | <i>Identify and input Biodiversity Components to help describe what makes up the Biodiversity Type. Examples of components include: vegetation tiers, habitat types,</i>                                                                                                                                                                                                                                                                                                                | For clarity Boffa Miskell's habitat type descriptors as biodiversity components based on memo dated 22 July 2019, including 'Physically Lost', 'functionally retained (high disturbance risk)' and 'functionally retained (low disturbance risk)' has been used.                                                                                                                                                                                             |
| <b>Biodiversity Attribute</b> | <i>Identify and input Biodiversity Attributes as measures of the condition, value or quantity of the Biodiversity Component.</i>                                                                                                                                                                                                                                                                                                                                                        | Habitat value within each of the Biodiversity Components                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Measurement Unit</b>       | <i>Enter measurement Units for each Biodiversity Attribute. For example, if the Attribute is 'number of adults' the Measurement Unit would be a count. If the Attribute is 'spatial extent of a vegetation tier', the Measurement Unit might be percent.</i>                                                                                                                                                                                                                            | 'High' value or 'Low' value as described and mapped in Boffa Miskell's memo dated 22 July 2019                                                                                                                                                                                                                                                                                                                                                               |
| <b>Area of Impact (ha)</b>    | <i>Measure and input the extent of habitat or area (ha) supporting the Biodiversity Type and over which the Biodiversity Attribute will be impacted by the proposal.</i>                                                                                                                                                                                                                                                                                                                | Area of impact calculations from Boffa Miskell's memo dated 22 July 2019, i.e. for 'Physically Lost' 'Functionally Retained (high disturbance risk)' and 'Functionally Retained (low disturbance risk)' habitats.                                                                                                                                                                                                                                            |
| <b>Based on Benchmark</b>     | <i>Input Benchmark values specific to each Biodiversity Attribute. Measurements of ecological condition, value or quality require reference to a benchmark state that reflects a 'natural' or 'pristine' or other desirable condition. Benchmarks are ideally measured, from a real site of the same vegetation community type of the Impact and Offset Site, and be a site that has been under sustained conservation management or be of the highest possible condition or value.</i> | The benchmark state for bat habitat is defined as the best quality river or gully riparian vegetation within Hamilton City based on expert opinion, i.e. habitat that includes communal roost sites, high quality roosting, foraging and flyway habitat, has high numbers of bats and is subject to intensive and effective pest control targeting the full suite of introduced mammals known to predate on bats as determined by a qualified bat ecologist. |

| Model inputs                          | Explanation (Maseyk et al., 2017)                                                                                                                                                                                                                                                                                                                                                                                                                    | Application for the Amberfield project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Measure <u>prior</u> to Impact</b> | <i>Measure and input the measured value of the Biodiversity Type or Component at the Impact Site prior to the proposed Impact occurring. This is the measure of biodiversity loss in the loss/gain calculation. The value is expressed in the stated Measurement Unit (Column F), using the same method of measurement as for the Benchmark. If the Impact to the Biodiversity type of component is total loss, then a value of zero is entered.</i> | <p>All 'High' value biodiversity components have been given a score of 3 relative to the benchmark of 5, e.g., they are considered to equate to 60 % the value of benchmark habitats.</p> <p>All 'Low' value habitats (i.e. pasture habitat types) have been given a score of 0.25 relative to the benchmark of 5, e.g., they are considered to equate to 5 % the value of benchmark habitats</p> <p>These assessments are based on the expert opinion of Gerry Kessels in relation to habitat quality relative to the benchmark</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Measure <u>after</u> Impact</b>    | <i>Estimate and input the predicted value of the Attribute at the Impact Site following the proposed Impact. The value is expressed in the stated Measurement Unit (Column F), using the same method of measurement as for the Benchmark. The quantum of Impact may be derived from the Assessment of Environmental Effects, or predictive models may be needed to inform this value. Experts with expertise relevant to each</i>                    | <p>For 'Physically Lost' habitats that will be replaced with housing development an after impact bat value score of 0 has been assigned</p> <p>For 'Functionally Retained' (high disturbance risk) habitats an after impact score that equates to 20 % of the pre impact score has been assigned, noting that this is an 'average' with the value expected to drop lower immediately prior to impact (i.e. year 0) and increase to near 100 % (i.e., 10 years after the impact when staging, mitigation buffer plantings and bespoke lighting design effectively mitigate for effects on bats). I have assumed that mitigation plantings will be &lt; 1 year old at impact)</p> <p>For 'Functionally Retained' (low disturbance risk) habitats an after impact score that equates to 50 % of the pre impact score has been assigned, noting that this is an 'average' with the value expected to drop lower immediately prior to impact (i.e. year 0) and increase to 100 % (i.e. 5 years after the impact when staging and mitigation plantings effectively mitigate for impacts on bats). I have assumed that mitigation plantings will be 5 years old at time of impact – this accounts for staging of the subdivision.</p> <p>These assessments are based on the expert opinion of Gerry Kessels in relation to habitat quality relative to the benchmark</p> |
| <b>Biodiversity value</b>             | <i>This is the calculated value of the Biodiversity Attribute at the Impact Site following the Impact. Attribute biodiversity value is the measure of the Attribute after the Impact, relative to the measure prior to the Impact, and adjusted in proportion to the Benchmark. This change in biodiversity value is then multiplied across the area of proposed Impact.</i>                                                                         | As per model calculation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

