APPENDIX O

Peacocke Structure Plan Review

Prepared by
Mansergh Graham Landscape Architects

July 2021

This review of the
Peacocke Structure Plan
has been undertaken on behalf of
Hamilton City Council.

All work has been undertaken and/or reviewed
by a Registered NZILA Landscape Architect.

Report prepared by:
Michael Graham
BSc, BLA,
Registered NZILA Landscape Architect
Director

Registered Member
of the
New Zealand Institute of Landscape Architects.

Report Version: R6
Date: July 2021

mansergh graham
LANDSCAPE ARCHITECTS

Contents

IV. Urbanisation

V. Conclusion

Executive Summary

Purpose

The purpose of this report was to review the *Peacocke Structure Plan* from a landscape architectural perspective based on further investigations and information provided since its inclusion within the *Operative Hamilton District Plan (ODP).* Analysis of this information has led to the development of a revised Structure Plan that responds to the implications of that information and reflects potential development scenarios for its integration. In addition to the refinement of the structure plan, guidance was prepared on landform retention, gully enhancement and the integration of urbanisation adjacent to *ecologically significant habitats.*

Background

This report assumed as a baseline the extent of *developable land* and *reserve area* shown within the *Peacocke Structure Plan* contained in the *ODP*, with exception of the transport road network which was revised to reflect the *Southern Links Alignment.*

Existing Site

The *Peacocke Structure Plan* area is located within the southern boundary of Hamilton City District. It encapsulates some 720 ha, that is bounded by the entrenched Waikato River to the north-northeast, Peacocke's Road to the south east and SH3 Ohaupo Road to the west. The landscape character of the site is heavily influenced by its landform which is expressed by two defining features; the *Waikato River* and the *Mangakotukutuku Stream Gully* system, and the more generic undulating land to the north and rolling topography to the south. The land cover of the site is reflective of its location on the southern edge of Hamilton City and the transitional nature of the area; the majority of development within the site is lifestyle and farm blocks containing extensive shelter belts and specimen trees, set within a wider agriculture background. Steeper and less accessible areas throughout the site, such as the incised stream system and the river trench, contain adventitious vegetation and limited indigenous plant cover.

Further Information

The further information considered as part of this report includes;

1. Identification of *significant ecological habitats;*
2. Identification of significant areas of *geotechnical hazard;*
3. An increase in extent of land identified as the *Southern Links Alignment* road network designation;
4. An increase in extent of land for *Storm water Detention Areas*.

Critical to the extent of *significant ecological habitats* identified was the presence of *long tailed bat (Chalinolobus tuberculatus)* activity within the site. The long-tailed bat is considered under threat of extinction and was ranked as *Threatened-Nationally Critical* by the Department of Conservation in 2017. While the identification of a community of an endangered species within the boundary of *Hamilton City* is to be celebrated, this comes with a responsibility to protect the species, and maintain and enhance their habitat. *Significant ecological habitats* identified included remnant rural plantings, vegetation within the gully system and on the western *Waikato Riverbank.* Enhancement of the gully system was proposed to create continuous *Proposed Bat Corridors* within the gully system, where clusters of *significant ecological habitat* sites indicated routes.

Analysis

This information resulted in a shift in allocation of land use within the *Structure Plan* area. While both infrastructure and reserve area allocations increased, the gross developable land area within the *Peacocke Structure Plan* reduced by 13 %. This shift in land use also reflects an alteration to the pattern of land use distribution within the *Structure Plan Area,* creating greater spatial separation between areas of developable land. Strategies for increasing potential yield within the *Structure Plan Area* were considered to offset the overall reduction in developable land, while suggested approaches for integration of the developable land with *Significant Ecological Habitats* and *Bat Corridors* were proposed.

Strategies

Proposed strategies focus around *intensification* of developable areas and *rationalisation* of the available areas for development. Review of the consented developments within the *Structure Plan Area* indicate that the minimum lot size within the *Hills Character Area* may be suitable for reduction to 400 m2 allowing for general *yield intensification.* In addition, given the spatial separation created by the pervasive gully system, increased density developments (terrace housing or three or four story apartments developments) could be considered adjacent to areas of higher amenity.

Rationalisation could also be achieved by considering small changes to the existing configuration of developable areas and include the removal of isolated *remnant rural vegetation* where accompanied by of offset works; or the infilling of emergent gully heads which are not *Significant Ecological Habitats* or part of the *Proposed Bat Corridor*. Some increase in developable land could be obtained which would allow the development of more efficient layouts.

It is recommended that *intensification* should be undertaken adjacent to areas which provide offset amenity, such as the *Proposed Bat Corridors.* It is also recommended that a localised transect approach should be maintained to ensure that larger lots are encouraged along the *Structure Plan Area* interface with rural land to the west and south.

Guidance

Specific guidance and recommendations have been prepared for the development of sloping land, and the interface of infrastructure and residential development with *Significant Ecological Habitats* and *Proposed Bat Corridors.* The proposal of a structured buffer zone has been introduced to protect the *Significant Ecological Habitats* and *Proposed Bat Corridors*, and control aspects of adjacent development.

The combination of these suggested approaches and the incorporation of the specific guidance have been applied in a two-step process to produce the *Developed Structure Plan*. *Version 1* incorporates the outcomes of the further information and includes the spatial implications of the guidance and recommendations. *Version 2* applies the *rationalisation* and *intensification* to portions of *Version 1*, to result in a more resolved *Developed Structure Plan* for consideration.

Conclusion

The *Developed Structure Plan* integrates an increased extent of reserve land and infrastructure with integrated residential development. Due to the pervasive gully system, associated *Significant Ecological Habitats* and *Proposed Bat Corridors*, the resulting spatial separation and amenity provides an opportunity to accommodate some *intensification*, both in density and yield within adjacent developable land. The revegetation of the *Mangakotukutuku Gully* system and *Waikato Riverbank* also provides an appropriate response to topographical challenges include *geotechnical hazards.* While the resultant spatial separation provides some challenges in terms of connectivity throughout the site, it also offers an opportunity to express the character of the site through a road network that responds to the varying topography and site features. Overall, the *Developed Structure Plan* provides a balanced development with a strong sense of place, grounded by the response to the existing land form, it's location on the *Waikato River* and the *Significant Ecological Habitats* within it.

I. Introduction

1. INTRODUCTION

Mansergh Graham Landscape Architects Ltd (MGLA) has been engaged by *Hamilton City Council* to undertake a review of the 720 ha *Peacocke Structure Plan* area from a landscape architectural perspective based on further investigations and information provided since its inclusion within the *Operative Hamilton District Plan (ODP).*

The *Peacocke Structure Plan* is an urban growth area identified in the *ODP.* This review identified the original anticipated resolution of the structure plan area based on the subdivision requirements of the *Chapter 5 Peacocke Structure Plan* provisions and *Appendix 2 ; Peacocke Structure Plan figures 2-1 to 2-3* contained in the *ODP*. (These figures identify *preliminary Land Use, Staging and Transport Network, and Character Areas and Neighbourhoods)*. This outcome was then compared with the configuration of two consented developments within the structure plan area to evaluate the consistency with the anticipated resolution.

In parallel, consideration was given to further information based on investigations and development that had been undertaken since the inclusion of the *Structure Plan* in the *ODP*. This information included findings based on further investigation with respect to ecological and geological considerations and the implications of further resolution of infrastructure components including transport linkages and storm water detention areas. The outcomes of this analysis were then explored to consider what effects potential alterations to the existing provisions may have on the anticipated overall masterplan configuration for the *Peacocke Structure Plan* Area culminating in a *Developed Peacocke Structure Plan*.

In addition to the development of the structure plan, guidance was prepared on landform retention, gully enhancement and the integration of urbanisation adjacent to *Significant Ecological Habitats* which support bat populations.

2. METHODOLOGY

This report utilises a comparative methodology approach to review the effects of different development scenarios. The comparative methodology utilises the application of a consistent model generation process to create a series of models based on permitted development provisions, and areas of consented development as defined within the *ODP*. This approach allows a comparison of density and distribution of development, infrastructure and open space. These models are then compared against one another to identify areas of congruence and variance at a macro level.

A subsequent model is then generated which incorporates the implications of the refinement of key sensitivities of the site and the greater resolution of the infrastructure elements. This combined model then forms the baseline for the development of alternate scenarios which test revisions to the existing rule set and structure plan layout. Suggested alternate strategies and or configurations are modelled, which include alterations to density, distribution, and treatment of areas of reserve areas. These are then able to be compared against the combined model baseline to establish a quantifying extent of change and enable a degree of evaluation in the round. This method culminates in the preparation of a *Developed Structure Plan.*

3. TYPICAL APPROACH GUIDANCE

In addition to the analysis of underlying constraints, limitations and opportunities within potential future development, this report will also provide guidance for typical treatment approaches to several aspects of future development that are considered characteristic of the area and desired to be retained. These are;

i. Retention of the natural landform, where sloping areas are undergoing urbanisation.

ii. Integration of gully systems within an area undergoing urbanisation.

iii. Ecological corridors within the wider Peacocke's Area, to address habitat enhancement and protection for native bats.(*Significant Ecological Habitats* and *Proposed Bat Corridors)*.

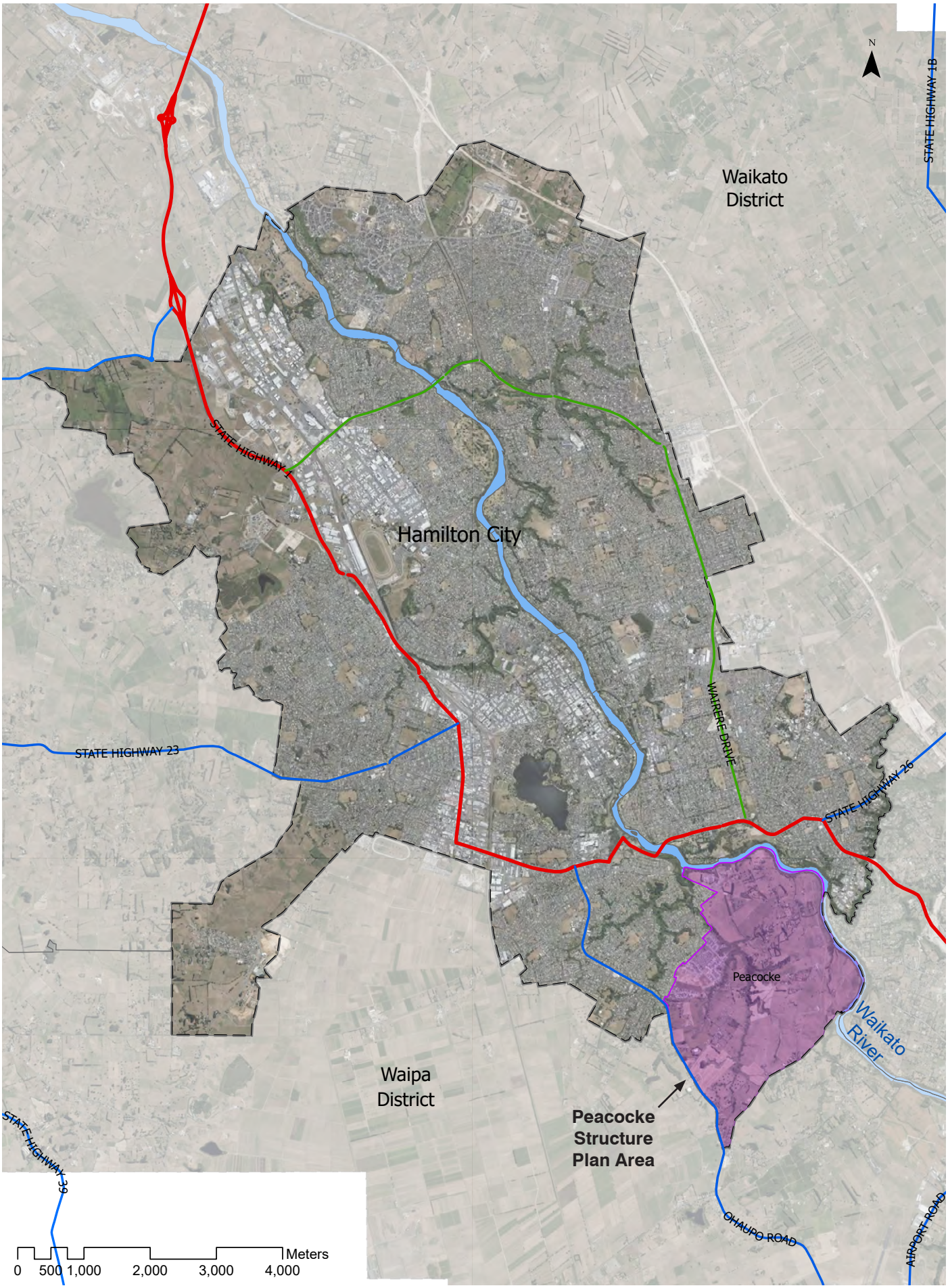


Figure 1. Location and context of Peacocke Structure Plan Area

II. Site and Context

1. THE PLAN CHANGE AREA

The *Peacocke Structure Plan* area is located on the southern boundary of Hamilton City District. It encapsulates some 720 ha, that is bounded by the entrenched *Waikato River* to the north-northeast, Peacocke's Road to the south east and SH3 Ohaupo Road to the west. The topography varies over the site with typically flatter areas in the north, excluding a prominent centrally located knoll; the southern portion is generally more elevated, forming a rolling hillscape. The site is effectively bisected by the centrally located *Mangakotukutuku Stream Gully* system, with the western boundary formed by SH3 Ohaupo Road, and the *Waikato River* dominating the eastern boundary. The site also includes an unusual geographical feature at its eastern extent on the *Waikato River,* where an incised trench separates a portion of the site. The trench is a remnant of the meanderings of the *Waikato River* course which once formed an island of this portion of the site before the river realigned to its present-day course.

2. LANDSCAPE CHARACTER

Landscape character is a function of the landscape's visual expression. This includes elements that contribute to its appearance and the cultural modifications which have occurred upon it. The landscape and visual quality of the site is a function of a series of factors including intactness of visual and physical elements such as topography and vegetation cover, the degree of modification that has occurred, surrounding landscape elements and attributes. Further contributing factors include juxtaposition and coherence between landscape elements within the site and those of the surrounding area, as well as human attributes or values assigned to an area.

Landscape Cover

The land cover of the site is reflective of its location on the southern edge of *Hamilton City* and the transitional nature of the area; aside from an area of residential development in the northwest, both existing and under construction, most of the development within the site is lifestyle and farm blocks. Consequently, the area still retains extensive shelter belts and scattered clusters of specimen trees, set within a wider agriculture background. This includes several trees which have been identified as *Significant* within the District Plan. These are predominantly located within Stage 1, the *North View Development,* and in and around *Glenview Club Park*.

