Boffa Miskell

Memorandum

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Attention:	HCC s42A Officers
Company:	
Date:	22 July 2019
From:	Boffa Miskell Ltd.
Message Ref:	Offset calculation to manage risk related of short-term effects on long-tailed bats (risk mitigation offset)
Project No:	A17134

1. Purpose of calculation

Considerable effort to manage effects on long-tailed bats has been proposed for the Amberfield development site. The onsite mitigation package includes habitat restoration, provision of artificial bat roosts, lighting controls, buffer planting and lot deferrals. The onsite package is intended to replace the high value habitat that is proposed to be removed, with an increased quantum and quality of habitat, and to minimise disturbance of the retained habitat from adjacent urbanisation.

It has been recognised that there is uncertainty in how long-tailed bats will respond to the landscape change in the short-term when the habitat restoration and buffer planting is establishing. The assignment of effects to individual activities or locations has been identified as a key difficulty. This is because the bat population is potentially impacted by multiple land-use changes across its home range in Hamilton.

It is considered that the onsite mitigation package will mitigate the potential effects of urbanisation on the bat population over the long term. However, there is some risk that there will be short-term effects on the bat population while the onsite mitigation becomes established. The Applicant, therefore, proposes to provide upfront offset funding to mitigate the risk of potential short-term effects.

The purpose of the offset funding is to manage and improve the resilience of the bat population during the early stages of the development (10 years). The offset funding replaces the adaptive management approach previously proposed by the Applicant. We consider the best management intervention in this instance is coordinated pest control in high value habitats such as communal roosting sites and high activity areas already identified across the population's range. Accordingly, offset funding is based on a calculation that estimates the dollar amount required per hectare to undertake predator control in comparable habitat for rodents, mustelids and possums over a 10-year period.

We recognise the need for a coordinated approach across the Peacocke Structure Plan Area and the population's home range in Hamilton. The below calculation has intentionally been designed to be transparent and simple so that future projects can apply a similar approach if required. However, the multipliers used in the calculation below are designed to specifically address short term risks to the bat population prior to the onsite mitigation package becoming fully established. The comprehensive onsite mitigation package is accounted for in this calculation. This calculation is not intended to be applied to other sites/projects in the absence of appropriate avoidance and mitigation.

2. Habitat hectares approach

A variety of currencies can be used to derive a value for the biodiversity effects (refer to New Zealand Government (2014), for further information).

An area-based currency is considered the most appropriate approach for the following reasons:

- The habitat being directly impacted consists of grazed farmland and exotic plantings. It is not a complex native ecosystem where multiple components of varying condition need to be accounted for and restored accordingly;
- Such habitat is not intrinsically high value. It is considered ecologically significant in this context only because it is used by long-tailed bats, a native species of very high conservation value; and
- As the intrinsic quality of the habitat being impacted is low, and removal of the habitat will result in uncertainty of effects on a single native species, more complex approaches are unnecessary and would result in a less transparent outcome.

Given the above, the vegetation types onsite have been broken down into “potential roosting, foraging and commuting habitat” and “open space” that is used less preferentially. This considers the relative value of different habitats for long-tailed bats so it can be reflected in the calculation. Such an approach is generally termed a ‘habitat hectares calculation’.

Classifying bat habitat and assigning habitat value

Notable differences in the levels of relative bat activity were recorded at different vegetation features across the site. Different features have been classified as either high value or low value habitat. High value habitat includes mature stands of tall stature woody vegetation as these features have potential to provide long-tailed bats with preferential roosting, foraging and commuting habitat. The remainder of the site is open pasture with the occasional isolated specimen tree and low hedgerows.

We note that acoustic surveys demonstrated that bat activity levels at different woody vegetation features differed, for example higher activity was recorded at the river edge of the riparian margin compared to the inland edge. Higher activity was also recorded along the E-W shelterbelt. This activity is likely attributable to bats using these features as dispersal corridors as they form part of a vegetated linkage that assist with efficient dispersal. However, in the interest of simplicity and transparency, all tall-stature woody vegetation, irrespective of whether it forms part of a connective linkage has been categorised as high value.

Long-tailed bats are edge adapted and use linear vegetation structures such as forest edges and shelterbelts to forage and commute along. Long-tailed bats use open areas less preferentially and this was confirmed during the acoustic surveys on the site, hence open space was assigned a lower habitat value.