Table 2.2: Data inputs into the Offset model

|                                | Explanation (in general accordance with Maseyk 2017)                                                                                                                                                                                                                             | Application for the Amberfield project                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Biodiversity Type</b>       | <i>No deviation from impact model explanation</i>                                                                                                                                                                                                                                | Same as impact model explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Biodiversity Component</b>  |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Biodiversity Attribute</b>  |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Measurement Unit</b>        |                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Discount rate</b>           | <i>Enter a discrete discount rate before any other values are entered into the Offset Model. The same discount rate applies to all Biodiversity Types, Components, and Attributes in the Offset Model. For more discussion on discount rates see the Good Practice Guidance.</i> | A discount rate of 3 % to account for the inherent risk in the temporal-lag between the impact occurring (due to the development) and the biodiversity gains being generated (due to the offset actions) has been used. The worked examples provided in the model User Manual apply a discount rate of 3 %, as informed by research conducted as part of the Department of Conservation's research project on biodiversity offsetting in New Zealand.                                                           |
| <b>Proposed offset Actions</b> | <i>Define and Input brief detail of the action(s) (management intervention) proposed to Offset Impact.</i>                                                                                                                                                                       | To offset permanent residual effects associated with 'Physical Loss' 18.5 ha of habitat will be restored through habitat re-creation (revegetation and establishment of 240 artificial bat boxes)<br><br>To offset temporary residual effects on retained habitat until mitigation plantings are established, intensive pest control will be undertaken within high value gully/river riparian margin habitat that is known to include communal roosts, within the known home range of this population of bats. |
| <b>Offset area (ha)</b>        | <i>Input the area (in hectares) over which the offset activity related to this Biodiversity Attribute will be implemented.</i>                                                                                                                                                   | As provided by the applicant, i.e. 18.5 ha of habitat recreation and 155.51 ha of pest control.                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                                                 | Explanation (in general accordance with Maseyk 2017)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Application for the Amberfield project                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Confidence in Offset Actions</b>             | <p><i>Estimate and input the likelihood that the proposed Offset Action (Column H) will be successful within the specified time estimate (Column O). This reflects that even with proven management techniques some uncertainty around outcomes is always present e.g. restoration plantings may fail due to unanticipated drought or pest pressures, or possum control targets may not be met due to bait interference by an unexpectedly high rat population. This confidence level does not include risk of default or failing to implement the proposed Offset Actions. Choose a confidence rating from the dropdown list, as follows:</i></p> <p><b>Moderate confidence:</b> Likelihood of success is &gt; 50 % but &lt; 75 %.</p> <p><b>High Confidence:</b> Likelihood of success &gt; 75 % but less than 90 %.</p> <p><b>Very High confidence:</b> Likelihood of success is &gt; 90 %.</p> | <p>A Very High Confidence (&gt; 90%) that habitat re-creation will achieve the predicted benefits after 25 years of revegetation has been assigned.</p> <p>A Moderate Confidence (50 % - 75 %) that the bat population within the proposed pest control area will benefit from intensive pest control has been assigned, largely based on Donnell et al. (2017)<sup>5</sup>. However, the degree to which bat populations will benefit cannot be predicted with any certainty.</p> |
| <b>Time period over which to calculate NPBV</b> | <i>Decide whether to run calculations across five yearly time-steps for 35 years, or at a finite user defined end point.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The time period over which to calculate NPBV is 25 years for revegetation offsets and 1 year for pest control offsets                                                                                                                                                                                                                                                                                                                                                              |
| <b>Measure <u>prior to</u> Offset</b>           | <i>Measure and input the value of the Biodiversity Attribute at the Offset Site prior to the proposed Offset Action being implemented</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>It is assumed that the bat value measure prior to offset is 1 relative the benchmark of 5 for the 18.65 ha that will be subject to habitat re-creation.</p> <p>It is assumed that the proposed offset site to receive 155.51 ha of pest control will be high quality bat habitat with an average a measure of 4 relative to the benchmark of 5.</p>                                                                                                                             |

Colin F.J. O'Donnella, C.F.J., M.A. Pryde, P van Dam-Batesa, G. P. Elliot 2017. Controlling invasive predators enhances the long-term survival of endangered New Zealand long-tailed bats (*Chalinolobus tuberculatus*): Implications for conservation of bats on oceanic islands. Biological Conservation 214 (2017): 154-167.

|                                          | Explanation (in general accordance with Maseyk 2017)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Application for the Amberfield project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Measure <u>after</u> the Offset</b>   | <i>Estimate and input the value of the Biodiversity Attribute at the Offset Site following the proposed Offset Action at the finite end point — the time at which the Offset Action is anticipated to have achieved the stated objective.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>It is assumed that habitat re-creation efforts will result in an increase in bat habitat value to 3.5 relative to the benchmark of 5 after 25 years.</p> <p>It is assumed that the bat habitat value within the 155.51 ha subject to pest control will increase to the benchmark state, i.e. 5 and will constitute the highest quality bat habitat in Hamilton City. This assumes that the proposed offset site will in fact constitute high quality bat habitat and that intensive pest control will reduce predation pressure and lead to population increases in bats. It also assumes that this area will form part of a wider pest control network and therefore that pest control targets will be achieved across the entire proposed area.</p> <p>These assessments are based on the expert opinion of Mr Gerry Kessels in relation to habitat quality relative to the benchmark</p> |
| <b>Time till end point (years)</b>       | <i>Predict and input the anticipated number of years (from the time of implementing the Offset Action) until the Offset Action is expected to achieve the Offset goal.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The time period over which to calculate NPBV will be: 25 years for revegetation offsets and 1 year for pest control offsets                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Biodiversity Value at Offset Site</b> | <i>This is the difference between the future value of the Attribute after the Offset action (Column N) and the current value of the Attribute at the Offset Site prior to the Offset being implemented (Column M). This change in Attribute value is calculated as a proportion of the Benchmark (Column G). The proportional raw gain is adjusted to the level of confidence in the Offset Actions succeeding, by multiplying the raw gain by the midpoint of the confidence range. This calculation also incorporates the time preference discount rate (cell E11) and the time taken to reach the stated objective for the Offset Action (Column O). The gain in value is multiplied across the Offset Area (Column I) to give a final Attribute value.</i> | No deviation in approach from model explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