Steeper and less accessible areas throughout the site, such as the incised stream system and the river trench, contain adventitious vegetation and limited indigenous plant cover. Although the existing adventitious vegetation offers amenity at present, future enhancement of the gully system will greatly improve the amenity derived from these features for surrounding development.

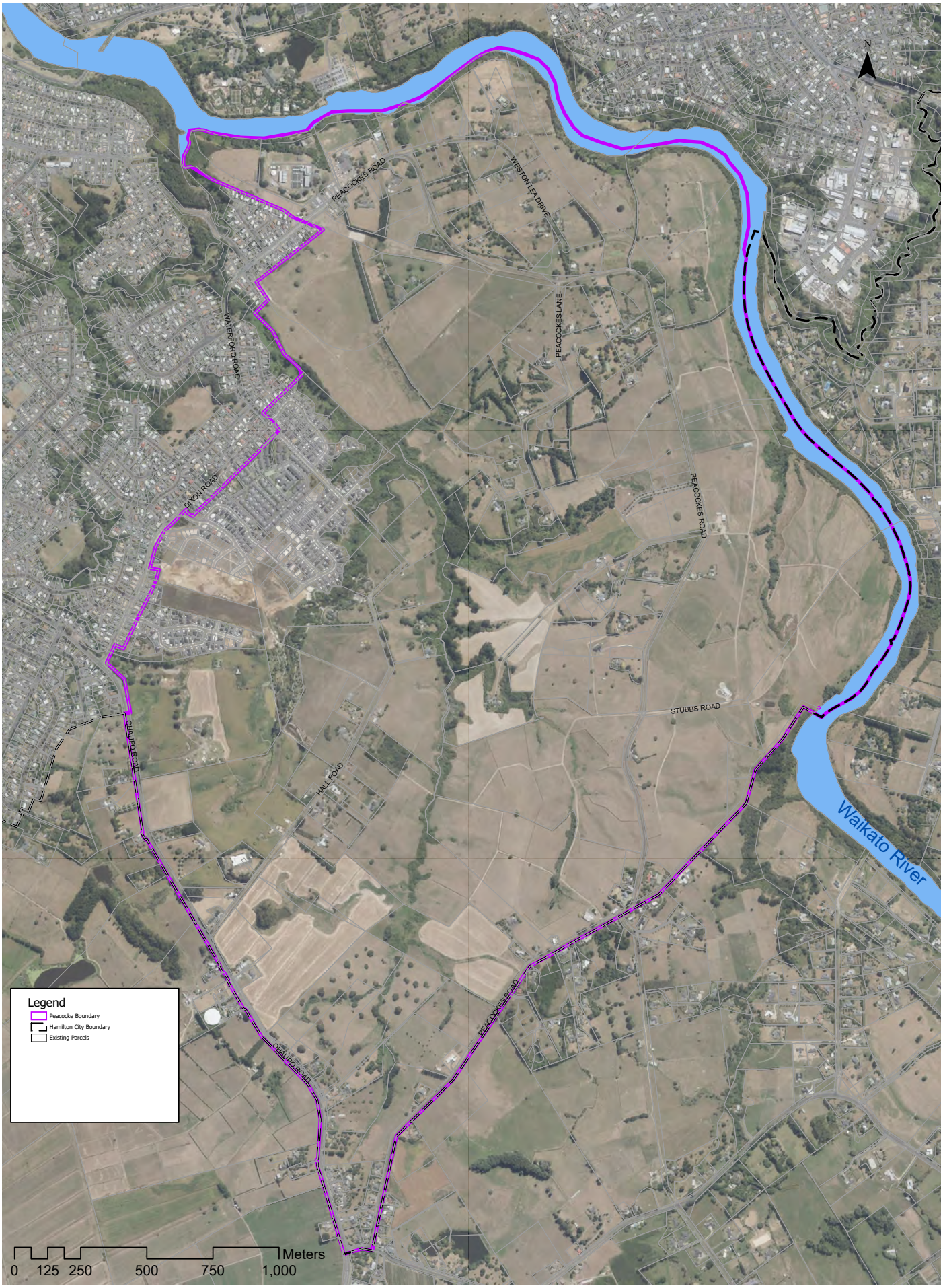


Figure 2. Aerial Photograph of Structure Plan Area showing existing land cover distribution.

Landform

The landform is considered a significant component of the sites character. *Figure 2-3 Peacocke Structure Plan - Character Areas and Neighbourhoods* contained within the ODP identified 3 character areas based on land form typologies within the Structure Plan Area; *Terrace, Gully* and *Hills.* (Refer to figure 3). The structure plan area is also divided into *17 Neighbourhoods Areas*. No more than two of these typologies are represented within each *Neighbourhood Area.* (Note: *Neighbourhood Area 17* is not identified as a landform typology, but rather as *Stage 1 of the overall staging for the area*). These landform typologies are used to guide minimum lot size which vary based on the likely gradient of the underlying topography. This is discussed in further detail in *Chapter 3, Site Development Analysis.*

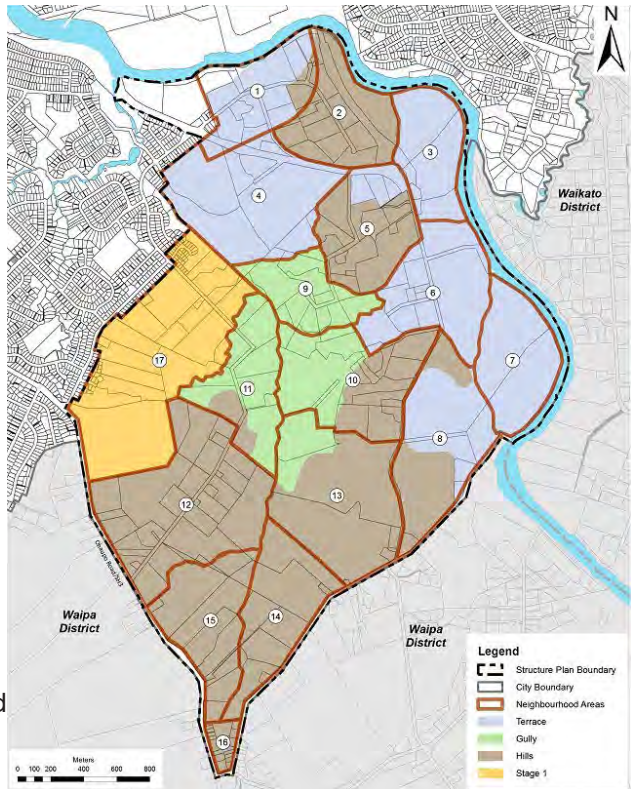


Figure 3; Peacocke Structure Plan - Character Areas and Neighbourhoods

The landscape character of the site is heavily influenced by its landform, which is expressed by two defining features; the *Waikato River* and the *Mangakotukutuku Stream Gully* system, and the generic rolling topography south of Hall Road.

On the eastern extent of the site, the western bank of the *Waikato River Trench* feature defines the landform with predominantly elevated flat river terraces, notwithstanding the delineating trench that creates the 'island' landform. This area offers high amenity values through views, proximity and access to the *Waikato River* and visual links to the wider adjacent landscapes. By contrast the *Mangakotukutuku Stream Gully* system, centrally located within the site, is a network of incised gullies which result in a more introspective and intimate feature. The gully system divides the containing landscape into discrete areas while allowing proximity views into the gully network.

While the landform in the north of the site is generally flatter and gently undulating, the southern portion of the site exhibits a rolling topography, which is generally more pronounced and elevated, affording broader views over the site and Hamilton City to the north. The undulating landform obscures the two landscape features within the broader context, enhancing the serendipity when revealed.

As the site is in the process of undergoing a shift of land use from rural to residential, much of the land cover will change. While the process of urbanisation does effect landform, careful consideration of the approach to development will assist with the retention of the broader topographical character of the site. Consideration of factors such as lot size, shape and orientation to slope, building design and the location, height and extent of retaining walls and batter slopes, all contribute to the maintenance of this broader character. Further recommendations in respect to this information are contained in C*hapter 5 Guidance and Recommendations of this report*.

3. FURTHER INFORMATION

The following information is a consequence of further investigation and/or refinement of requirements for the *Structure Plan Area*. As the information outlined below is location dependent and has a spatial dimension it is shown on an accompanying plan. To assist with orientation, the information is shown over an aerial photograph of the site and cadastral data. Nominal *Future Reserve Land*, which approximates the gully system and riverbank area, is also shown to assist with interpretation.

Geotechnical Hazards

As part of the further investigations of the site, a geotechnical assessment was undertaken and land that was considered *geotechnically hazardous* was identified. The identified areas are considered unsuitable for development and were typically evident in association with gullies and riverbank areas. (It is noted that many of the areas overlap with the ecologically significant areas). This was information was provided by HCC and shown on *Figure 4 Geotechnical Constraints.*

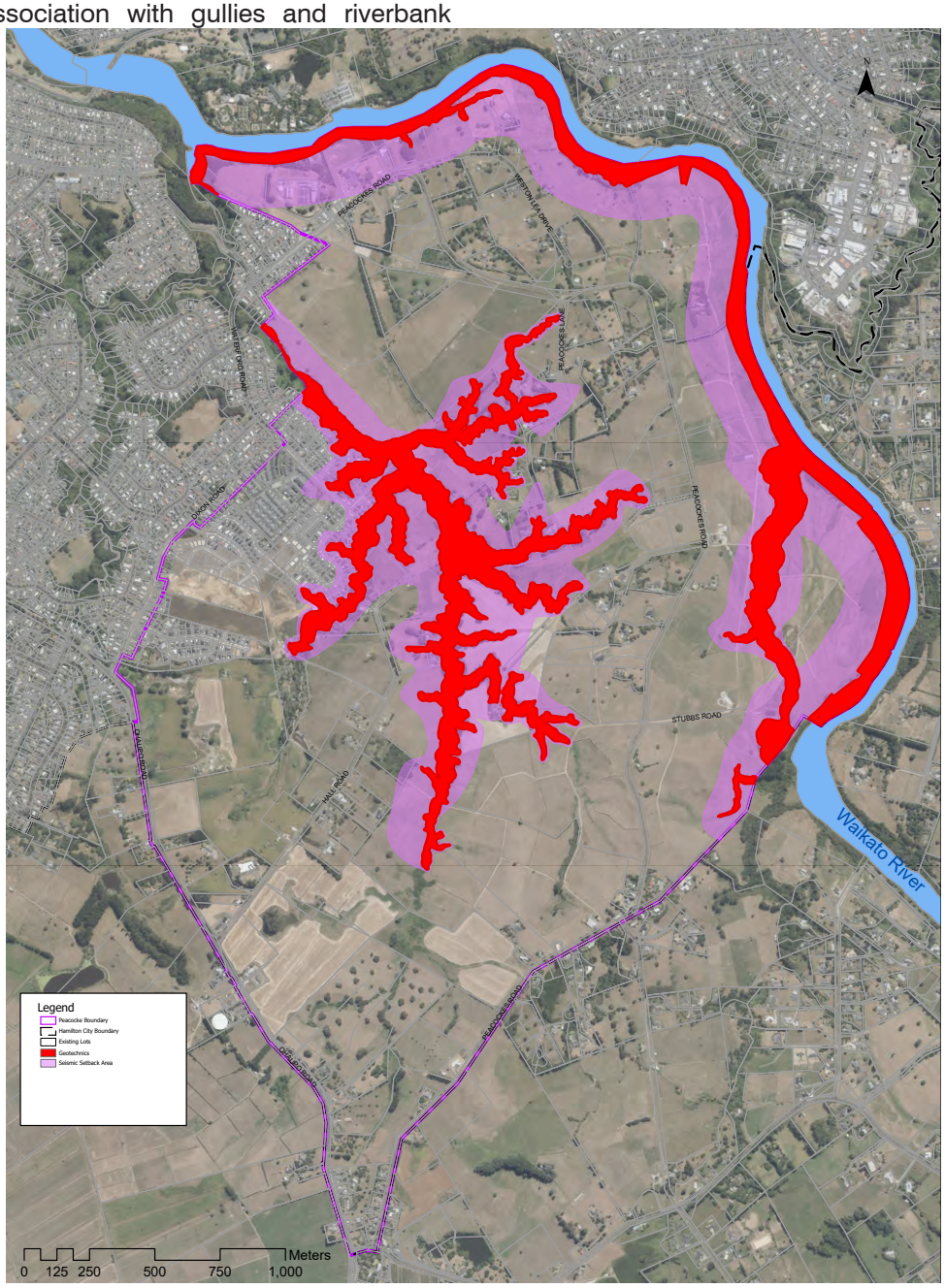


Figure 4; Geotechnical Hazard overlay shown in red. Seismic buffer area shown in pink. Development can occur within Seismic buffer area subject to engineering validation.

Further a *seismic buffer* was identified and is also shown on *Figure 4 Geotechnical Constraints.* This buffer captures a more extensive area of the site that extends beyond the visible extent of the riverbank and gully system. This buffer does not preclude the potential for development, but any development within it may be subject to geotechnical validation and require specific design to proceed.

Significant Ecological Habitat

Investigations of the ecological values contained within the site were undertaken. The *PSPA Assessment of Ecologial Significance report (Kessels & Baber 2021),* included an evaluation of both the *flora* and *fauna* of the site. While remnants of indigenous vegetation are largely confined to the *Waikato Riverbank* and the *Mangakotukutuku Gully System*, the exotic vegetation within these areas and throughout the site also provide wildlife habitat. These habitats support a variety of common native bird, invertebrate, and reptile species.

Part of the *Mangakotukutuku Gully System*, the *Mangakotukutuku Stream* has comparatively high biodiversity and contain nationally threatened species such as the *Giant Kokopu* and *Longfin Eel* and includes invertebrates such as *Mayfly, Caddis fly* and *Koura (freshwater crayfish).*

One of the more significant developments within the *Peacocks Structure Plan* area is the identification of l*ong-tailed bat (Chalinolobus tuberculatus)* activity within the site. This activity includes roosting, commuting (flight paths between specific sites) and foraging within the site and adjacent areas. The long-tailed bat is considered under threat of extinction and was ranked as *Threatened-Nationally Critical* by the Department of Conservation in 2017. As the site is undergoing urbanisation, significant consideration has been given to maintaining and enhancing ecological habitat for the *long-tailed bat* throughout the site. This is detailed in the *Peacocke Structure Area Plan Change Long-tailed Bat Report, (dated June 2021)* prepared for *Hamilton City Council* by *4Sight Consulting.*

While the *Significant Ecological Habitat* identification process focusses on the preservation of the *long-tailed bat* habitat, many of the recommended actions also enhance the wider ecological environment of the structure plan area generally. While *Significant Ecological Habitats* were identified within the *Waikato Riverbank* and the *Mangakotukutuku Gully System,* other parts of these areas, existing shelter belts and tree stands were identified as *moderate or low ecological habitats.* (Refer to figure 5a).