The specific criteria used to assign habitat value is described below. Bat activity levels, i.e. average number of bat passes per recorder per night, are based on the surveys undertaken to inform the assessment of ecological effects (Boffa Miskell Ltd, 2018).

Habitat value criteria:

High value habitat:

1. Average number of passes per unit per night is ≥1 pass;
2. Feeding buzzes recorded at a least one acoustic recorder deployed in this habitat; and
3. Encompasses stands of mature tall stature woody vegetation which provides habitat structure and potential roosting opportunities.

Low value habitat:

1. Average number of passes per unit per night is <1 pass;

2. No feeding buzzes recorded at any recorders deployed across this habitat;
3. Habitat characterised by open grassland occasionally interspersed with single trees.

Quantification of high-quality bat habitat

With the exception of roosts, long-tailed bats do not reside in the habitats discussed above. Instead they forage / commute near or above them as they provide structural cues for them to echolocate off. Consequently, the removal of vegetation features (e.g. a shelterbelt) results in removal of an area of habitat that is larger than the feature itself.

To quantify the areas of bat habitat currently available onsite we have relied on knowledge of bat behaviour and ecomorphology[1] to estimate the amount of area around habitat features long-tailed bats predominantly use for both foraging and commuting. Long-tailed bats are considered edge adapted and the relative activity of bats across the project site is consistent with previous studies in Fiordland (O'Donnell, 2000). Furthermore, the frequency modulated search-phase echolocation calls of long-tailed bats indicate that they are adapted to forage for insects close to background clutter as opposed to open habitats (Parsons, Thorpe, & Dawson, 1997). The width of the preferred foraging and commuting 'edge' for long-tailed bats is unknown. However, pipistrelle species overseas that have similar foraging behaviour have been observed using a comparable search-phase call structure at a maximum of approximately 5 m of an edge (Kalko & Schnitzler, 1993). Long-tailed bats have been observed flying over open farmland, potentially foraging, therefore we have taken a precautionary approach and quantified potential high-quality foraging habitat as 15 m from an existing vegetation margin (Figure 1).

As described above, the remainder of the site has been classified as low value open space (dwellings are not factored into the calculation). Figure 2 is a map displaying the high value and low value long-tailed bat habitat on the Amberfield site.