|                                                 | Explanation (in general accordance with Maseyk 2017)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Application for the Amberfield project |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| <b>Biodiversity Value at Impact Site</b>        | <i>This value is imported from the corresponding Impact Model and feeds into the Offset Model spreadsheet (Column R).</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                        |
| <b>Attribute Net Present Biodiversity Value</b> | <i>The Net Present Biodiversity Value (NPBV) is determined for each Attribute by calculating the difference between the Attribute biodiversity value at the Offset Site and at the Impact Site to give the net change in biodiversity value over time. A no net loss biodiversity exchange is demonstrated when this value is equal to or greater than zero. Negative values demonstrate a net loss, positive values demonstrate a net gain.<br/>Where the five yearly time-step option is chosen (Offset Model_5 yearly), this cell is populated with the Attribute NPBV value at the point that is equal or greater than zero or, when an equal or greater than zero NPBV is not reached, the NPBV at Year 35.</i> |                                        |
| <b>Component Net Present Biodiversity Value</b> | <i>The NPBV for each component is calculated by averaging the NPBV of all the Attributes used to account for the Biodiversity Component (whether they were calculated using a finite end point or a five yearly time-step). All Biodiversity Attributes are equally weighted.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                        |

### 3 Proposed offsets assessment

The proposed offset actions were tested against the offsetting principles described in Section 2.1 above and it is considered that all offsetting principles to be adequately addressed through the proposed offsets. In its current form, the model outputs indicate that the proposed offsets will fall slightly short of a NNL outcomes in the long-term (i.e. 25 years or longer) but will generate large NG outcomes in the short-term. Specifically the model indicates that:

- The proposed 18.65 ha of habitat re-creation (revegetation and establishment of artificial roost boxes) to address permanent 'Physical Loss' is likely to result in a small long-term Net Loss outcome for bats (the model indicates that 23.2 ha of habitat restoration would likely achieve a NNL outcome); and
- The proposed 155 ha, ten-year pest control programme to address temporary residual effects in 'retained habitat' is likely to result in a large Net Gain (the model indicates that 75.3 ha would be the minimum areal extent needed to achieve a NNL outcome)

A series of tables are provided below further detail on our assessment and model outputs and are summarised as follows:

- Offsetting principles:
  - Table 3.1 assesses the proposed offsets against offsetting objectives and principles (as per methods section 2.1)
- Permanent residual adverse effects:
  - Table 3.2 presents the impact model inputs and outputs based on applicant's permanent residual impacts on bat habitat;
  - Table 3.3 presents the offset model inputs and outputs based on the Applicants proposed offset/compensation measures for addressing permanent residual impacts; and
  - Table 3.4 presents a hypothetical minimum proposed habitat restoration/revegetation offsets more likely to achieve a long-term NNL outcome for bats.
- Temporary residual adverse effects:
  - Table 3.5 presents offset model inputs and outputs based on Applicant's proposed offset/compensation measures for addressing temporary residual impacts;
  - Table 3.6 presents offset model inputs and outputs based on Applicants proposed offset/compensation measures for addressing temporary residual impacts; and
  - Table 3.7 presents a hypothetical minimum proposed offset/compensation measure for achieving a likely NNL outcome for temporary residual effects on bats.

**Table 3.1: Project assessment against offsetting objectives and principles.**

| Key offsetting principles                       | Assessment against key biodiversity offsetting principles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Limits to offsetting                            | <p><b>Addressed</b> – the development <u>has</u> avoided and/or mitigated for significant adverse effects on river/gully riparian margin bat habitat that is critical to ecological connectivity across the landscape.</p> <p>Adverse effects on this habitat type would breach the ‘Limits to offsetting’ threshold due to the potential for severance or partial severance of bat flyways. Severance or partial severance could render large areas of otherwise suitable bat habitat inaccessible or difficult to access and the actual impact could therefore be orders of magnitude greater than the local impact. This would therefore be inappropriate on ecological grounds, even with offsets/compensation proposals.</p>                                                                                                                                                                                                                                                                                                                                 |
| No Net Loss NNL outcome                         | <p><b>Mostly addressed</b> – The model indicates that there will likely be a small long-term Net Loss but there will likely be a significant temporary Net Gain.</p> <p>In my view the applicant could more robustly demonstrate no net loss outcomes for bats through an increased quantum of habitat recreation (i.e. above and beyond the proposed 18.65 ha) in exchange for a reduction in the areal extent of the proposed pest control. However, on balance, because the net loss of permanent offset (habitat re-creation) is relatively small compared to the NG from temporary offsets (pest control). I consider a NNL to be achieved overall. Noting also that:</p> <ul style="list-style-type: none"> <li>• The gains from the pest control will extend beyond the 10 year period as the increased bat population will take a while to decline to pre-pest control levels once the pest control programme is terminated.</li> <li>• The habitat re-creation/restoration offsets will continue to improve in value for bats beyond 25 years</li> </ul> |
| Landscape context                               | <b>Addressed</b> – proposed offsets consider landscape context and proximity to impact site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Additionality                                   | <b>Addressed</b> – proposed offsets would not have happened otherwise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Long term outcomes and preferably in perpetuity | <b>Mostly addressed</b> – in that the duration of benefits associated with the proposed offsets is commensurate with the duration of effect (i.e. permanent offsets have been offered for permanent residual effects and temporary offsets have been offered for temporary residual effects. However as stated above the model indicates that the applicants long-term proposed offsets will fall slightly short (but short term offsets will likely result in a large temporary Net Gain).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Offsets be like for like                        | <b>Addressed</b> - The offsets have been is applied so that the biodiversity values being achieved through the offset are the same or similar to those being lost.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