Significant Ecological Habitats & Proposed Bat Corridor

While the identification of a community of an endangered species within the boundary of Hamilton City is to be celebrated, this comes with a responsibility to protect the species and maintain and enhance their habitat. While *Significant Ecological Habitats* have been identified and cover part of the gully system, portions of the gully system were identified as *moderate to low* habitat result in fragmentation of the ecological corridor. In order to provide enhancement of existing habitat it is proposed that the balance of the main gully system is revegetated with ecologically appropriate species to form *Bat Corridors* which connect *Significant Ecological Habitats*

To provide a level of protection for both *Significant Ecological Habitats* and the proposed *Bat Corridors,* consideration has been given to mechanisms to which minimise potential effects of adjacent development. A *buffer zone system* has been introduced with a 20m *Bat Buffer Zone* (minimum) proposed adjacent to all *Significant Bat Habitats,* while a *5m building setback* is proposed for developments adjacent to either a *Bat Buffer Zone* or *Bat Corridor.* The *buffer zone* is more fully described in *Section 5.3 Residential Development adjacent to Key Bat Habitats and Proposed Bat Corridors.* (Refer to figure 5b). (Please note at the time of production, the extent of ecologically significant habitats, corridors and buffer zones mapped, were subject to further refinement and may not present the final configuration).

While the *Significant Ecological Habitats* have been identified as having specific ecological values, which warrant protection, it is noted that these areas also have significant overlap with geotechnical factors which preclude large areas from potential development.

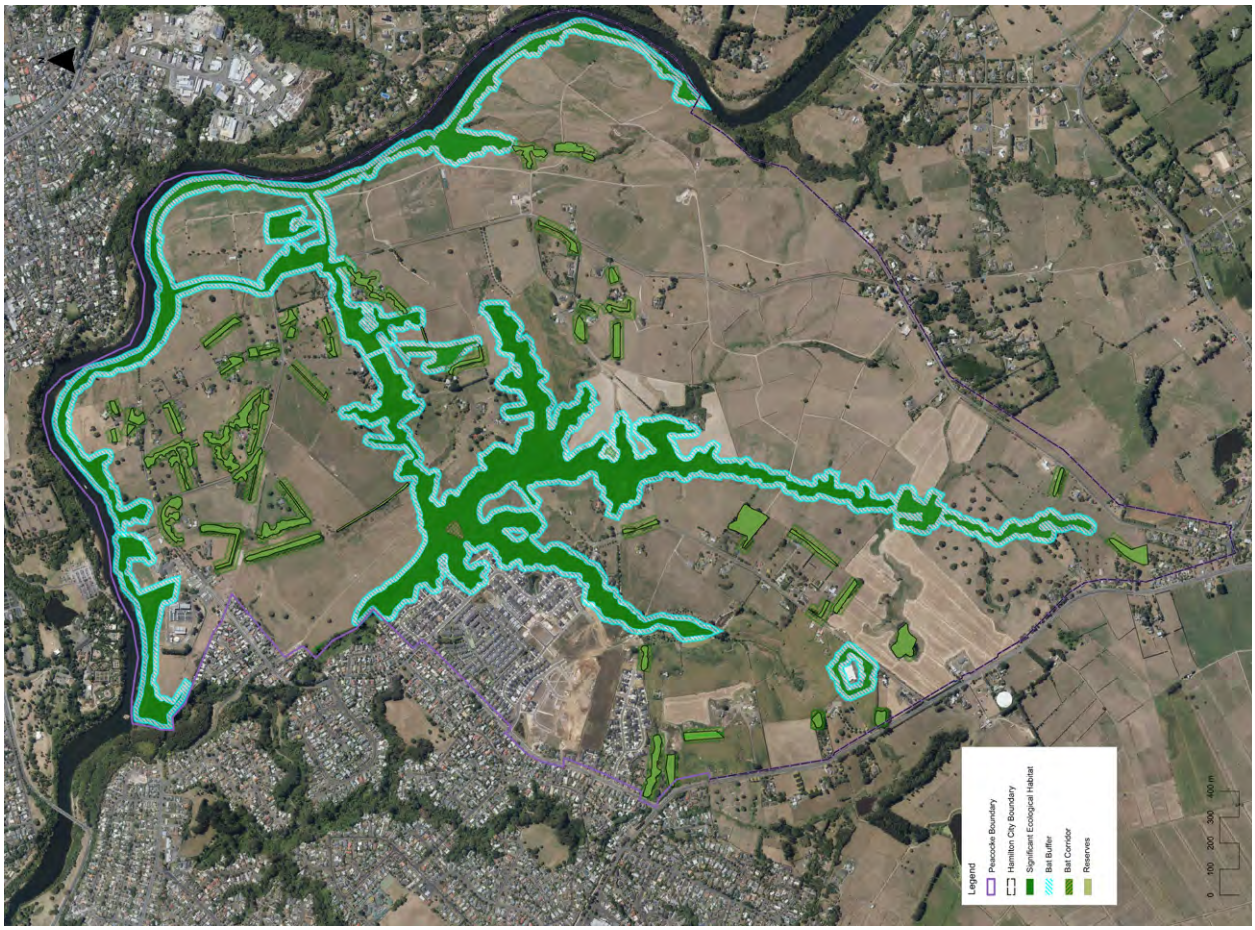


Figure 5a; Overlay of identified *Significant and Moderate Ecological Habitat* areas with associated buffer zones.

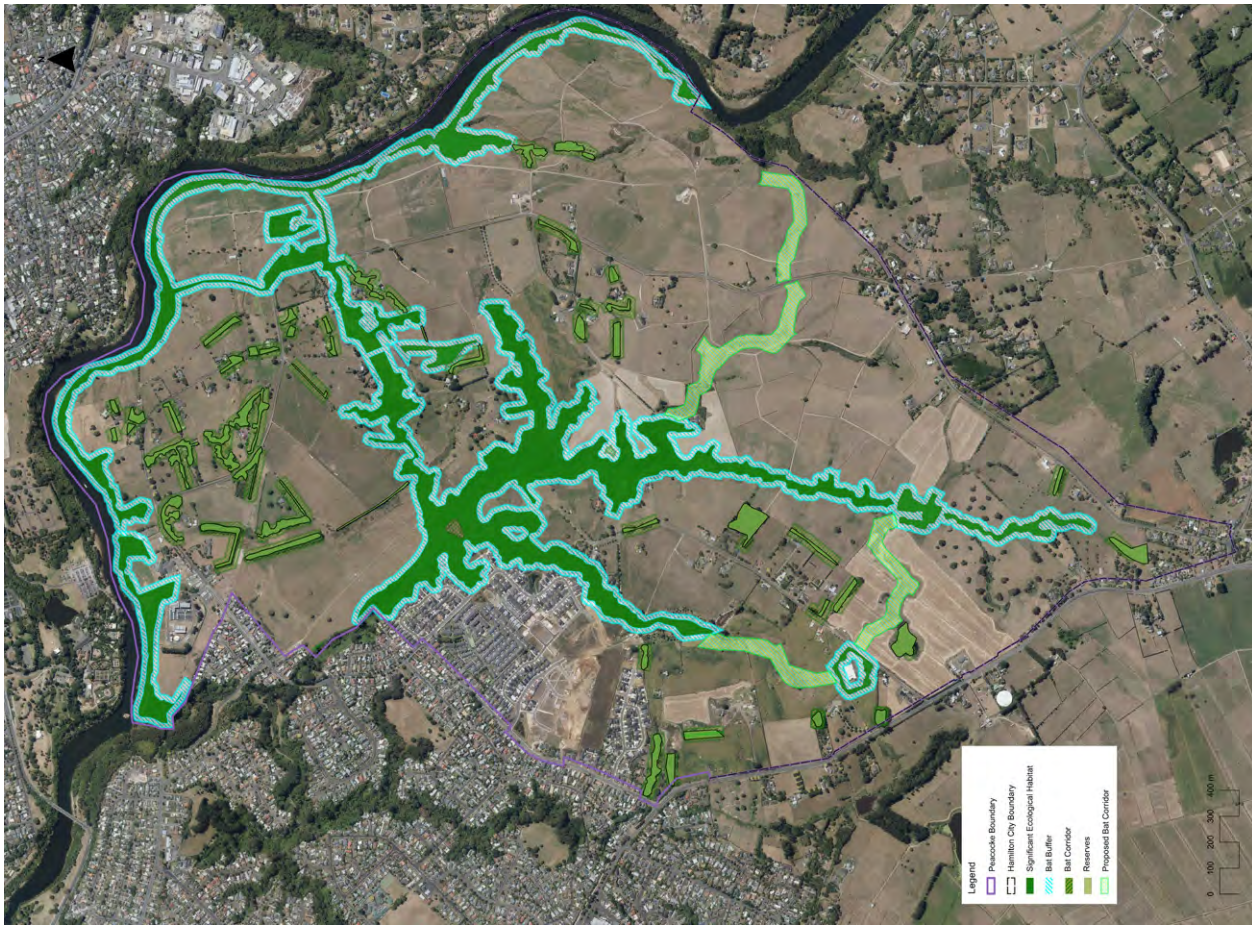


Figure 5b ;Overlay of *Proposed Habitat Corridor* creating continuous ecological corridors. *Proposed Habitat Corridor* shown with associated buffer zones.

Additional Infrastructure

As part of the further investigations into the *Structure Plan Area*, further resolution of the infrastructural requirements was developed. Specifically, this related to the identification of the designation boundary of the *Southern Links Alignment* road network and the associated land requirement for key intersections, rotaries and road corridors. As portions of the network are proposed to sit both above and below the existing ground plane the extent of land required exceeds the typical road reserve.

In addition, *Stormwater Detention Wetland* areas and locations were identified and included within the model. While these provide a baseline representation within the overall scheme, they are considered preliminary, and some further resolution of extent and location is likely.

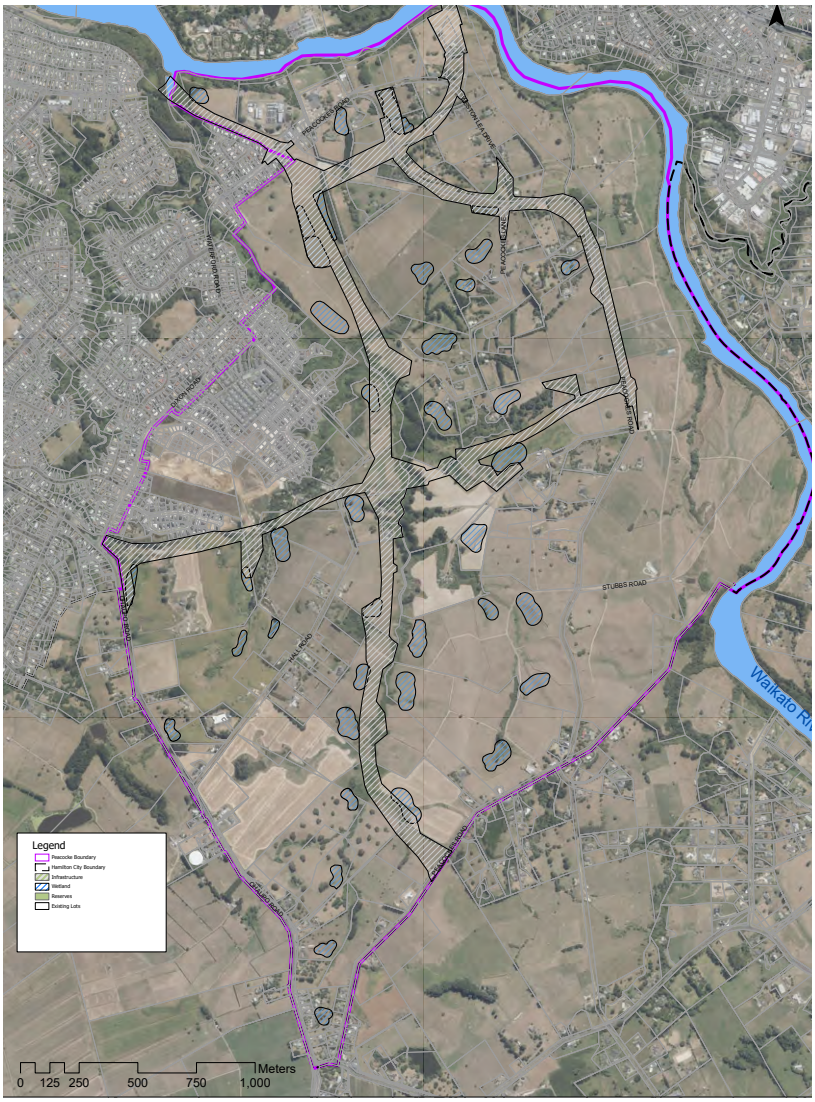


Figure 6; Infrastructure overlay. *Southern Links* road network and Storm Water Detention Areas.

Distinct Spatial Pattern

In combination, the information outlined above forms a distinct spatial pattern within the *Structure Plan* area which creates a separating corridor between areas of developable land. The pattern formed by the natural components of the landform and vegetation, are reiterated by the intrinsic land use constraints that under lie the formative process of this landscape. This broad pattern is also echoed by the infrastructural components of the S*outhern Links Alignment* and the positioning of the *Stormwater Detention Areas*. The combined effect of these aspects is to produce a notable accumulation of layers that produce a pervasive swathe of land use that is unavailable for development.