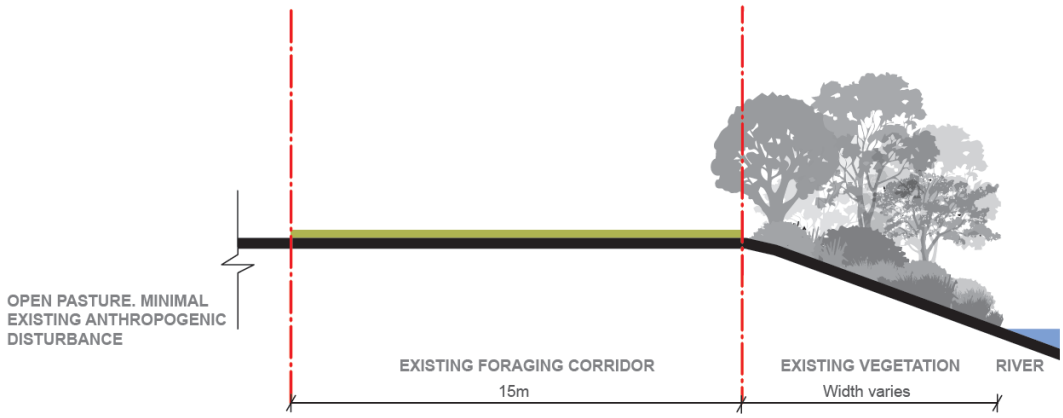
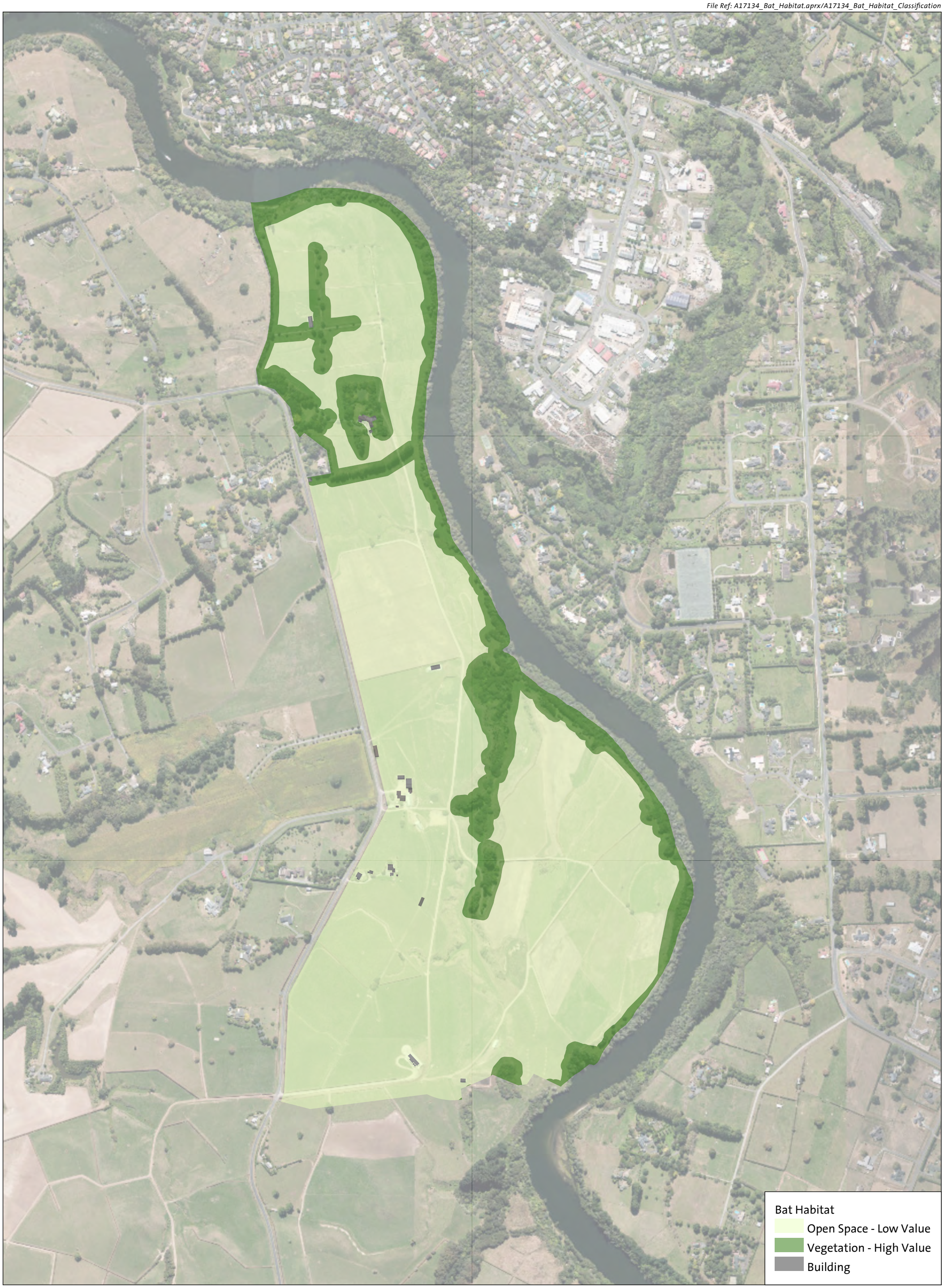


Figure 1: An estimated width of the existing bat foraging corridor in the absence of anthropogenic disturbance on the site currently.

[1] Echolocation characteristics of different bat species provide information on how they use different habitat types particularly in relation to foraging.



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Data Sources: Boffa Miskell

Projection: NZGD 2000 New Zealand Transverse Mercator

A17134 HAMILTON SOUTH DEVELOPMENT

Bat Habitat Classification

Date: 04 July 2019 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **Rachel.deLambert@boffamiskell.co.nz** | *Drawn:* ATy | *Checked:* GCu

Quantification of bat habitat physically removed or functionally disturbed in the short-term

It should be noted that although a feature can be retained onsite, its functionality as bat habitat can be lost, effectively decreasing the feature's value as bat habitat. Long-tailed bats are sensitive to anthropogenic disturbance, particularly light. To ensure the habitat being physically retained is adequately buffered the following management actions is being undertaken:

- Fast growing, densely foliated vegetation is being planted in front of retained habitat to filter light from the adjacent development;
- Bat sensitive lighting will be installed along roads and on dwellings adjacent to retained and enhanced habitat; and
- Lot deferrals have been included in the conditions to ensure artificial light is not introduced adjacent to retained or enhanced bat habitat until the vegetative buffer has met specified performance criteria.