**Table 3.2: Impact model outputs based on applicant's permanent residual impacts on bat habitat.**

| Permanent residual impact that requires offsetting | Habitat value | Areal extent of Impact (ha) | Bench-mark | Condition measure prior to impact | Bat habitat value measure after impact | Biodiversity Loss Score |
|----------------------------------------------------|---------------|-----------------------------|------------|-----------------------------------|----------------------------------------|-------------------------|
| 'Physical loss'                                    | High          | 5.6                         | 5          | 3                                 | 0                                      | -3.36                   |
|                                                    | Low           | 70.93                       |            | 0.25                              | 0                                      | -3.55                   |
| Total                                              |               |                             |            |                                   |                                        | -6.35                   |

**Table 3.3: Offset/compensation model outputs based on Applicants proposed offset/compensation measures for addressing permanent residual impacts (NPBV < 0 = Net Loss, NPBV of 0 = No Net Loss and an NPBV of > 0 = Net Gain)**

| Permanent residual impact that requires offsetting | Proposed Offset type                     | Proposed Offset amount | Bench-mark | Condition measure pre-offset | Condition Measure post offset | Finite point (years) | Confidence in offset actions | Time Discount rate (%) | Biodiversity gain score | NPBV                    |
|----------------------------------------------------|------------------------------------------|------------------------|------------|------------------------------|-------------------------------|----------------------|------------------------------|------------------------|-------------------------|-------------------------|
| 'Physical Loss' of 5.6 ha of high value habitat    | Onsite revegetation with bat roost boxes | 18.5 ha                | 5          | 1                            | 3.5                           | 25                   | >90 %                        | 3                      | 5.10                    | -1.25<br>(-6.35 + 5.10) |
| 'Physical Loss' of 70.93 ha of low value habitat   |                                          |                        |            |                              |                               |                      |                              |                        |                         |                         |

**Table 3.4: Hypothetical proposed habitat restoration/revegetation offsets more likely to achieve a NNL outcome for long term residual effects on bats**  
**(NPBV < 0 = Net Loss, NPBV of 0 = No Net Loss and an NPBV of > 0 = Net Gain)**

| Permanent residual impact that requires offsetting | Proposed Offset type                     | Proposed Offset amount | Bench-mark | Condition measure pre-offset | Condition Measure post offset | Finite point (years) | Confidence in offset actions | Time Discount rate (%) | Biodiversity gain score | NPBV                |
|----------------------------------------------------|------------------------------------------|------------------------|------------|------------------------------|-------------------------------|----------------------|------------------------------|------------------------|-------------------------|---------------------|
| 'Physical Loss' of 5.6 ha of high value habitat    | Onsite revegetation with bat roost boxes | 23.2 ha                | 5          | 1                            | 3.5                           | 25                   | .90 %                        | 3                      | 6.35                    | 0<br>(-6.35 + 6.35) |
| 'Physical Loss' of 70.93 ha of low value habitat   |                                          |                        |            |                              |                               |                      |                              |                        |                         |                     |

**Table 3.5: Offset/compensation model outputs based on Applicants proposed offset/compensation measures for addressing temporary residual impacts (NPBV < 0 = Net Loss, NPBV of 0 = No Net Loss and an NPBV of > 0 = Net Gain)**

| Temporary residual impact that require offsetting | Habitat value | Areal extent of Impact (ha) | Bench-mark | Condition measure prior to impact | Bat habitat value measure after impact | Biodiversity Loss Score |
|---------------------------------------------------|---------------|-----------------------------|------------|-----------------------------------|----------------------------------------|-------------------------|
| ‘Functionally retained (High disturbance risk)’   | High          | 11.88                       | 5          | 2.5                               | 0.5                                    | -4.75                   |
|                                                   | Low           | 11.99                       |            | 0.25                              | 0                                      | -0.6                    |
| ‘Functionally retained (Lower disturbance risk)’  | High          | 5.29                        |            | 2.5                               | 1.25                                   | -1.32                   |
|                                                   | Low           | 5.5                         |            | 0.25                              | 0                                      | -0.28                   |
| Total                                             |               |                             |            |                                   |                                        | -6.95                   |

**Table 3.6: Offset model outputs based on Applicant's proposed offset/compensation measures for addressing temporary residual impacts (NPBV < 0 = Net Loss, NPBV of 0 = No Net Loss and an NPBV of > 0 = Net Gain).**

| Temporary residual impact that requires offsetting                                             | Proposed offset type                                                                             | Bench-mark | Condition measure pre-offset | Condition Measure post offset | Finite point (years) | Confidence in offset actions | Time Discount rate (%) | Biodiversity gain score | NPBV                   |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------|------------------------------|-------------------------------|----------------------|------------------------------|------------------------|-------------------------|------------------------|
| 'Functionally retained (High disturbance risk)' High value (11.88 ha) and Low value (11.99 ha) | 155.51 ha of intensive pest control within high value habitat that includes communal roost sites | 5          | 4                            | 5                             | 1                    | 50 % - 75 %                  | 3                      | 14.35                   | 7.4<br>(-6.95 + 14.35) |
| 'Functionally retained (Lower disturbance risk)' High value (5.29) and Low value (5.5 ha)      |                                                                                                  |            |                              |                               |                      |                              |                        |                         |                        |