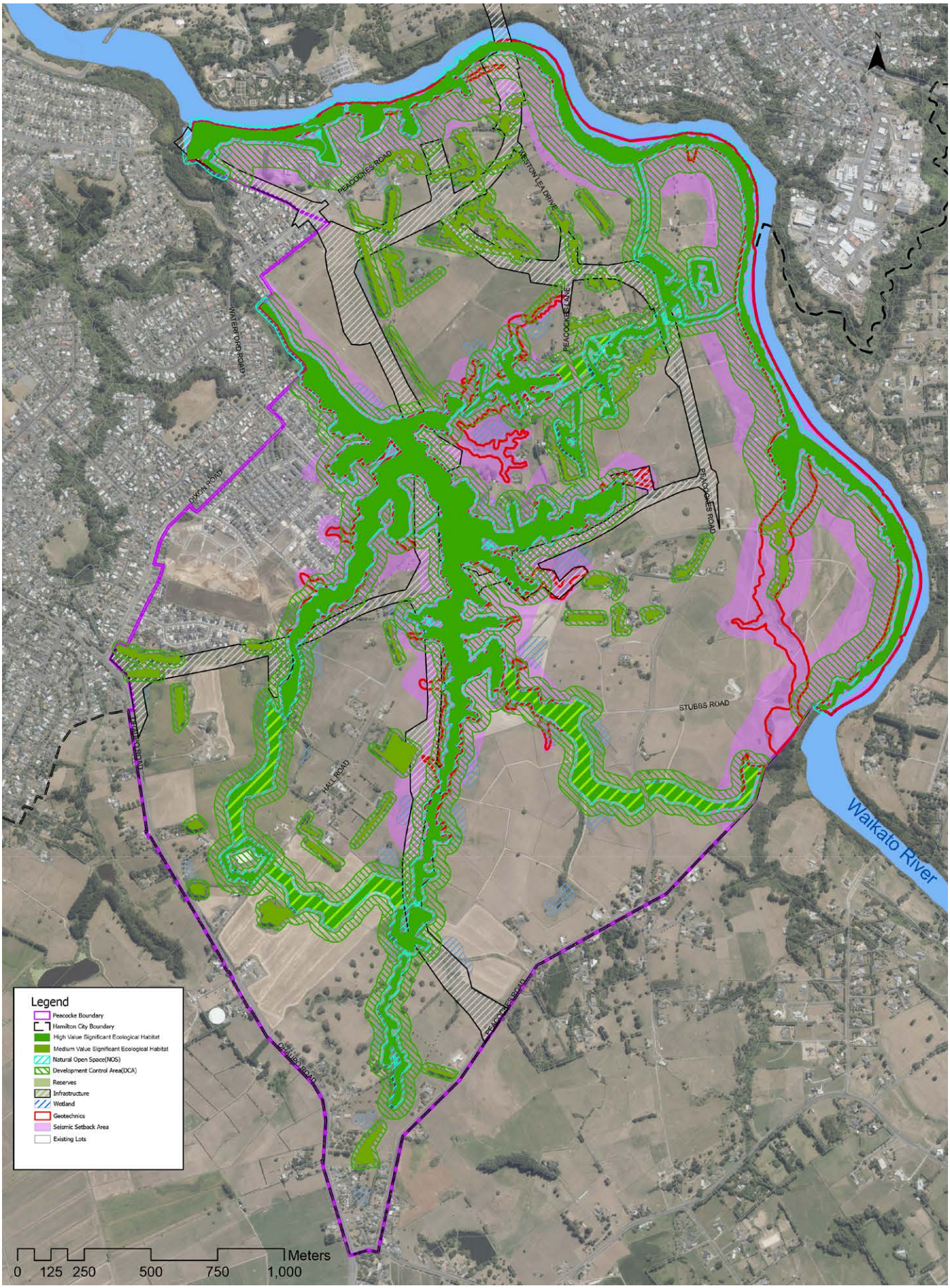


Figure 7; The combined spatial distribution of the additional information exhibits a moderate degree of overlap.

4. OPERATIVE DISTRICT PLAN

Within the *ODP* the *Peacock Structure Plan* area is identified as a *Special Character Zone* with a specific objective identified (*Section 5.2.8 Peacocke Character Zone*);

> *To ensure urban development within the Peacocke Character Zone delivers high quality levels of residential amenity, respects and restores the area's natural environment, and is sustainably integrated with the city as a whole.*

The specific policies under this section offered further guidance in the resolution of character which is to be achieved;

> **5.2.8a**
>
> *Ensure through master planning that urban development is not compromised through inappropriate land use activities*
>
> **5.2.8b**
>
> *Ensure the appropriate nature, scale and intensity of urban development is undertaken in an efficient and coordinated manner in order that integrated and efficient development occurs within and between the neighbourhoods and the city as a whole.*
>
> **5.2.8c**
>
> *Ensure that development is consistent with the Peacocke Structure Plan and any master plan prepared for the area.*
>
> **5.2.8d**
>
> *Ensure that development of non-residential activities is located in areas identified in the Peacocke Structure Plan or any approved master plan that provides for such activities.*

Of relevance is the emphasis that urban development should be undertaken in an efficient and coordinated manner, not only internally within the *Structure Plan Area*, but with respect to the city as a whole. The overall objective explicitly balances this statement with the direction that urban development *respects and restores the area's natural environment and sustainably integrated into the whole*. Within the *Structure Plan Area*, therefore the restoration of the natural environment should be balanced by an efficient and connected urban development.

The accumulation of layers of land, either unsuitable or with alternate priorities, produced a pervasive swathe of land unavailable for development, contributing a large portion of the land proposed to restore the area's *natural environment*. It is paralleled by the transport corridor which, if appropriately detailed, can contribute to the natural environment and assist with integration with the *Structure Plan* area itself and the wider city. Having identified the general landscape background and highlighted the additional information provided, the following section follows the analysis of information toward the further development of the *Structure Plan*.

III. Site Development Analysis

This section identifies the potential outcome of the original, ***Structure Plan*** *based on the* ***ODP*** *rules. It compares the findings of two consented developments with the same areas of the original structure plan, and discusses congruence and variances. Based on these findings, directions for further development of the* ***Structure Plan*** *are suggested.*

1. PERMITTED RULE SET AND ANTICIPATED YIELD

The Peacocke's Plan Change Area contains 3 character areas that reflect topography and guide anticipated yield for the area. These include the *Terrace, Gully* and the H*ills Character Areas.* Development within the *Hills Character Area* is further differentiated based on steepness of topography; land in excess of a 5 degree slope requires lots with a minimum net site area of 800m2, whereas areas with 5 degree or less slope allow lots with a minimum net site area of 400 m2 but a maximum net site area of no greater than 800m2.

The following table represents a potential yield for each zone based on the permitted rule set contained within the ODP.

Zone	Minimum Net Site Area	Average Minimum Net Site Area	Maximum Net Site Area	Minimum Shape Factor	Potential Yield
(Stage 1) General Residential	400m2			15m - diameter circle	**239**
Terrace Area	200m2				**1996**
Gully Area	800m2			15m - diameter circle	**323**
Hill Area (> 5 degrees) (< 5 degrees)	800m2 400m2		- 800m2	15m - diameter circle	**1697** **396**
TOTAL					**4651**

Table 1: Potential Yield based on the permitted rule set.
(Note; the Stage 1 area is not ascribed a character area in the ODP so reflects the general residential guidance).

Preliminary Potential Yield

The figures contained above (Table 1) were derived from preliminary data that, while incorporating road networks and ecological reserves, did not include an allowance for recreational or infrastructural reserves, or community facilities. The potential yield identified was for lots that were compliant with minimum size and shape factors identified in the ODP.

Subsequent comparison between the preliminary data and two consented areas of development, which included reserve and community facilities allowances, identified a degree of consistency with the anticipated yield for the overall site but also some interesting variances (Refer Table 2). While the combined overall yield between the potential and consented development is within 6 percent of one another, consideration of each development separately highlights notable differences between the potential and consented yields. These are reflective of the degree of design resolution between the developments, and different site constraints within the two locations. These are discussed in greater detail in the following section.

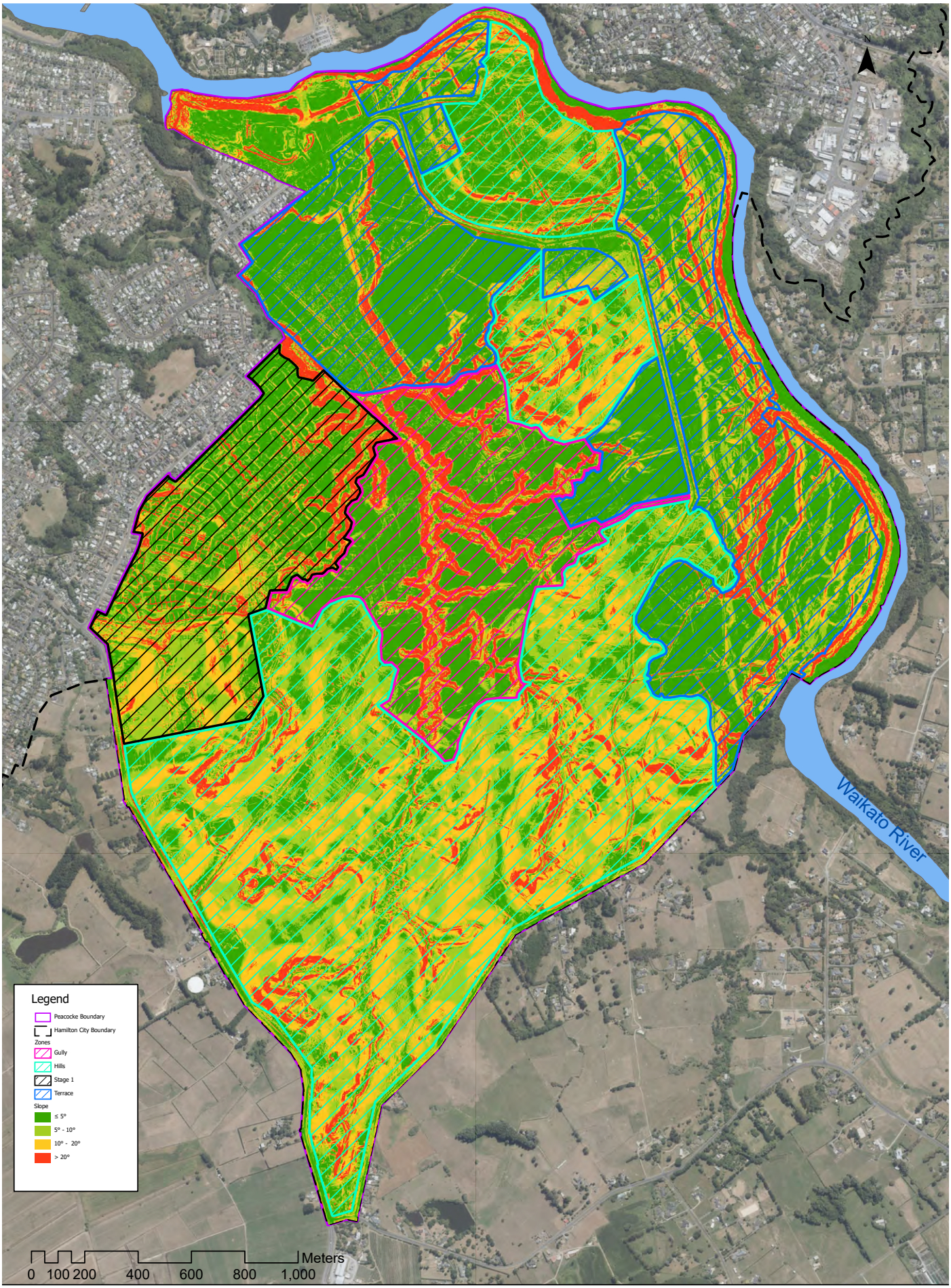


Figure 8; Overview of structure plan area showing existing slope angle distribution over site with character areas outlined.

2. CONSENTED DEVELOPMENTS

Northview Development

The *Northview Development* is a 25-hectare area located in the northwestern corner of the structure plan. The development area is broadly triangular in form, delineated to the north by the eastern extent of the arterial route, a portion of the gulley system along its eastern boundary and SH3 forms its western boundary. The development area is reflective of the *Hills Character Area*, (as identified in the *ODP*) containing undulating terrain with localised steeper portions. The area contains portions of the wetland gully system, several wetland reserves and cluster of significant trees. The low-lying topography is generally located peripherally within the development area.

This development responds to the topography of the site, existing land cover and features to create a responsive development.

a. The road network is generally located along contour lines where possible avoiding steep gradients.

b. Natural ground level is preserved and protected around significant trees and reserve areas.

c. Existing topography is utilised for the development of low-lying wetland reserves.

d. A connected street network is utilised following an organic grid framework which responds to the natural landform and the location of protected features and landforms.

e. Street hierarchy creates a legible and easy to navigate street network.

f. Open space reserves and parks are developed around significant trees and landscape features.

g. Open space and street network are integrated through cycle/ walkways to provide for accessible neighbourhood network.

h. A neighbourhood centre is located at an entrance node into the development.

i. Lot size allows for a range of dwelling typologies with specific lot development undertaken to respond to site limitations, locating intensification around open space amenity areas with balance of site development at anticipated density.

j. While some localised areas are flattened to create building platforms, larger height differences are dealt with inter-block, using retaining walls and/or battering between lots.

Amberfield Development

Amberfield Development is a much larger development area, of some 111 hectares located on the eastern edge of the *Peacockes Structure Plan* area. The Waikato River adjoins it's eastern and northern boundary, with Peacockes Road forming its western boundary. The *Amberfield Development* extends south to just beyond Stubbs Road. Overall, the site expresses a general fall from Peacockes road to the Waikato River with the site containing a number of distinct terraces. Unsurprisingly, most of the development area falls under the '*Terrace Area*' classification, with a small portion of the southern extent of the site classified '*Hill Area'*.

The area contains several gullies and an extensive tract of the western riverbank. While the riverbank offers amenity values along the development areas eastern boundary, it also includes associated areas of geotechnical hazard. Two gully areas are located internally within the development area. The *Amberfield Development* area also includes sites of archaeological sensitivity.

This development responds to the topography of the site, existing land cover and features to create a responsive development.

a. The road network is generally located along contour lines where possible avoiding steep gradients.

b. Natural ground level is preserved and protected around gully areas and reserve areas.

c. A connected street network is utilised following an organic grid framework which responds to the natural landform and the location of protected features and landforms.

d. Street hierarchy is legible and easy to navigate street network.

e. Open space reserves and parks are developed around significant locations including archaeological and landscape features.

f. Open space and street network are integrated to provide for accessible neighbourhood network.

g. A neighbourhood centre is located at an entrance node into the development.

h. Lot development is intensified around public open space amenity areas, with larger lots located on steeper land conventional and smaller lots are generally located on flatter ground.

i. Lot size allows for a range of dwelling typologies.

j. Potential for further intensification is designed into development with larger than minimum lot size.

Comparison of Average Lot Size

While the overall approach and outcomes of the two developments appear similar, they differ notably in the average lot size, (the minimum lot size for both developments is 400m^2). The average lot size for Amberfield is 532m^2 while for Northview is 355m^2.

Zone	Total Land Area	Potential Lot Yield	Average Lot Size	Consented Lot Yield	Average Lot Size	Gross Density
Northview Subdivision	25 ha	266	436 m^2	315	**355 m^2**	**794 m^2**
Amberfield Subdivision	111 ha	993	474 m^2	909	**532 m^2**	**1221 m^2**
TOTAL	**136 ha**	**1295**		**1224**		

Table 2: Land not available for residential development includes land utilised for infrastructure, parks, reserves, community facilities, protected / unavailable for development (eg Ecologically Significant Areas and/or geotechnical hazard).