The above management has been designed to ensure long-term viability of bat habitat being retained and enhanced on site and limit short-term disturbance while the vegetation establishes. Notwithstanding the above, uncertainty remains as to how long-tailed bats will respond to the landscape change, particularly in the short-term while the proposed plantings are establishing.

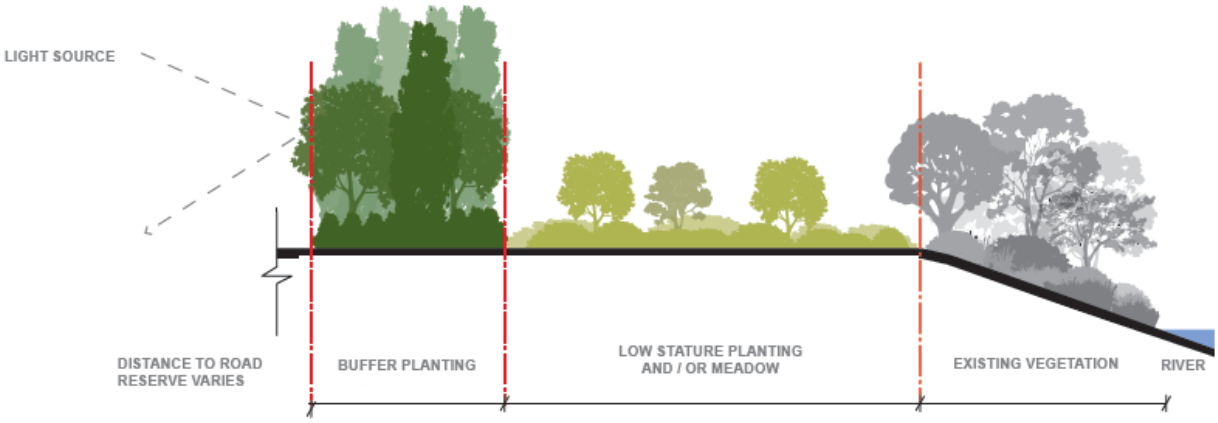


Figure 3: Example of a retained bat habitat buffered from adjacent artificial light sources.

Categorising risk of time lag effect

To provide a quantification of bat habitat for the offset calculation relative the temporal extent of the effect (time lag effect) we have defined three categories which habitats are placed in to determine the temporal scale of habitat loss or disturbance.

Short-term functional loss is defined as habitats that will be physically retained through the development design, but due to the sensitivity of long-tailed bats to anthropogenic disturbance, the value of these habitats could be decreased in the short-term because of the adjacent urbanisation. The three categories of habitat loss are defined below:

- **Physical loss:** Physical habitat loss is calculated on a 1:2 basis. A 1:2 multiplier has been deemed appropriate as the largest temporal lag will be between the removal of this habitat, and the replacement habitat providing the structure and function preferred by long-tailed bats. We note that the multiplier is not higher as we are only factoring in the time lag, the quantum and value of replacement habitat in the long term has already been assessed as being sufficient to mitigate for the loss.
- **Functionally retained:** This category includes areas of habitat that will be retained, and therefore the time taken for replacement habitat to mature does not need to be accounted for. However, the habitat needs to be buffered to ensure disturbance for adjacent urbanisation does not decrease the

functionality of the habitat for bats in the short-term. There is a time lag between the buffers being planted and them reaching a height and level of vertical canopy closure, that will effectively filter adjacent light.

- **Functionally retained – higher disturbance risk:** This category includes areas of habitat that fall within construction **stages 1 – 11**. House occupation of these construction stages are estimated to commence between January 2023 - August 2025. As per Consent Condition 81, a minimum of 10 m buffer planting will be planted along the retained habitat in the first season following consent. Planting is therefore estimated to be completed by spring 2020. Consequently, it is estimated that house occupation will be occurring adjacent to these sites within 5 years of buffer planting establishment.