**Table 3.7: Hypothetical proposed pest control regime still likely to achieve a NNL outcome for bats (NPBV < 0 = Net Loss, NPBV of 0 = No Net Loss and an NPBV of > 0 = Net Gain)**

| Temporary residual impact that requires offsetting                                             | Proposed offset type                                                                           | Bench-mark | Condition measure pre-offset | Condition Measure post offset | Finite point (years) | Confidence in offset actions | Time Discount rate (%) | Biodiversity gain score | NPBV                |
|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------|------------------------------|-------------------------------|----------------------|------------------------------|------------------------|-------------------------|---------------------|
| 'Functionally retained (High disturbance risk)' High value (11.88 ha) and Low value (11.99 ha) | 75.3 ha of intensive pest control within high value habitat that includes communal roost sites | 5          | 4                            | 5                             | 1                    | 50 % - 75 %                  | 3                      | 6.95                    | 0<br>(-6.95 + 6.95) |
| 'Functionally retained (Lower disturbance risk)' High value (5.29) and Low value (5.5 ha)      |                                                                                                |            |                              |                               |                      |                              |                        |                         |                     |

## 4 Summary and Conclusion

The Weston Lea's proposed offset measures for the Amberfield Development subdivision against the principles of biodiversity offsets and the Biodiversity Accounting Model have been tested to:

- Assess the likelihood that a No Net Loss (NNL) or preferably Net Gain (NG) in long-tailed bat values affected by the project will be achieved in the long-term; and
- Assist Mr Gerry Kessels with his professional assessment in his capacity as the bat expert and principal ecologist representing HCC.

In conclusion, I consider that the proposed bat offsets measures pro-offered by the applicant adhere to key biodiversity offsetting principles. Of key importance the applicants have avoided significant adverse effects on critical river/gully riparian margin bat habitat and, based on the model, are likely to generate No Net Loss outcomes for temporary residual effects that cannot be avoided, remedied or mitigated.

## 5 Applicability

This report has been prepared for our client Hamilton City Council for the purpose of assisting with the assessment of the Amberfield subdivision Resource Consent application and with respect to the particular brief given to us. The report shall not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:



Dr Matt Baber

Consultant Ecologist

Authorised for Tonkin & Taylor Ltd by:



Glen Nicholson

Project Director

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ATTACHMENT 3:

Table 1. Summary Review of Adequacy of Proposed Avoidance, Remediation, Mitigation and Monitoring Measures

| Area/topic with reference to Panel Direction No 7 (7.06.19) | Summary of potential adverse effects on long-tailed bats and their habitats associated with construction and operation of the Amberfield development subdivision                                                                                                                                                            | Applicant's avoidance, remediation, and mitigation measures (as expressed in Applicant expert evidence and in the Boffa Miskell memo dated at 22 July 2019 – Attachment 2)                                                                                                                                                                                                                                                                                                                                       | Adequacy of proposed measures to avoid, remedy or mitigate the effects of the development (opinion of G Kessels as expressed in EIC, JWS statements and supplementary evidence)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Review of Applicant's avoidance, remediation and mitigation measures in response to submitter experts concerns (as expressed by submitter experts in evidence and/or the JWS statements)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| 1. Physical loss of bat habitat                             | Loss of High Value habitat: 5.60 ha                                                                                                                                                                                                                                                                                         | 1. 18.5 ha of habitat restoration which includes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <u>Adequate:</u><br>The proposed gully restoration is in a gully landform with direct connectivity to the Waikato River. It is over 100 m in width. This restoration will provide feeding, commuting and likely roosting habitat (in the long term).<br><br>Planting is proposed adjacent to the river edge. This will enhance these areas as in addition to the required light protection, the buffering will also provide increased wind protection, likely creating high quality feeding and new commuting corridors.<br><br>In time, as the trees planted for their roost creation characteristics start to become cavity bearing (approx. 25years plus), they will provide additional roosting habitat for bats.<br><br>There is a time lag between the gully being planted and becoming functional habitat. The Applicant has proposed a compensation/offset package to account for this time lag which has been tested through a offset model.<br><br>No removal of vegetation with the Waikato River margin vegetation will occur, except for a very small area as detailed in paragraph 40 of Mr Blayney's EIC. This is a very minor a clearance of modified low stature exotic vegetation and hence it is essentially an effect of negligible magnitude. | 1. Increase the hectares planted: <u>Addressed in part:</u> the offset model indicates that as an alternative to increasing habitat (by planting), targeted pest control and habitat enhancement over the long-term will offset the loss of high value bat habitat.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 2. Abandonment of roosts, and/or total avoidance of areas   | Loss of Low Value Habitat: 70.93 ha<br><br>Abandonment and avoidance of roosts are equivalent to roost loss through habitat change. Presently there are 3 known roost sites.<br><br>Permanent avoidance or abandonment of habitat is equivalent to permanent habitat loss. This includes avoidance and aversion of flyways. | i. Naturalised meadow, stormwater wetland planting;<br><br>ii. 9 ha of forest restoration in a gully landform with direct connectivity to the Waikato River.); and<br><br>iii. A further 7.5 ha of buffer planting is proposed adjacent to the edge features being retained on site.<br><br>2. The proposed planting will replace the removal of potential roost trees at a minimum ratio of 1:100 (as agreed in the JWS dated 10-11 June 2019)<br><br>3. Provision of an additional 240 artificial roost boxes. | <u>Adequate:</u><br>The proposed gully restoration is in a gully landform with direct connectivity to the Waikato River. It is over 100 m in width. This restoration will provide feeding, commuting and likely roosting habitat (in the long term).<br><br>Planting is proposed adjacent to the river edge. This will enhance these areas as in addition to the required light protection, the buffering will also provide increased wind protection, likely creating high quality feeding and new commuting corridors.<br><br>In time, as the trees planted for their roost creation characteristics start to become cavity bearing (approx. 25years plus), they will provide additional roosting habitat for bats.<br><br>There is a time lag between the gully being planted and becoming functional habitat. The Applicant has proposed a compensation/offset package to account for this time lag which has been tested through a offset model.<br><br>No removal of vegetation with the Waikato River margin vegetation will occur, except for a very small area as detailed in paragraph 40 of Mr Blayney's EIC. This is a very minor a clearance of modified low stature exotic vegetation and hence it is essentially an effect of negligible magnitude. | 2. Time lag with removing vegetation and the years before trees grow. <u>Addressed:</u> time lag effects are addressed in implementation of the funds generated through the offset package.<br><br>3. Effects of change of pasture to urban habitat has not been adequately accounted for as foraging habitat. Value of this habitat is disputed between Applicant experts and submitter experts. <u>Addressed in part:</u> the offset model has accounted for loss of this as "Low Value Habitat".<br><br>4. Loss of N-S vegetation corridor not accounted for. <u>Addressed:</u> loss of this high value habitat is accounted for in the offset calculations and model.<br><br>5. Detail and numbers about roost boxes – design location, number, protection in perpetuity, is required. <u>Addressed:</u> refer to draft consent conditions 112 and 117(d) which requires the Applicant to install, maintain and monitor 240 roost boxes. The installation of these roost boxes will alleviate, to some extent, the medium term effects of the subdivision, as part of an overall offset package.<br><br>6. Development lot at west end of the eastern shelterbelt should not be a residential lot and alternatively form part of East-West shelterbelt reserve. <u>Addressed in Part:</u> The Applicant has shifted the boundaries of Lot 182 to protect the root system of the trees on the southern boundary of the HCC-owned lot on Peacockes Road as these trees form a continuation of the East – West shelterbelt.<br><br>7. Permanent lot removal all the way along the southern margin of the eastern shelterbelt to prevent light, noise disturbance and make more habitat. <u>Addressed in part:</u> the lighting expert evidence indicates lighting effects will be less pronounced due to bespoke lighting required on dwelling and roads adjacent to habitat.<br><br>8. Avoid loss of known roost tree in Knoll Park – by changing engineering parameters, expanding reserve. <u>Addressed in part:</u> while this roost tree is proposed to be removed, the loss of this high value habitat has been accounted for in the compensation/offset calculations and model. |