The following factors are considered relevant in terms of the difference in the average lot yield.

a. *Benefit of Scale;* larger area of land allows greater controls over development configuration enabling greater control over the distribution and variety in lot size. Smaller land area in influenced by a greater edge effect imposing more constraints on potential configurations.

b. *Topographical Challenges;* the *Amberfield development* is located on more extensive areas of flatter land (*Terrace Area*) requiring less modification to develop building platforms, while the *Northview development* is located on more undulating landform (similar to that

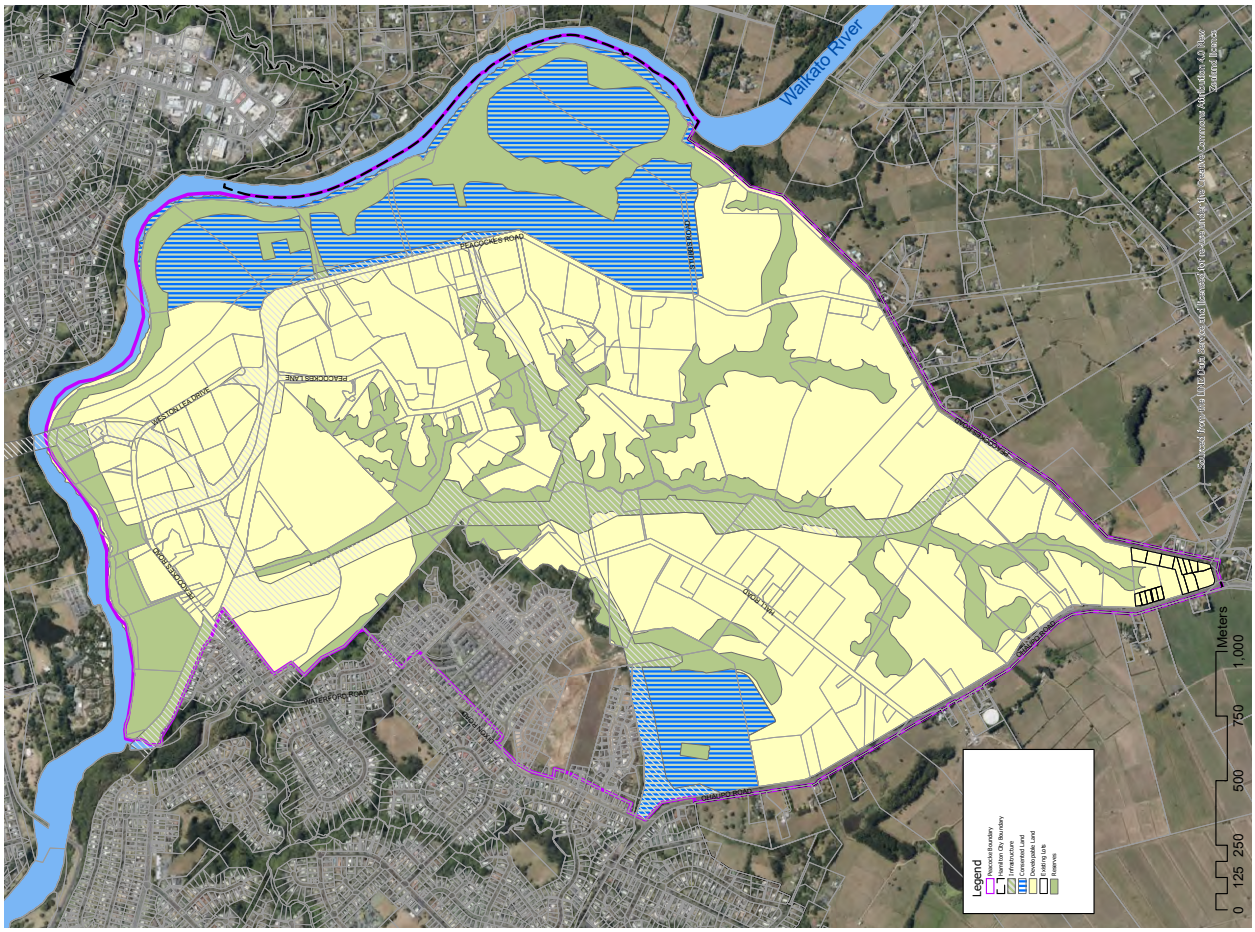


Figure 9a; Location of two areas of consented land.

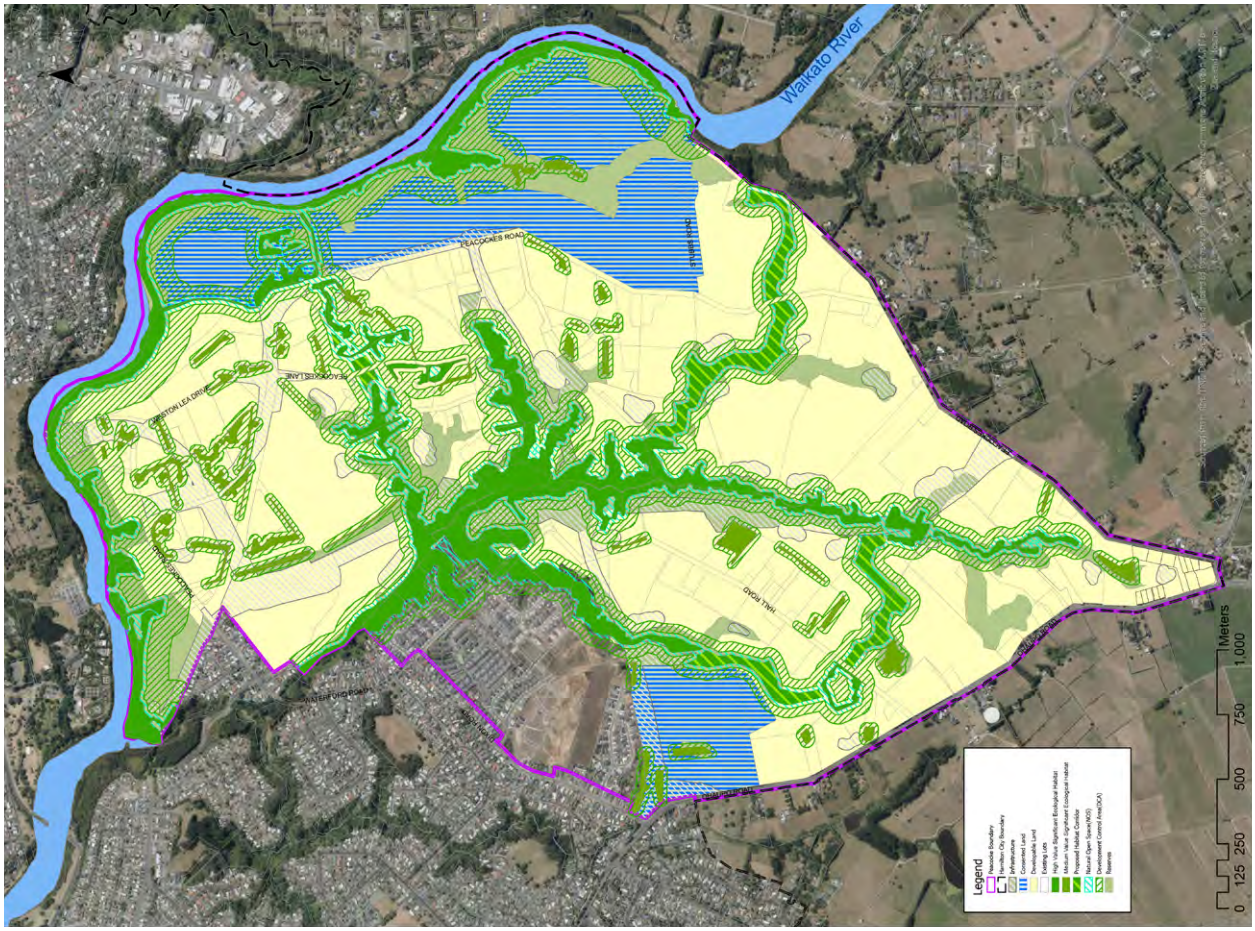


Figure 9b; Location of two areas of consented land.

of the *Hills Character Area*), requiring more landform modification to provide road infrastructure and develop building platforms.

c. *Stage of Development*; the *Amberfield Development* represents a master planned development with provision for further resolution subject to market consideration and staged detailed refinement. The *Northview Development* represents a more detailed stage of development with the resolution of areas to a higher level of more specific detailed design.

d. *Grain of Development;* smaller lots produce smaller block sizes. As the average lot size decreases the ratio of road network to developable land also increases. This has an economic implication as the cost of developing more roading is typically offset by more lots. Smaller lots produce a greater return per m2 than larger lots. The *North View Development*

has a smaller grain of development overall.

3. IMPLICATIONS FOR THE STRUCTURE PLAN AREA

While the preceding factors have implications for the balance of the *Structure Plan Area,* three are most pertinent, *benefit of scale, topographical challenges and grain of development.*

Benefits of Scale

While the balance area of the structure plan is larger than the combined area of the consented developments, the spatial separation generated by the gully system reduces the developable land to a series of smaller parcels. While in some cases these parcels are not significantly smaller than the *Amberfield Development,* the complexity of these parcels is much greater.

Rather than these parcels being long broad areas offset from a linear road edge, these parcels extend from short linear edges, which have limited potential for connectivity, and configure to form tapering peninsulas with detailed irregular edges. As a consequence, the potential for replicable layout configurations is reduced, an internalised road network is required and a greater extent of development roadway per lot will be required. Further the relationship of road infrastructure and ecological reserve areas, restricts connectivity between parcels and within the wider network.

Topographical Challenges

The balance area is predominantly classified as *Hills Character Area*. Within this *character area* the topography is generally rolling hills with slopes, typically ranging between 5 to 20 degrees. (Although limited areas exceed 20 degrees). The landscape character approach advocates the retention of the overall landform in the area. While some land modification is possible within this context, it is constrained by the ecological values protected within *Significant Ecological Habitats*, *Proposed Bat Corridors* and *infrastructure development.*

Within the areas of identified ecological value, it is not only necessary to maintain existing ground contours within these areas, but also to ensure that the relative hydrology of the surrounding catchment is maintained in order to supply an appropriate level and distribution of water into the systems. Further the development of road infrastructure, including storm water detention, is constrained by engineering design and safety standards that determine the engineered road gradients and the location of storm water detention facilities. In combination these factors result in some challenges for urban development seeking good urban design outcomes.

Grain of Development

Topographical challenges also influence the *grain of development* as the configuration of a subdivision is driven in part by the minimum lot size. Within this *character area* the topography is generally rolling hills with slopes, typically ranging between 5 to 20 degrees. (Although limited areas exceed 20 degrees). Under the ODP, minimum lot size on slopes in excess of 5 degrees is 800m2. Most of the sloping land within the *Hills Character Area* is currently in excess of 5 degrees.

The contemporary response for development on sloping ground is to create flat areas to achieve useable space within residential lots. Larger lots are typically encouraged to provide room for the mitigation of the slope. This is generally achieved through the introduction of battered slopes or retaining walls. Larger lots however capture more of the sloping ground required to be mitigated. This can result in a continuous chasing cycle; while the use of batter slopes are desirable, they generate extensive areas of 'unusable' (not flat) land. The alternative is to utilise retaining walls which occupy less space, allowing more usable land to be created. As these are often implemented on a lot-by-lot basis, both the quality and appearance of retaining walls can vary, cumulatively producing an undesirable visual effect within a development.

In addition to the potentially undesirable character outcome of extensive retaining walls of varying construction within the area, the larger lots carry an associated economic effect of fewer lots being created to offset the infrastructure costs.

To offset some of the economic implications for the *Structure Plan* area, consideration of opportunities to increase the number of lots within the area is included in the following section.

4. POTENTIAL FOR INCREASED YIELD WITHIN THE STRUCTURE PLAN AREA

Further information within the structure plan area has identified areas which constrain development for ecological and geotechnical reason or are required for infrastructure. These areas are more extensive than contained in the *ODP Structure Plan*. From a visual amenity perspective, this will create an attractive setting for residential development, however the cost of development will be affected as the potential numbers of lots (yield) serviced by the infrastructure are reduced. Options for increasing the yield of development are therefore considered. There are two fundamental approaches: *Intensification* and *Rationalisation*.

Intensification

Intensification can be achieved in two ways;

1. A *reduction in the minimum lot size or grain* of development, which allows a greater number of lots within the same area; OR
2. An increase in the *density* of development which increases the number storeys and/or site coverage permissible within a development on a lot.

As the structure plan area is segregated by the pervasive gully system an opportunity exists to encourage *increased density* in areas that are adjacent to the gully system, particularly on narrow peninsulars of developable land. The gully system is proposed to be enhanced to provide high amenity. The narrow peninsulars of developable land are relatively limited in area and constrained by narrow access areas.

Development with increased density in these areas, such as terrace housing or apartment blocks, would potentially allow an increase in development height to four storeys and provide increased site coverage. Such development would need to demonstrate its effects on adjacent amenity and integration with surrounding development in the vicinity. Specific consideration of shadowing, overlook and response to the wider pattern of development would need to be considered. It is anticipated that this approach would be suitable for some limited areas.

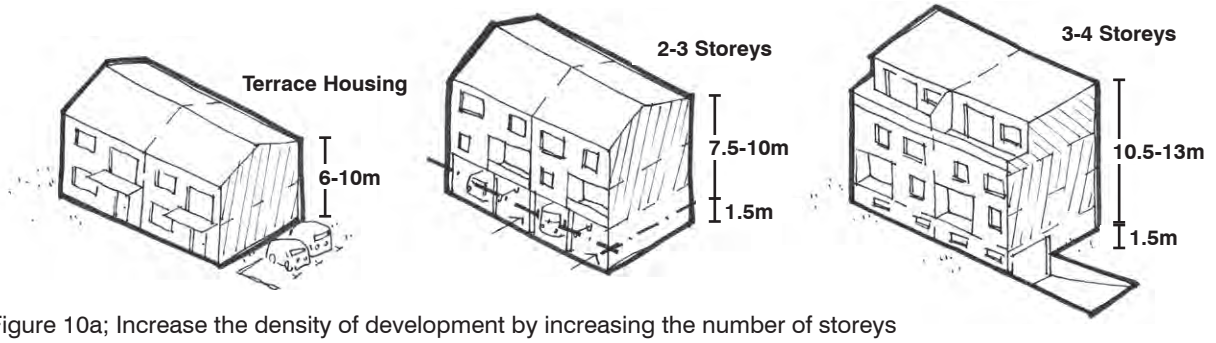


Figure 10a; Increase the density of development by increasing the number of storeys

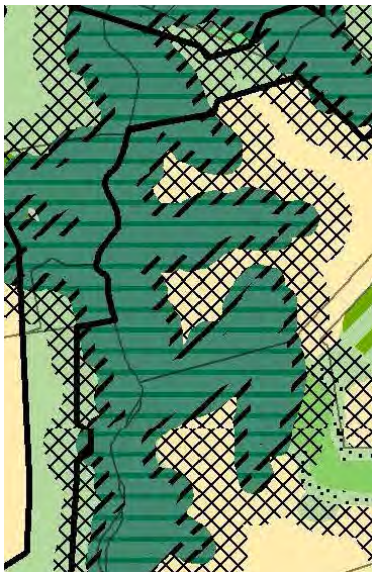


Figure 10b; Existing constraints along gullies creates narrow peninsulas of developable land.