  Given the above, the area multiplier has been calculated on a **1:1** basis. A 1:1 multiplier has been deemed appropriate to account for the increased risk of a short-term effect in this area during the timeframe of approximately 5 – 10 years before the characteristics of the buffer planting are sufficient to fully protect the retained habitat from disturbance. We note that the lot deferrals will also ensure that lots will not be occupied immediately adjacent to retained high value habitat until the buffer planting has reached certain performance standards.

- **Functionally retained – low disturbance risk:** This category includes areas of habitat that fall within construction **stages 12 – 30**. House occupation of these construction stages are estimated to be commence between March 2026 – October 2030. As above, a minimum of 10 m buffer planting will be planted along the retained high value habitat in the first season following consent. Planting is therefore estimated to be completed by spring 2020. Consequently, it is estimated that house occupation will be occurring adjacent to these sites no less than 5 years (and potentially upwards of 10 years) after buffer planting establishment.

  Given the above, the area multiplier has been calculated on a **1:0.5** basis. A 1:0.5 multiplier has been deemed appropriate to account for the limited risk of effects to bats during a time lag period before buffer planting reaches a maturity where it fully protects the retained habitat from disturbance.

The description of how these categories have been applied for the Amberfield site are as detailed below:

3. Calculation of habitat removed or disturbed onsite

Area multipliers (discount rates) relative to habitat value and extent of disturbance/ impact

Ratios have been assigned to reflect the value of different habitat types, and the extent of habitat physically removed or functionally disturbed as a result of the development. These have been described in Section 2 above but are summarised again in Table 1 and Table 2 below.

It should be noted that multipliers or discount rates are based on professional opinion. The 'time lag' multipliers have also considered the comprehensive mitigation package that is already proposed for the site. Hence, the multipliers are lower then what would be typically applied to an offset-type calculation for the removal of habitat for a Threatened - Nationally Critical species. This would need to be considered if a similar calculation is applied to other developments within the PSPA.

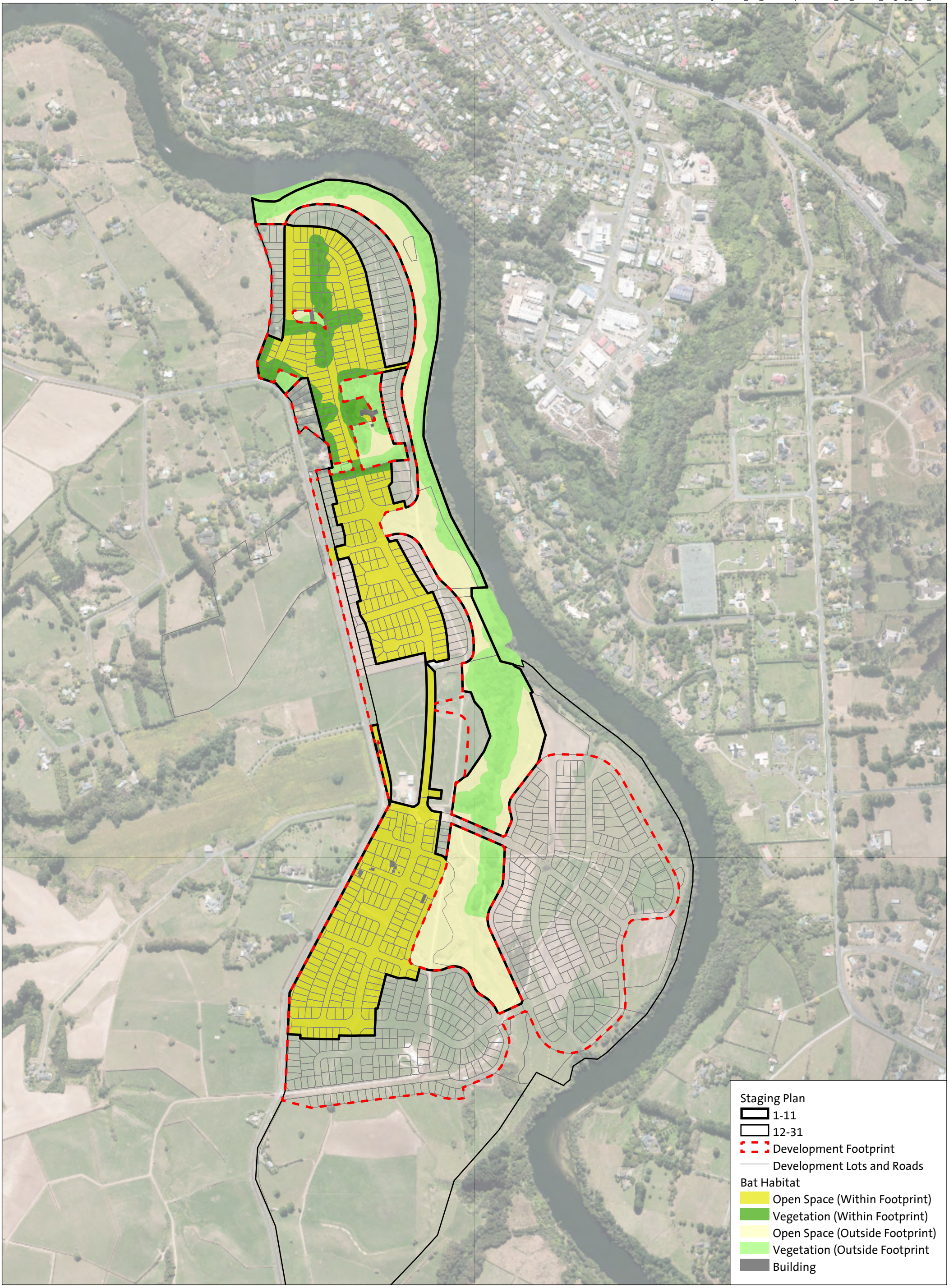
Table 1: Ratios applied to different long-tailed bat habitats on the Amberfield site. Different ratios are applied to reflect the value of various habitats and extent of direct and indirect habitat loss associated with said their removal.