| Area/topic with reference to Panel Direction No 7 (7.06.19)                                        | Summary of potential adverse effects on long-tailed bats and their habitats associated with construction and operation of the Amberfield development subdivision                                                                                                                                                                                                                                                                                       | Applicant's avoidance, remediation, and mitigation measures (as expressed in Applicant expert evidence and in the Boffa Miskell memo dated at 22 July 2019 – Attachment 2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Adequacy of proposed measures to avoid, remedy or mitigate the effects of the development (opinion of G Kessels as expressed in EIC, JWS statements and supplementary evidence)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Review of Applicant's avoidance, remediation and mitigation measures in response to submitter experts concerns (as expressed by submitter experts in evidence and/or the JWS statements)                                                                                                                                                                                                                      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| 3. Loss of function <u>within</u> the site due to light, noise, traffic/roading, novel structures. | <p>Functionally retained – higher disturbance risk: This category includes areas of habitat that fall within construction stages 1 – 11.</p> <p>Functionally retained – low disturbance risk: This category includes areas of habitat that fall within construction stages 12 – 30</p> <p>Areal Extent (from Table 3, Attachment 2): i) Retained high value vegetation within 15m habitat edge - 17.17ha; ii) retained low value habitat – 17.49ha</p> | <p>4. Avoidance of clearance of vegetation along the Waikato River riparian margin.</p> <p>5. Vegetative buffering of the existing vegetation comprising the riparian margin and the East-west link.</p> <p>6. Early planting to minimise time lag between planting establishing and artificial light being introduced to site.</p> <p>7. Lot deferrals to ensure artificial light is not introduced adjacent to retained or enhanced bat habitat until the vegetative buffer has met specified performance criteria.</p> <p>8. Bat-sensitive lighting along riverside roads with limited down spill.</p> <p>9. Restrictions on outdoor lighting (including all lots north and south of the East – West Shelterbelt.</p> <p>10. Shifting the boundaries of Lot 182 to protect the root system of the trees on the southern boundary of the HCC-owned lot on Peacockes Road as these trees form a continuation of the East – West Shelterbelt.</p> <p>11. Both southern gully crossings will have bat-friendly lighting treatments and plantings to encourage bats under the bridge and over the culvert.</p> | <p><u>Adequate</u>: Actions to address loss of functions of remaining habitat on site (including residual time lag effects) include:</p> <p>i. Buffer vegetation composition designed to be fast growing and effectively capture light and planted as early as is practicable;</p> <p>ii. Lot deferrals tied to performance criteria of the buffer vegetation, so edge habitat is functionally maintained while the buffer vegetation is establishing;</p> <p>iii. Set-back from the river margin and lighting restrictions in addition to the lot deferrals to ensure that the river corridor will not be impacted while the buffer vegetation is establishing;</p> <p>iv. Changes to the development staging to increase, as much as practicable, the time lag between buffer planting and house construction close to the river edge; and</p> <p>v. Restrictions on outdoor lighting in addition to what is proposed to include all lots north of the East – West Shelterbelt and all lots immediately to the south.</p> | <p>9. Develop conditions to specify replacement ratio for removal of potential bat roost trees. <u>Addressed in part – 240</u> are proposed to be installed to create additional roost habitat.</p> <p>10. Loss of pasture an issue, bats do use it; insufficient time allowed for monitoring of effects included in the staging of the development – response of bats to loss of habitat and presence of houses; how will adaptive management take place if effects found once earthworks start; the way staging is designed will not allow for robust data gathering; have to be able to respond with management before population declines . <u>Addressed in part</u>: the Applicant now does not propose an adaptive management approach. The offset model has accounted for the loss of this habitat in determination of an offset/compensation package. Design of river margin and e-w corridor is expected to maintain flyways, while restored southern gully habitat will replace lost foraging habitat associated with the pastureland.</p> <p>11. Planting in the southern gully should not be compromised for views and should prioritise bat connectivity and spatial use. <u>Addressed</u>: The revised early planting plans have addressed this matter.</p> <p>12. All areas indicated on the marked map RS1. are recommended as setback sites and further areas to be revegetated in native vegetation thereby maintaining connectivity in the landscape and providing high quality habitat for bats on site while reducing the risk of light impacts on and off site (eg. Hammond Park in particular). <u>Not addressed</u>. The Applicant has not proposed any further extension of setback areas other than those shown on the Bat Mitigation Strategies maps.</p> <p>13. The far southern amenity and buffer planting should be replaced with native plantings to maintain connectivity. <u>Not Addressed</u>: I understand that these amenity planting designs have not been altered.</p> <p>14. Lighting design to be developed by lighting engineer in collaboration with bat specialists and be in accordance with national and international best practice. Southern gully developed as mitigation and also requires lighting restrictions on adjacent lots consistent with the above. <u>Addressed</u>: the design of lighting on site has been addressed as per recommendations of the Applicant's lighting expert and suitable conditions include in the conditions set.)</p> |