Figure 10c; Permitted standalone residential development (800m^2).

Figure 10d; Higher density development : 400m2 lots, terrace housing, 2-4 story building.

Figure 11a and 11b; Progression from permitted density to high density through reduced lot size, reducing grain of development adjacent to higher amenity areas.

A more generic approach to intensification can be achieved by reducing lot size to increase overall yield. This opportunity exists within the structure plan where a large portion of the *Hills Character Area.* Within this *Character Area* the minimum lot size is differentiated based on steepness of topography; land in excess of a 5 degree slope requires lots with a minimum net site area of 800m2. The *Northview Development,* however, has an underlying topography like the *Hills Character Area*, and supports the smaller minimum lot size of 400m2. This would indicate that the smaller minimum lot size could be applied across the *Hills Character Area*. By applying the minimum lot size of 400m2 across the entire *Hills Character Area*, the increased *grain* of development has the potential to substantially increase the yield for the area.

More detailed contour analysis as part of the development evaluation as gradients steeper than 10 degrees may still require larger lot size to enable appropriate integration. This approach is still affected by the configuration of the land available for residential development, where the gully incursions create narrow peninsulars of developable land, but the smaller grain (lot size) allows a better fit within the network of gullies and reserves. Further, intensification by increasing the grain is not a simple multiplication factor of the original lots layout, but typically increases of the extent of road infrastructure as a result of the narrowing of block configuration.

Rationalisation.

By contrast *rationalisation* seeks to increase the area available for residential development by releasing areas previously attributed potential habitat status. Within the rationalisation approach two options exist which may allow the release of previously unallocated land, identified *medium* and *low Ecological Habitats* but not captured as part of *proposed bat corridor,* for further development.

Remnant Rural Plantings

The size and distribution of fragmented *medium and low Ecological Habitats* throughout the *Structure Plan Area* largely corresponds with the existing rural vegetation patterns (hedgerows, shelter belts or groups and stands of trees), and their use by the indigenous fauna. Remnant rural plantings which have been identified as *moderate to low ecological habitat* , and not proposed to form part of the *Proposed Bat Corridor,* can be considered for removal. Due to the remnant nature of such planting, they are typically irregularly located and of a form that does not integrate well within a finer grained overall subdivision pattern. In many instances their removal would provide more space and allow an improved configuration of development. The development of *offset works* to allow their removal should be considered.

As a further consideration, in some instances amenity value may be derived from the retention of all or part of remnant rural plantings in themselves. This would need to be evaluated at the time of the subdivision design as, although retention of mature trees within a subdivision is a valuable amenity, some species and/or specimens are unsuitable for retention within a more built-up context. This would need to be considered on a case-by-case basis.

Gully Heads

Within the *Structure Plan* development, a preliminary principle has been to allocated *Reserve* status to the gully landform to enable its revegetation and integration. Factors supporting this approach are the extent of geotechnical hazard associated with the gully system, making it unsuitable for development, and the ecological benefit associated with *Proposed Bat Corridors,* creating continuous linkages throughout the site.

In the southern portion of the structure plan area however, several gullies exist which are emergent branches off the main system. These areas have not been identified as geotechnical hazards; do not contain the seismic buffer and have not been identified as *Significant Ecological Habitat.* While they have been proposed as preliminary reserve areas, they encroach into the fabric of the subdivision and, in some instances, create substantial incursions limiting connectivity and extension of the residential development. It is considered that infilling a portion of these emergent branches, would provide an increase in the land area available for development and improve connectivity. This would need to be considered in context of detailed landform modelling, assessment of hydrological implications on the associated gully network and geotechnical verification, and any subsequent ecological assessment.

.

Figures 12a, 12b and12c; Progressive infilling of gully head allowing increased lot numbers and improved development layout.

Combined Approach

The *rationalisation* and *intensification* approaches are not mutually exclusive and the application of one or other, or both, to discrete areas of the *Structure Plan* are recommended to achieve the best fit for development. The application should be guided by *urban design principles* which encourage increased density adjacent to areas of high amenity and open space, and consideration of a transect approach. In this instance the transect should be considered in relation to the intensification adjacent to the *Proposed Bat Corridors,* moving to relatively larger lots toward the southern, western and eastern edges of the site.

IV. Urbanisation

1. EFFECTS OF URBANISATION ON LANDSCAPE CHARACTER WITHIN THE STRUCTURE PLAN AREA

The visual character of the *Structure Plan* area is predominantly rural, but in a state of transition, containing areas of residential development in the northwest, with most of the development over the balance of the site being lifestyle and farm blocks. Consequently, the area still retains extensive shelter belts and scattered clusters of specimen trees set within a wider pastoral background. This backdrop is interspersed with the incised stream system and edged by the eastern boundary by the river.

The most significant visual change that will occur with the urbanisation of the structure plan area is the replacement of the existing rural land cover of pasture and shelter belts by residential development. The change to residential development is significant as it results in a degree of modification to the underlying landform while overlaying a mosaic of buildings, varying in height, form, extent and colour across the area. This process physically alters the landform at the subdivision level, creating the benches and building pads that accommodate the roads and building sites

The development of houses, inter-lot fence lines and curtilage constrain the views and obscure the underlying landform. These elements block penetrative views within the development, while the variety in form and height of residential development largely obscures the nature of the underlying landform. At the broader level, the underlying topography is still perceptible, but only when wider views of the residential development are obtainable. This typically occurs when the individual residential development subsumes to the subdivision, to appear as a coherent residential cover, revealing the underlying topography again.

Not all *Structure Plan* areas will be built on, with reserves, road corridors and community facilities separating neighbourhoods within the zones. The incised gully stream system and riverbank, identified as *Significant Ecologicak Habitat* and *Proposed Bat Corridors*, will be extensively revegetated, creating forested areas. Community facilities, such as sports field and neighbourhood parks, will create expansive grass open space areas of parkland character. Arterial roads will also break the extent of residential development, not only spatially, but in particular where extensive roadside berms are present. In some instances, the road carriage way itself is largely screened by berm side planting, creating the impression of a broad swathe of planting.

It is anticipated that, with the maturing of the areas of *Significant Ecological Habitat* and *Proposed Bat Corridor,* extensive berm planting and neighbourhood parks, development of discrete parcels within the *Structure Plan* area will be largely screened from one another. The overall effect will create a development comprised of discrete residential areas connected by vehicular and pedestrian network which is interwoven within significant vegetated corridors.

Landform with Overlying Residential Development

The existing underlying topography is an important component of the broader landscape character of the site. While it is intended to retain the existing topography as much as possible, the practicalities of doing so while shifting to a substantially different land use (from rural to residential) is difficult to achieve. The transition from naturally determined landscape character (indigenous forest and grassland to culturally determined landscapes (rural and residential) all involve a level of modification to the landform, with the extent of intervention increasing the further one shifts from a natural character toward

a more culturally modified (constructed) landscape character.

This is explicit in the transition from rural pastoral character to residential character; the legibility of landform between landscape characters can differ greatly. The nature of the pastoral landscape reduces the land cover to a low growing monoculture that closely follows the landform, albeit with the occasional shelterbelt intervention. This pastoral landscape character, although resulting in frequent fine re-contouring of the landform through cultivation, is one that is very revealing of the underlying landform. The Most agrarian land use creates a comparatively thin and consistent veneer of vegetation over the underlying landform.

By contrast the transition to residential land use introduces a more extensive modification of the landform itself, and greater variety and scale in the land cover. The legibility of the landform becomes what can be determined beneath the overlying mosaic of houses, associated curtilage development, and the variety of built form that land cover may take. Consequently, the visible expression of landform within residential development is apprehended at a macro level, in a broader sense of residential blocks rather than scrutinised to the nearest metre. This has implications when considering the retention of landform within the *Structure Plan* area as, within areas of development, topography will only be legible in the broad context, as a general form rather than subject to detailed scrutiny. Subtle topographic variations are lost to the transition.

Within areas of residential development therefore, modification to the landform that results in improved urban design outcomes while maintaining the landform in the broader context is compatible with the desired overall landscape outcome. This compatibilist approach is a useful guide to evaluating landform modifications within the *Structure Plan* area. This approach is consistent with the policies that support the objective identified under section 5. *2.8 Peacocke Character Zone* of the *ODP*. It must be considered with respect to the retention of both the landform and ecological qualities of the ecological habitat areas as discussed below.

Landform around Ecological Reserve Areas

The landform within the ecological reserve areas (*Significant Ecological Habitat* and *Proposed Bat Corridors*) is required to remain largely unmodified to maintain their ecological qualities. As these areas are pervasive within the *Structure Plan* area, by default they will largely determine the broader landform. Landform modification should only occur outside these areas, and in manner that does not adversely affect the ecological quality of the reserve areas. .

Of relevance is the hydrological qualities of the stream gully system and surrounding areas, both in terms of the formative processes of the gullies and the health of stream system within it. These systems are determined not only by the gullies themselves, but the water catchments that surround them.

Modification to surrounding landform should be guided by the broad topography of the exiting site. High points should remain relative high points within the modified landform. Low points should remain relative low points. Intermediate easing of gradients is anticipated. Consideration of the existing general landform should be used to guide landform modification, improving the integration of residential development while ensuring the ecological qua of the retained areas. In the event of conflict between these land uses, the maintenance of the ecological reserve areas must take precedence. This allows an appropriate level of landform modification integration.

Landform modification of surrounding areas is only acceptable if it maintains the ecological qualities that are required to sustain the areas of *Significant Ecological Habitat* and *Proposed Bat Corridors* .

Guidances and Recommendations

The following *guidance* and *recommendations* have been prepared to augment the typical urban design approach with respect to the specific landscape characteristics of the *Peacocke Structure Plan* area. The *guidance* relates to matters that may assist with the understanding of the context or suggest an approach that may be used. The *recommendations* relate to matters that must be considered to ensure the desired outcome for the Structure Plan area. While most of the following sections contain both *guidance* and *recommendations*, the approach to development adjacent to *Significant Ecological Habitats* and *Proposed Habitat Corridors* contains proposed rules to direct development

2. RETENTION OF NATURAL LANDFORM

The *Structure Plan* area contains extensive areas of gently undulating to rolling landform. Development on sloping sites provides desirable vistas and overlook, however contemporary residential development seeks level building sites and outdoor space. As highlighted previously, while some landform modification is an expected co-committant to the urbanisation process there are limitations on landform gradient that are suitable for this approach. Gradients in excess of 10 degrees (20%) are typically unsuitable for the contemporary residential development approach and will require alternate design approaches. These may include to residential development such as stepped mid lot development, pole houses or more extensive. (Refer to figures 13a, 13b and 13c).

Guidance

i. Modification to landform is an anticipated co-committant with the shift from rural residential to residential development.

ii. Ecological reserves are fixed points within the existing landscape.

iii. Modification to landform should be guided by the broad topography of the exiting site. High points should remain relative high points within the modified landform. Low points should remain relative low points. Intermediate easing of gradients is anticipated.

iv. The general undulations within the topography should be emulated. Remnant landforms should be contoured to integrate with the broader topography of the area.

v. Consider the extent of flat area required within a site. Utilising as much of the original slope profile can be relatively cost effective to achieve, and still create attractive lots.

vi. Minimise retaining walls in the front yard of lots to improve the amenity of streetscapes. Berms or sloping landscaped areas are preferable in front yards.

vii. A combination of batters and retaining walls located inter lot can be an effective device for absorbing vertical differences without being highly visible from the public domain.

viii. Gradients in excess of 20% are typically unsuitable for the contemporary residential development approach and are likely to require specific design approaches for residential development.

ix. Steeper lots are likely to produce the need for high retaining walls. Consider reducing building platforms by building two or more storeys.

x. Limit the range of retaining walls style within a development, especially

where those retaining walls are seen from publicly accessible locations.

xi. Where larger scale subdivision is being undertaken by a single developer it is preferred that the developer should undertake the bulk of the retaining work in a consistent style.

xii. Consideration of a design guide for the area to assist with an understanding of the desired approach and expectations.

Recommendations

The following recommendations are proposed to retain *Natural Landform* within the *Structure Plan* Area.

a. *Significant Ecological Habitat* and *Proposed Bat Corridors* should not be subject to landform modification or the adverse effects of modification to the surrounding landform.

b. The existing general landform should be used to guide any landform modification by replicating the general orientation of topography in order to improve the integration of residential development with the site.

c. Roading within the structure plan area should reflect the topography and features within the site

d. On sloping ground, lot orientation and size should be considered to reduce the extent of retaining required. Running lots along the contour requires less retaining than running across the contour.

e. On sloping ground, extensive cutting to create building platforms should be avoided.

f. Where retaining walls are required, they should be no higher than 1.5 m tall. If taller retaining is required, it should be stepped with a minimum 0.5m space between them to allow for planting to break the apparent expanse of wall.

g. No retaining wall or fence combination should be taller than 3m.