Habitat type	Habitat value ratio	Reasoning
High value – Mature woody vegetation and associated 15 m edges which provides potential roosting, foraging and commuting habitat	1:3	Although there were notable differences in the level of bat activity along different vegetation features across the site (e.g. activity along the E-W shelterbelt was significantly higher than the activity along the inland edge of the riparian margin), all mature woody vegetation and associated edges have been categorised as high value habitat for the purpose of providing a simple and transparent value classification which can be used other developers across the PSPA in the future if required. A 1:3 ratio has been applied to high value habitat as there will be a direct effect to the bats of its removal. A 1:3 ratio ensures all high value habitat potentially removed is captured in the time lag offset calculation and recognises the higher value of mature vegetation.
Low value - open space used by bats incidentally	1:0.5	Although long-tailed bats do occasionally move across open grassland it is not a preferred habitat and it is only used incidentally. This was demonstrated in the bat activity surveys onsite. Consequently, the removal of open space will have a lower effect on long-tailed bats and a 1:0.5 ratio has been applied.

Table 2: Ratios applied address the uncertainty of the effects of the landscape change, both physical habitat removal and disturbance effects, in the short-term while mitigation planting is establishing.

Type of habitat removal	Removal ratio	Reasoning
Physical loss	1:2	The proposal mitigates direct loss of available habitat through the revegetation of large areas of retained open space on the site, effectively elevating restored areas from low value bat habitat to high value habitat. The 1:2 ratio has been applied here in the recognition that there will be a large time lag before the replacement habitat matures to a similar level of the habitat being removed. The ratio is not higher as the calculation is only responding to the uncertainty of effects during the time lag period (i.e. the discount ratio considers the larger quantum of habitat being planted, and the higher quality of this habitat once matured).
Retained – higher disturbance potential	1:1	This category includes areas of habitat that will be retained, and therefore the time taken for replacement habitat to mature does not need to be accounted for. However, the habitat needs to be buffered to ensure disturbance for adjacent urbanisation does not decrease the functionality of the habitat for bats. There is a time lag between the buffers being planted and them reaching a height and level of vertical canopy closure, that will effectively filter adjacent light. A 1:1 multiplier has been deemed appropriate to account for the higher risk of a short-term disturbance effect before the characteristics of the buffer planting are sufficient to fully protect the retained habitat from disturbance.
Retained – low disturbance potential	1:0.5	This category includes areas of habitat that will be retained, and therefore the time taken for replacement habitat to mature does not need to be accounted for. However, the habitat needs to be buffered to ensure disturbance for adjacent urbanisation does not decrease the functionality of the habitat for bats in the short-term. There is a time lag between the buffers being planted and them reaching a height and level of vertical canopy closure, that will effectively filter adjacent light. A 1:0.5 multiplier has been deemed appropriate to account for the low risk of a time lag occurring between development of the later stages of the subdivision and the planted buffers reaching a maturity where they will fully protect the retained habitat from disturbance.