| Area/topic with reference to Panel Direction No 7 (7.06.19)                                                                                                              | Summary of potential adverse effects on long-tailed bats and their habitats associated with construction and operation of the Amberfield development subdivision                                                                                                                                                                         | Applicant's avoidance, remediation, and mitigation measures (as expressed in Applicant expert evidence and in the Boffa Miskell memo dated at 22 July 2019 – Attachment 2)                                                                                                                                                                                                                                                                       | Adequacy of proposed measures to avoid, remedy or mitigate the effects of the development (opinion of G Kessels as expressed in EIC, JWS statements and supplementary evidence)                                                                                                                                                                                                                                                                                                                                                                                            | Review of Applicant's avoidance, remediation and mitigation measures in response to submitter experts concerns (as expressed by submitter experts in evidence and/or the JWS statements)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| <p>4. Loss or degradation of function <u>offsite</u> due to light, noise, traffic/roading, novel structures.</p> <p>5. Other (unanticipated) adverse effects on bats</p> | <p>Fragmentation and direct, indirect and cumulative effects on the population including behavioural changes in localities of loss or degradation of function offsite: -</p> <p>Any high value habitat which bats access to adjacent to or across Amberfield, such as the Waikato River margin, Hammond park, Mangakotukutuku Gully,</p> | <p>12. Increased set-back of development from the Waikato River opposite Hammond Bush.</p> <p>13. Provision of an additional 240 artificial roost boxes.</p> <p>14. Funding for offset fund for pest control and habitat enhancement in high value bat habitat within the locality. will improve the ecological conditions of high restoration programme</p> <p>15. Lighting design along road and within residential areas adjacent to high</p> | <p><u>Adequate</u>. The proposed offset funding for targeted pest control, restoration of high value habitat and installation of 240 bat boxes, within the home range of the affected bat population, if undertaken to best practice, will likely improve the ecological condition of targeted high value bat habitat. In turn, these measures will improve the resilience of these bats to adapt to changes in the landscape because of this development.</p> <p>The intention for the proposed monitoring is to provide HCC with information that will contribute to</p> | <p>15. Buffer should be developed to maintain ecological function (light spill and quality bat habitat) and long-term viability for the bats as it appears that 10m is not sufficient as currently designed and not within current international best practice. A 4m height is not considered sufficient; there should be canopy closure above as well as vertical. <u>Addressed in part</u>: The buffer planting will address light spill and create additional edge habitat for bats. It will not be ecologically self-sustaining and will require ongoing maintenance from HCC to maintain its purpose once the land is vested to Council.</p> <p>16. Inadequate East west shelter belt - loss of flyway to the southern side of the east west shelter belt given the current design and assumption that bats will continue to use flyway on the other side. <u>Addressed in part</u>: Restrictions on outdoor lighting in addition to what is proposed in Condition 90 (Rev E - April 2019) to include all lots north of the East – West Shelterbelt and all lots immediately to the south. Shifting the boundaries of Lot 182 to protect the root system of the trees on the southern boundary of the HCC-owned lot on Peacocks Road as these trees form a continuation of the East – West Shelterbelt</p> <p>17. Address loss of north-south connectivity on western boundary to connect with east-west shelter belt – retain trees and look for engineering solutions. <u>Addressed in part</u>: while this shelter belt is proposed to be removed, the loss of this high value habitat is accounted for in the offset/compensation package, and in addition flyways north and south along the river and east – west across the site will be provided for in the design and buffer and early planting plans.</p> <p>18. Continued possibility of residual effects that cannot be remedied which will further threaten the persistence of the south Hamilton bat population. <u>Addressed in part</u>: There is uncertainty in the nature, location and extent of the potential adverse effects on bats associated with this development. A range of onsite measures to maintain and facilitate commuting corridors, and implementation of a range of animal pest control and habitat enhancement measures through the offset/compensation package are proposed to strengthen the resilience of the local bat population to cope with offsite and unanticipated adverse effects.</p> |