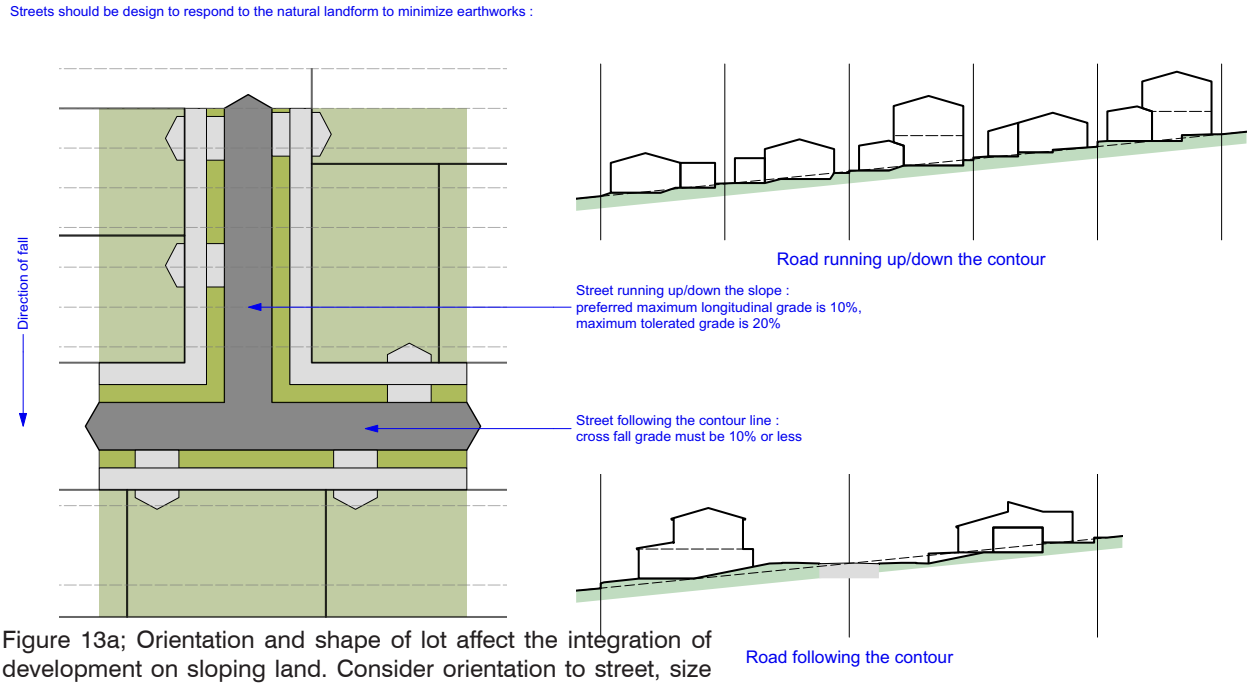
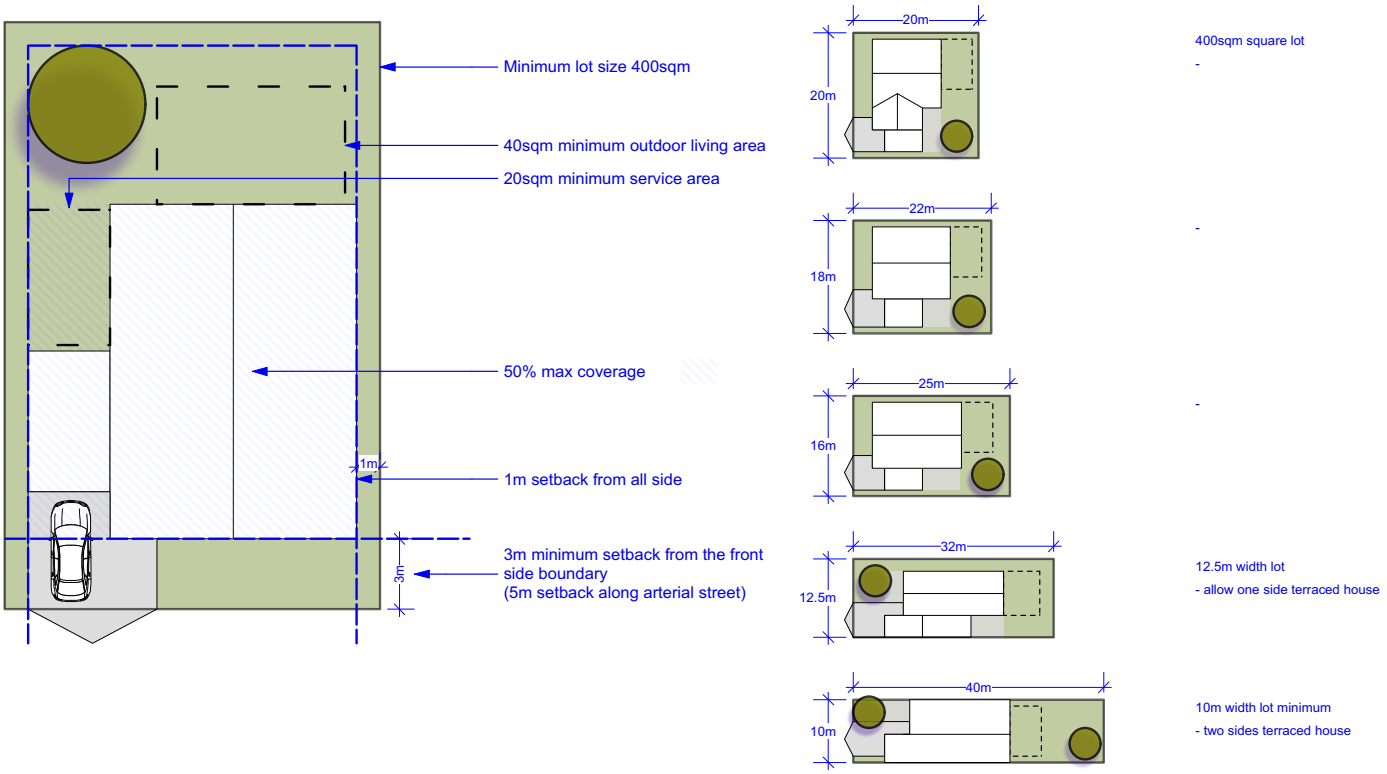
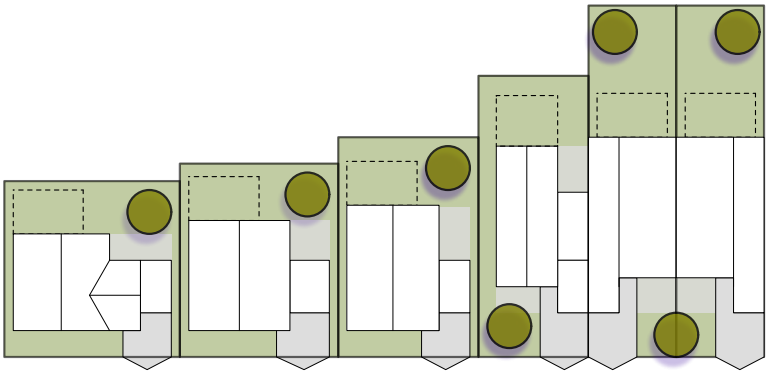
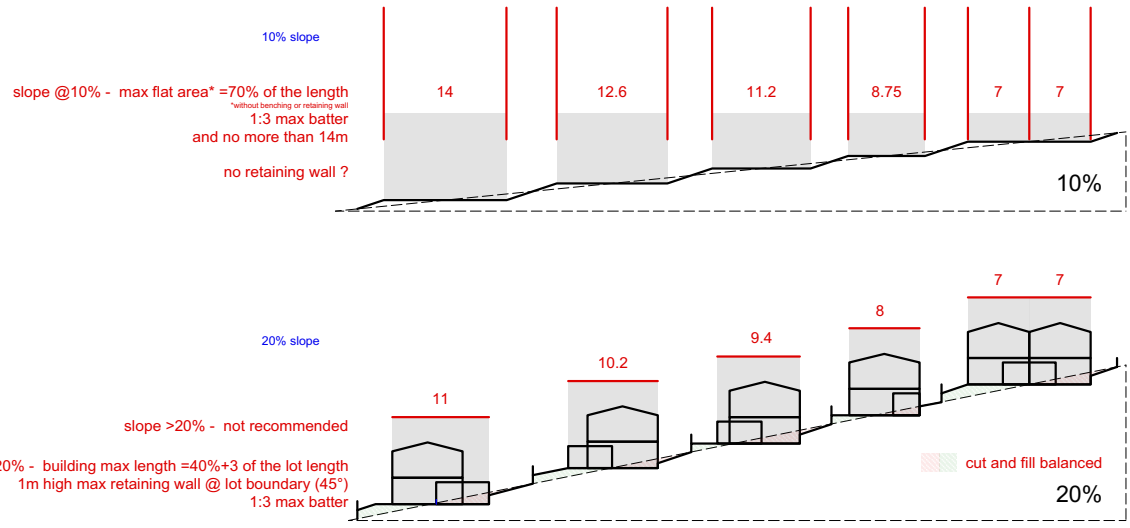


Figure 13a; Orientation and shape of lot affect the integration of development on sloping land. Consider orientation to street, size and shape of lot with respect to the slope gradient.







Figures 13b and 13c; Orientation and shape of lot affect the integration of development on sloping land. Consider orientation to street and size and shape of lot with respect to the slope gradient.

Peacockes Structure Plan Review
July 2021 | 33

3. KEY BAT HABITATS AND PROPOSED BAT CORRIDORS

The focus of much of the habitat maintenance and restoration within the *Structure Plan* area is the *Mangakotukutuku Gully System* and the western *Waikato riverbank*. While the W*aikato riverbank* and large areas of the gully system have been identified as *Significant Ecological Habitat* and afforded proposed enhancement and protection from development, there remains portions of the gully system that were not identified as high value.

Although these fragmented areas currently may present more depleted ecological habitat, they form part of the wider gully system and through habitat enhancement will, in conjunction with the *Significant Ecological Habitat* areas form a continuous ecological corridor. Once established the gully system would provide an extensive connected ecological corridor throughout the structure plan area. This ecological corridor will assist in supporting not only the long-tailed bat, but other indigenous flora and fauna. These depleted ecologically fragments of the gully system are identified as *Proposed Bat Corridors.*

In addition to habitat enhancement, the proposed ecological corridor may also provide an opportunity to facilitate bat movement across the road network where the road is at grade with the ground level. (This is distinct from bridges where the elevated roadway is located above the typical flight path of the bats). The provision of heavily vegetated corridors with over hanging tree canopies either side of the roadway, which reduce the gap between portions of the corridor, are referred to as *Bat Hop Overs*. These are currently considered a viable option for supporting *bat commuting* but would be subject to revision with further research. (Refer to figures 14a, 14b, 14 c and 14d).

Guidance

i. Avoid locating roads through *ecological corridor*.

ii. Where roads pass through the *ecological corridor;*

- Where roads are at grade create *bat hop overs.*
- Elevate berms to enhance the *hop over* effect.
- Consider split lanes with planted central islands.

iii. Within revegetation areas, consider to both fast and slow growing tree species including *Kunzea, Cordyline australis, Plagianthus regius* as well as, *Podocarpus totara, Dacryarpus dacryoides*. (A more comprehensive list of suitable species is to be developed in association with Ecologists)

iv. Consider the development of informational signage to heighten public awareness of potential conflict areas.

v. Within reserves and riparian areas, consider poison rather than felling unwanted trees where practicable, to provide potential roost trees for bats.

Peacockes Structure Plan Review
July 2021 | 34

Recommendations

a. Any landform modification around *Significant Ecological Habitat* and *Proposed Bat Corridor* areas should maintain the hydrology to the areas.

b. Within the *Significant Ecological Habitat* and *Proposed Bat Corridor* areas any restoration and enhancement planting should be undertaken with eco-sourced vegetation.

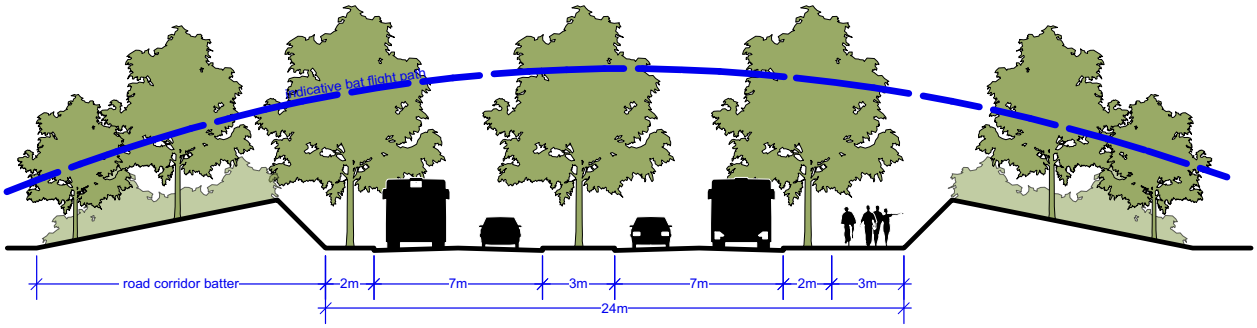
c. Lighting used adjacent to *Bat Buffers* or *Proposed Bat Corridors* should be low output and avoid light spill. No lighting shall result in levels greater than 0.1 lux standard when measured within 3 metres of an SNA boundary. *(Refer to following section)*.

d. Where bridge structures must pass through the *Proposed Bat Corridor*, they should be above bat flight paths.

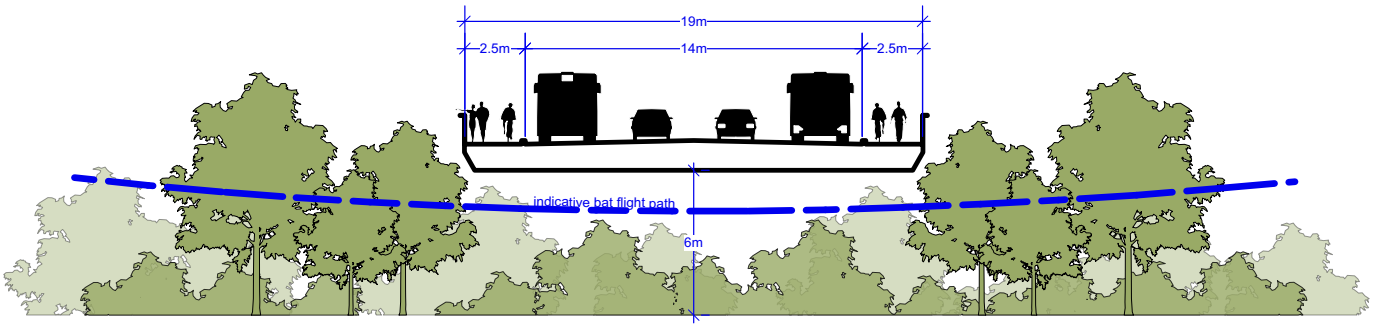
e. Where roads must pass through the *Proposed Bat Corridor* there width should be minimised as much as practically possible and, if necessary, consideration should be given to slow speed environments to facilitate the narrowing.

f. Where roads must pass through the *Proposed Bat Corridor*, they shall include bat disturbance mitigation structures such as the development of *Bat Hop Overs*;

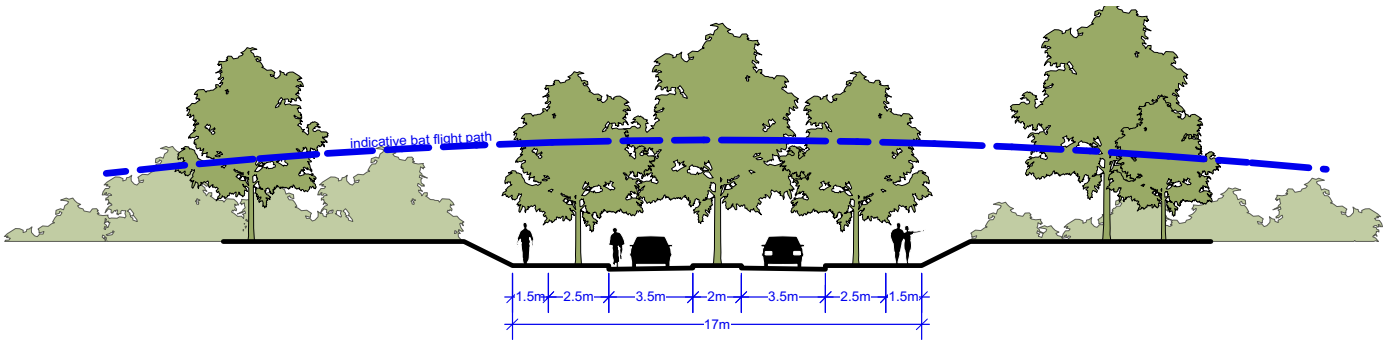
Please note: Evidence validating best practice response to maintaining and enhancing bat ecology within urban and peri-urban environments within New Zealand is at a very early stage. This guidance and recommendation should be reviewed considering subsequent evidence.