Figures 4 and 5 below shows how the high value and low value habitat has been grouped into risk categories i.e., physically removed (within footprint), retained but higher disturbance risk (habitat outside of project footprint but within construction stages 1 – 11), and retained with lower disturbance risk (habitat outside of project footprint but within construction stages 12 – 30).



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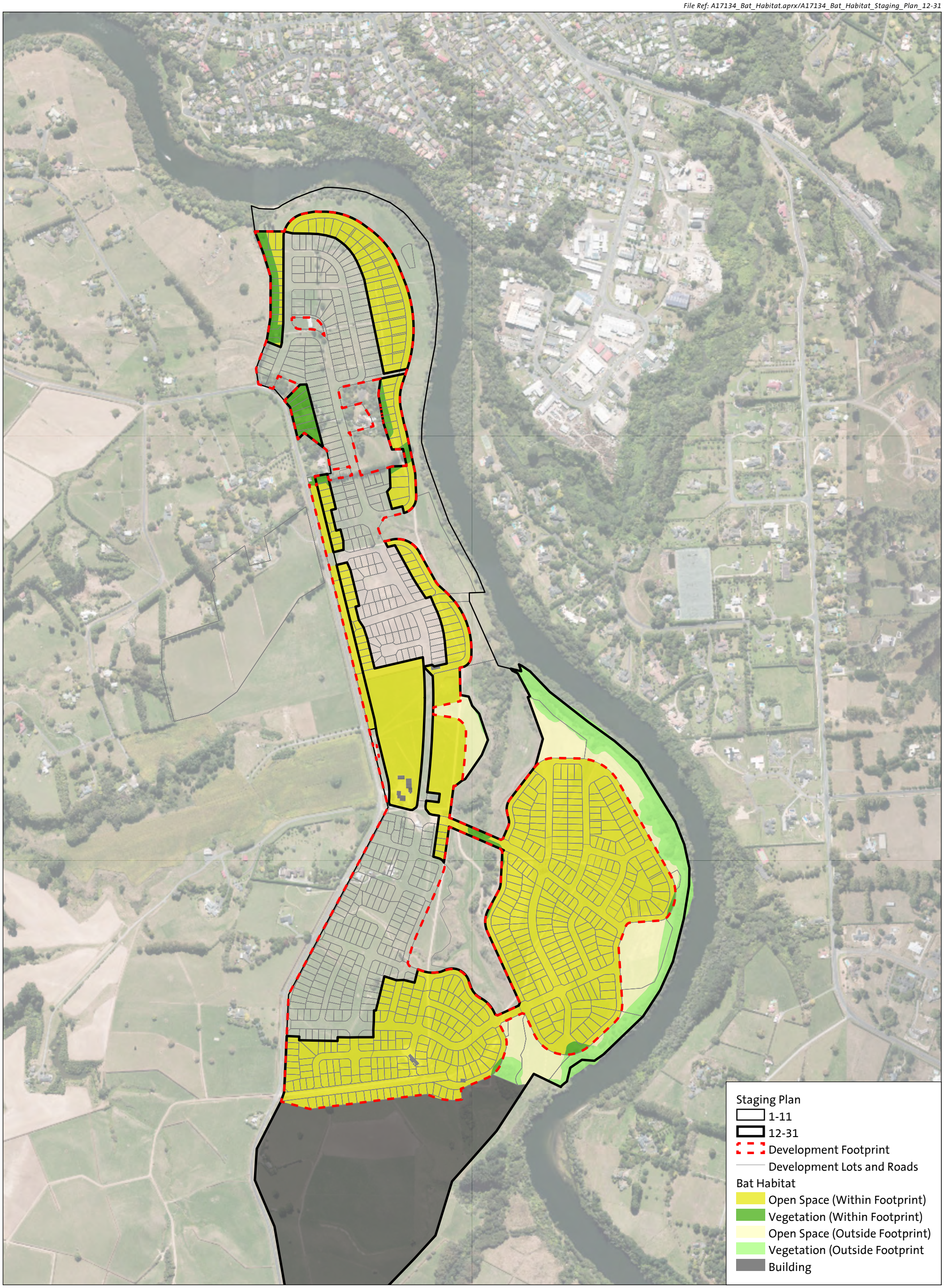
A17134 HAMILTON SOUTH DEVELOPMENT