| Area/topic with reference to Panel Direction No 7 (7.06.19)                  | Summary of potential adverse effects on long-tailed bats and their habitats associated with construction and operation of the Amberfield development subdivision                                                                                                                | Applicant's avoidance, remediation, and mitigation measures (as expressed in Applicant expert evidence and in the Boffa Miskell memo dated at 22 July 2019 – Attachment 2)                                                                                                                                 | Adequacy of proposed measures to avoid, remedy or mitigate the effects of the development (opinion of G Kessels as expressed in EIC, JWS statements and supplementary evidence)                                                                                                                                                                                                                                                                                                                                                            | Review of Applicant's avoidance, remediation and mitigation measures in response to submitter experts concerns (as expressed by submitter experts in evidence and/or the JWS statements)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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|                                                                              | Stanford park, Hamilton gardens.<br><br>Unanticipated potential adverse effects – not able to be quantified at present.                                                                                                                                                         | value bat habitat areas will also reduce light spill offsite.<br><br>16. Monitoring for a period of 10 years which shall be for the purpose of providing information on long-tailed bat activity.                                                                                                          | HCC's understanding of bat activity in response to urbanisation across the South Hamilton home range.<br><br>The intention for the proposed monitoring is to provide HCC with information that will contribute to HCC's understanding of bat activity to allow appropriate management responses to urbanisation within the Peacocke Structure Plan by biodiversity protection and restoration initiatives within the structure plan and in the wider locality through other Council and Waikato Regional Council strategies.               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 6. Increase in urban predators eg cats                                       | Urbanisation is likely to lead to the introduction of more cats. Cats are known to predate bats in roosts. Cats can catch bats in flight as well as from roosts. Population level of risk increases with the presence of roosts and again with the presence of communal roosts. | As part of the offset package funding will be given to HCC to distribute locally for animal pest control. This may or may not include feral cat pest control but will include rat, possum and mustelid control which are also known predators of bats.<br><br>Artificial roosts will have pest protection. | <u>Adequate in part.</u> As there are no known communal bat roost sites within Amberfield the immediate effect of a cat bat may not be beneficial unless a much wider domestic cat ban was implemented, which is beyond the scope of HCC's expert ecologist's role to address as part of this application.<br><br>Implementation of a pest control programme targeting high value bat habitats (on site and offsite) would likely alleviate the effects of cat predation to some degree by reducing the effects of other predator species. | 19. No control of predators discussed apart from cats. Rats stoats, mustelids, possums may be issues as known to prey upon bats. <u>Addressed in part:</u> proposed pest control programme as part of the offset package will target pests in high value bat habitat.<br>20. Cat free subdivision. <u>Not addressed.</u> A cat ban would be beneficial but it would require a southern Hamilton wide cat control management regime to be implemented to be effective.                                                                                                                                                                                                                         |
| 7. Mortality, injury, abandonment of roosts, and/or total avoidance of areas | Direct disturbance, injury or mortality of bats in any occupied roost tree from activities such as tree felling, construction activities or collision and avoidance of existing and recreated bat roost habitat within the Amberfield Development area.                         | Application of pre-felling surveys and protocols of known and potential roost trees to be felled in accordance with current best practice.                                                                                                                                                                 | <u>Adequate.</u> Suitable design and consent condition measures are proposed to minimise the risk of direct mortality of bats. The Applicant has proposed a number of planting measures to keep vegetation at appropriate height and to be managed in the short and long term to minimize bat-vehicle collisions along with bridge, culvert and lighting design. For example, retention of tall stature                                                                                                                                    | 21. Communal roosts could be present, monitoring was not undertaken to determine the use of roosts by more than one bat. (one night of emergence count. <u>Addressed in part:</u> The Applicant's witnesses consider those roosts found are likely to be solitary roosts (a single male) and unlikely to be communal roosts, based on their interpretation of the evidence presented to date. Further monitoring, including baseline and pre-felling surveys will provide further information to the type of roost sites found on site. Best practice pre-felling protocols do not allow felling of occupied roost trees which are required to be adopted as part of the draft condition set. |
| 8. Direct mortality – tree felling and traffic                               |                                                                                                                                                                                                                                                                                 | 1. Standard/best practice tree felling protocols to avoid felling trees while occupied by bats.<br>2. All retained features will be physically separated from roads/traffic via                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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|                                                             | If unmitigated, these factors, such as tree felling and vehicle collisions, could kill bats and reduce the population levels across the landscape.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | vegetative buffers. With two exceptions:<br>a. Where roads bisect the E-W shelterbelt.<br>b. The two southern gully road crossings.                                        | trees along the E-W shelterbelt will encourage bats to cross the aforementioned roads above the height of the cars<br><br>Suitable condition of consent requires best practice measures to survey and inspect all known and potential roost trees before felling and restrict felling if a tree is occupied by bats. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>9. Monitoring</b>                                        | <p>The revision of an adaptive management approach to an avoidance/mitigation and offset/compensation approach means an intensive monitoring for bats is no longer necessary. However, the draft consent conditions require a number of ecological related performance standard monitoring and management plan certification measures.</p> <p>Monitoring for bats (and associated light monitoring) is still required as outlined in draft consent conditions 114 to 115 for a period of 10 years. In addition artificial bat roosts will be periodically inspected for signs of occupancy over this period.</p> |                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                      | <p>22. Understanding the effectiveness of artificial roosts as mitigation. <u>Addressed in part:</u> long term monitoring of the roost boxes is required in the draft condition set. Regardless, there is evidence that a small percentage of these boxes will likely be used by bats over time.</p> <p>23. Need for robust framework to ensure monitoring is successful, strategies to ensure ongoing management can be put in place before and after the houses are built, to build in as much resilience as possible. Acoustic monitoring is being relied upon but may not to show effects in time to reverse the impact to the bat population. The initial habitat loss will have a behavioural change that will affect the accuracy of the monitoring. <u>Addressed in part:</u> the change in approach from an adaptive management one to setting an offset/compensation package and associated upfront funding for targeted animal control and habitat enhancement will likely increase resilience of the population reduces the need for a more rigorous monitoring design.</p> <p>24. Ongoing monitoring of light levels to ensure they remain below detectable levels (1 lux) inside screening. Light levels higher than this trigger additional screening. Measurements required of proposed light sources (two story building) to inform height of buffer. <u>Addressed in part:</u> the lighting expert evidence is such that no specific monitoring is considered necessary.</p> <p>25. If bat decline detected after any stage then all further stages of development are stopped. <u>Not addressed:</u> however, staging of development will lessen short term effects on past and likely allow them to adjust to changes in landscape.</p> |