Bat Habitat Staging Plan 1-11

Date: 10 July 2019 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **Rachel.deLambert@boffamiskell.co.nz** | *Drawn:* ATy | *Checked:* GCu



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A17134 HAMILTON SOUTH DEVELOPMENT

Bat Habitat Staging Plan 12-31

Date: 10 July 2019 | Revision: 0

Plan prepared by Boffa Miskell Limited

Project Manager: **Rachel.deLambert@boffamiskell.co.nz** | *Drawn:* ATy | *Checked:* GCu

Existing bat habitat available onsite

The extent of habitat as described in Section 2 was calculated in ArcGIS v10.3 and multipliers detailed in Table 1 were applied to calculate the total amount of habitat available on the Amberfield site. These calculations are summarised in Table 3 below.

Table 3: Area in hectares of long-tailed bat habitat available on the Amberfield site with habitat value mulipliers (based on ratios in Table 1) applied.

Habitat type	**High value habitat – mature vegetation with 15 m habitat 'edge' preferentially used by bats for foraging and commuting**			**Low value habitat - Open pasture > 15 m from a vegetated edge**			
Disturbance type	Removed	Retained – higher disturbance potential	Retained – low disturbance potential	Removed	Retained – higher disturbance potential	Retained – low disturbance potential	Total (ha)
Habitat onsite (ha)	5.60	11.88	5.29	70.93	11.99	5.50	111.20
Habitat value multiplier	x3			x0.5			
Area of habitat onsite adjusted for habitat value (ha)	16.81	35.65	15.87	35.47	6.00	2.75	**112.54**

Net habitat removal and disturbance and corresponding quantum of offset required

The final step in calculating the area of habitat lost and the corresponding offset required is summarised in Table 4 below.

Table 4: Summary table of long-tailed bat habitat removed on the Amberfield site which requires offset. The time lag ratios relating to the level of potential effect in the short-term applied (as per Table 2).

		High value habitat – mature vegetation with 15 m habitat 'edge' preferentially used by bats for foraging and commuting	**Open pasture > 15 m from vegetated edge (ha)**	**Total habitat removed with multipliers (ha)**
Habitat physically removed		16.81	35.47	
Time lag multiplier	x2	33.62	70.93	104.55
Retained – higher disturbance potential		35.65	6.00	
Time lag multiplier	x1	35.65	6.00	41.65
Retained – low disturbance potential		15.87	2.75	
Time lag multiplier	x0.5	7.94	1.37	9.31
Total habitat removed (with Multipliers)		77.21	78.30	**155.51**

To produce a final value for the recommended offset, we have based the calculation on an estimated cost of undertaking pest control for ship rats, mustelids and possums (key long-bat predators) for 10 years.

While a range of factors impact the per hectare cost of ground-based pest control, market rates for labour costs are the most variable, as the work is labour intensive, somewhat specialised, and varies subject to seasonal demand. Another key variable is the accessibility of the area and the terrain.

Costings for current, directly comparable example projects on which to base cost estimates are not readily available, hence we have relied on publications produced by the Department of Conservation and the OSPRI partnership organisation responsible for the TBFree NZ Ltd. These documents include costs for different ground based control programmes, for example:

- Possums only (TBFree) - average cost per hectare between $10 and $26/ ha
- Stoats only (10,000 ha in Abel Tasman National Park) - $24.40/ ha
- Possums and rats (15,000 ha in Falls River) - $61.52 per ha

The data indicates a conservative rough-order cost of $25-35/ ha for a single species in a remote area, with some economies of scale likely where multiple species are targeted, as fewer visits would be required overall.

Given the offset fund is envisioned to be used for pest control for rodents, mustelids and possums across the semi-rural landscape where the bat population currently resides, control is likely to cost less than $50 per hectare annually. We consider this to be a conservative cost estimate.

Consequently, the total cost of offset recommended is:

155.51 ha multiplied by $50.00 per ha annually over 10 years:
= 155.51 ha x $50 x 10 years
= **$77,754.70**

References

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