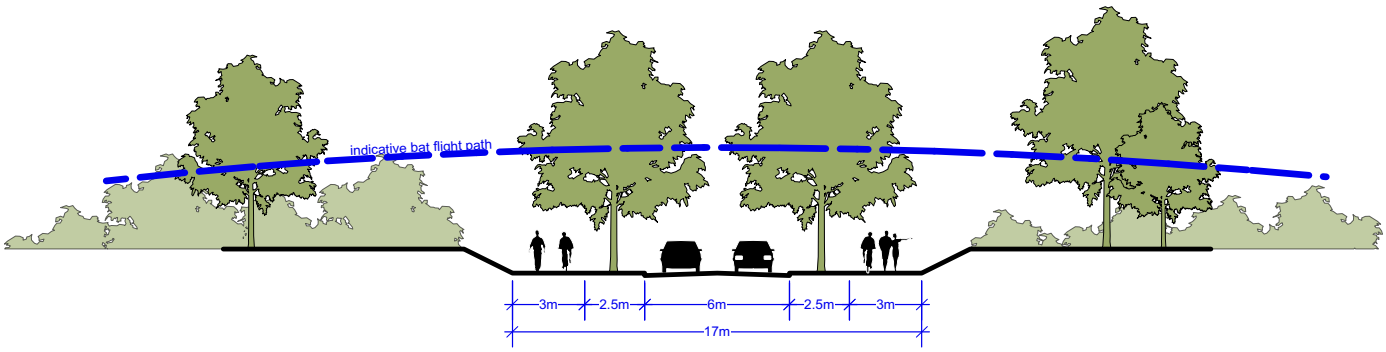
Hop Over Option



Bridge Option
road crossing over a gully



Hop Over - Option 1



Hop Over - Option 2

Figures 14a, 14b, 14c and 14d; Options for roading landscape interventions to assit with bat movement through the Structure Plan area.

4. LIGHTING APPROACH WITHIN THE STRUCTURE PLAN AREA

The development of the S*tructure Plan area* will result in a significant shift of land use within the area toward urban development. A typical co-committant of urbanisation is the introduction of artificial light sources which may be antagonistic toward the bat ecology located within the area

Sources of lighting which can disturb bats are not limited to roadside or external security lighting, but can also include spill via windows, and permanent but sporadically operated lighting such as sports floodlighting. Further, the colour temperature of light can also have an effect on bats, whether it is a warm yellowish light (2700- 3000 K) or a cool bluish light (+5000 K). Warmer light has been found to be less disturbing than bluish light to bat ecology.

The location, orientation and height of newly built structures and hard stand areas can have a substantial impact on light spill. Small changes in the placement of footpaths, open space and the number and size of windows can all achieve a good outcome in terms of minimising light spill into *Significant Ecological Habitat* and *Proposed Bat Corridor areas.*

The Structure Plan development has a responsibility to protect, maintain and enhance the habitat and, as such, specific guidance in relation to the nature and use of lighting within the area has been developed. (Refer to figure 15).

Guidance

i. Led luminaires should be used where possible due to the sharp cut off, lower intensity and good colour rendition and dimming ability. They should always be mounted on the horizontal (no upward tilt).

ii. Light pole heights should be carefully considered to minimise light spill.

iii. Streetlights can be fitted with rear shields or have optics selected to stop back light, reducing unwanted light spill and directing light into the task area.

iv. Specialist bollard or low level downward directional luminaires should be considered. Their use should only be as directed by a lighting professional as they can also result in unacceptable glare, poor illumination efficiency and result in poor facial recognition which may be unsuitable for the task area.

v. Any external security lighting should be set on motion sensors with short timers (1min).

vi. Glazing should be restricted or redesigned where it is determined the glazing is likely to be a potential for significant effect on bat habitat. Where glazing cannot be avoided, consideration can be given to factory tinted glazing or window films to achieve illuminance targets.

vii. Light spill can be successfully screened through soft landscaping and the installation of walls, fences and bunding.

Recommendations

a. No light source shall be permitted within the structure plan area if it results in the exceedance of a 0.3 lux standard when measured from a Bat buffer or Bat Corridor boundary.

b. No light source shall be located within *Bat buffer* or *Bat Corridor,* to allow the *Bat buffer* or *Bat Corridor* to act as a light spill buffer.

c. A 5-metre building set back restriction shall be applied to any property that abuts *Bat buffer* or *Bat Corridor*, which restricts the construction of structures or any form of occupied space (such as lighting, buildings, swimming pools, gazebos and caravans).

d. Lighting used adjacent to a *Bat buffer* or *Bat Corridor* should be low output and avoid light spill.

e. The temperature of lighting within public spaces must not exceed 2700 Kelvins.

f. The temperature of lighting within residential properties when bounded by a road must not exceed 3000 Kelvins.

g. Post construction compliance checking should be undertaken to confirm that the proposed lighting level has been achieved. An assessment of compliance by a lighting professional should include a discussion of any remedial measures which are likely to be required to achieve compliance would be appropriate.

Note; Where potential areas of concern are identified, consultation with an ecologist and lighting professional would assist in determining the appropriate level of response.

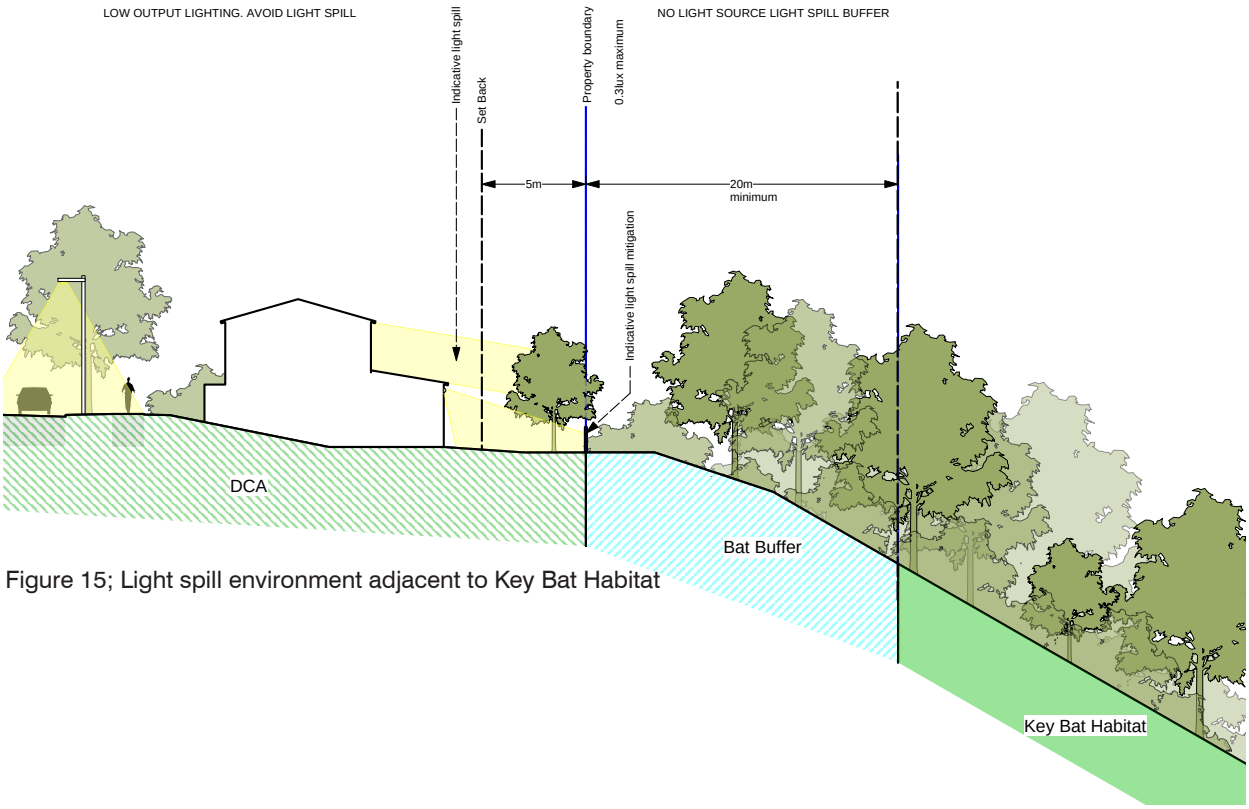


Figure 15; Light spill environment adjacent to Key Bat Habitat

5. RESIDENTIAL DEVELOPMENT ADJACENT TO SIGNIFICANT ECOLOGICAL HABITAT AND PROPOSED BAT CORRIDORS

Within the *Structure Plan* extensive areas of the site have been identified as providing S*ignificant Ecological Habitat* or are proposed to be revegetated to provide such values in the long term (*Proposed Bat Corridors*). To protect these areas from development 'buffer zones' are proposed to control both the proximity and potential effects of permissible development adjacent to these areas. The level of protection reflects the existing or future value attributed to the area. Where the area has been identified as a *Significant Ecological Habitat*, a *Bat Buffer Zone* is proposed that extends for a minimum of 20m from the edge of the high value bat habitat . Where an area has been identified as having depleted habitat value such as an ecologically depleted gully portion, but form an important linkage between *Significant Ecological Habitats*, a 50m wide *Bat Corridor* is proposed. Development that occurs adjacent to either a *Bat Buffer Zone* or *Bat Corridor,* will require a 5 m building set back zone to limit proximity effects of structures. (Refer to figures 15a, 15b and 15c).

Bat Buffers and Bat Corridors

The *Bat Buffer* is a 20m(minimum) buffer zone immediately adjacent to the *high value Bat Habitat.* This buffer zone is proposed to provide a spatial separation between the *high value Bat Habitat* and any development. *Bat Corridors are 50m wide and* are associated with the *Significant Ecological Habitats,* and are intended to establish habitat linkages between *high value Bat Habitats*.

Rules

1. The *Bat Buffer* and *Bat Corridors* may contain predominantly native vegetation and/ or grass, and may contain walking, cycling or maintenance tracks.
2. No buildings are permitted within *Bat Buffers* and *Bat Corridors.*
3. Lighting is not permitted within *Bat Buffers* or *Bat Corridors*
4. Barrier structures and informational or interpretive signage are permitted.
5. *Bat Buffers* and *Bat Corridors* are anticipated to form part of the Reserve Area which contains existing ecological value areas

Set Back Zone

It is proposed that residential development is permitted adjacent to *Bat Buffers* and *Bat Corridors*, however controls will apply to effects of development which may extend beyond the building envelope. Such controls will include light spill, acoustic levels and restrictions on the development of structures within 5m of *Bat Buffers* and *Bat Corridors* .

Rules

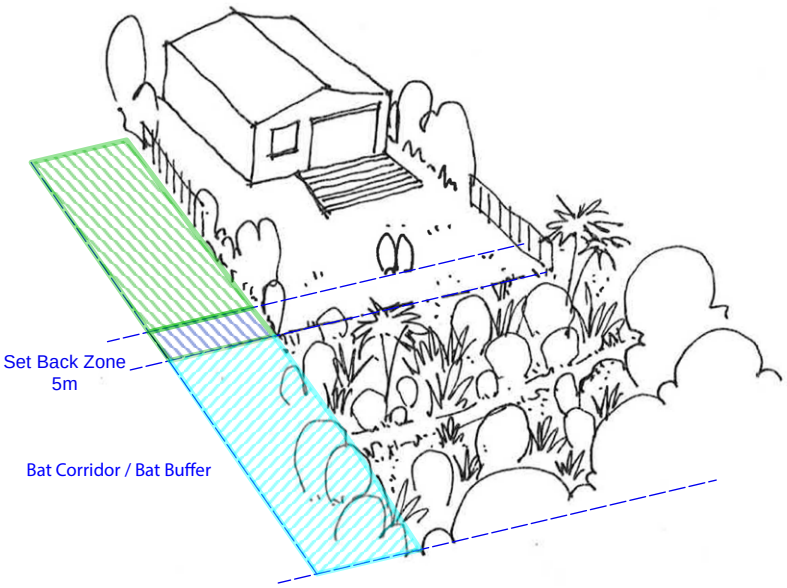
1. Within a *Set Back Zone* no building development is permitted within 5 metres of a *Bat Buffer* or *Bat Corridor .*
2. Higher density development may be considered (up to four storeys) where the development has been determined to have no detrimental environmental effects on adjacent reserve areas. (a *Bat Buffer* or *Bat Corridor)*.
3. Higher density development may be considered (up to four storeys) where the development can be demonstrated to be appropriately integrated, is not appear out of scale with surrounding development.
4. Any proposed building or structure located within a *Set Back Zone* shall be assessed with regard potential environmental effects caused

by the development on the associated a *Bat Buffer* or *Bat Corridor*. This shall include water discharge, light spill shading and noise generation

5. Consideration shall be had to locating noise generating activities or equipment away a *Bat Buffer* or *Bat Corridor*; heat pumps, location of garages and carparks etc.

6. Boundary fences addressing a *Bat Buffer* or *Bat Corridor* shall not exceed 1.6m height and shall provide a minimum 50% visual permeability.

7. Aprivate access gate is permitted within a boundary fence addressing a *Bat Buffer* or *Bat corridor* to provide access to a public track or walkway.



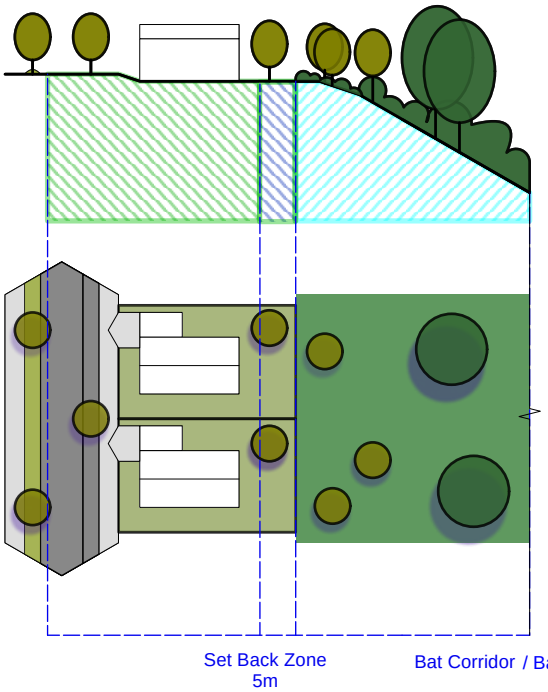


Figure 16a; Examples of the anticipated relationship of development adjacent to the tiered buffer zone

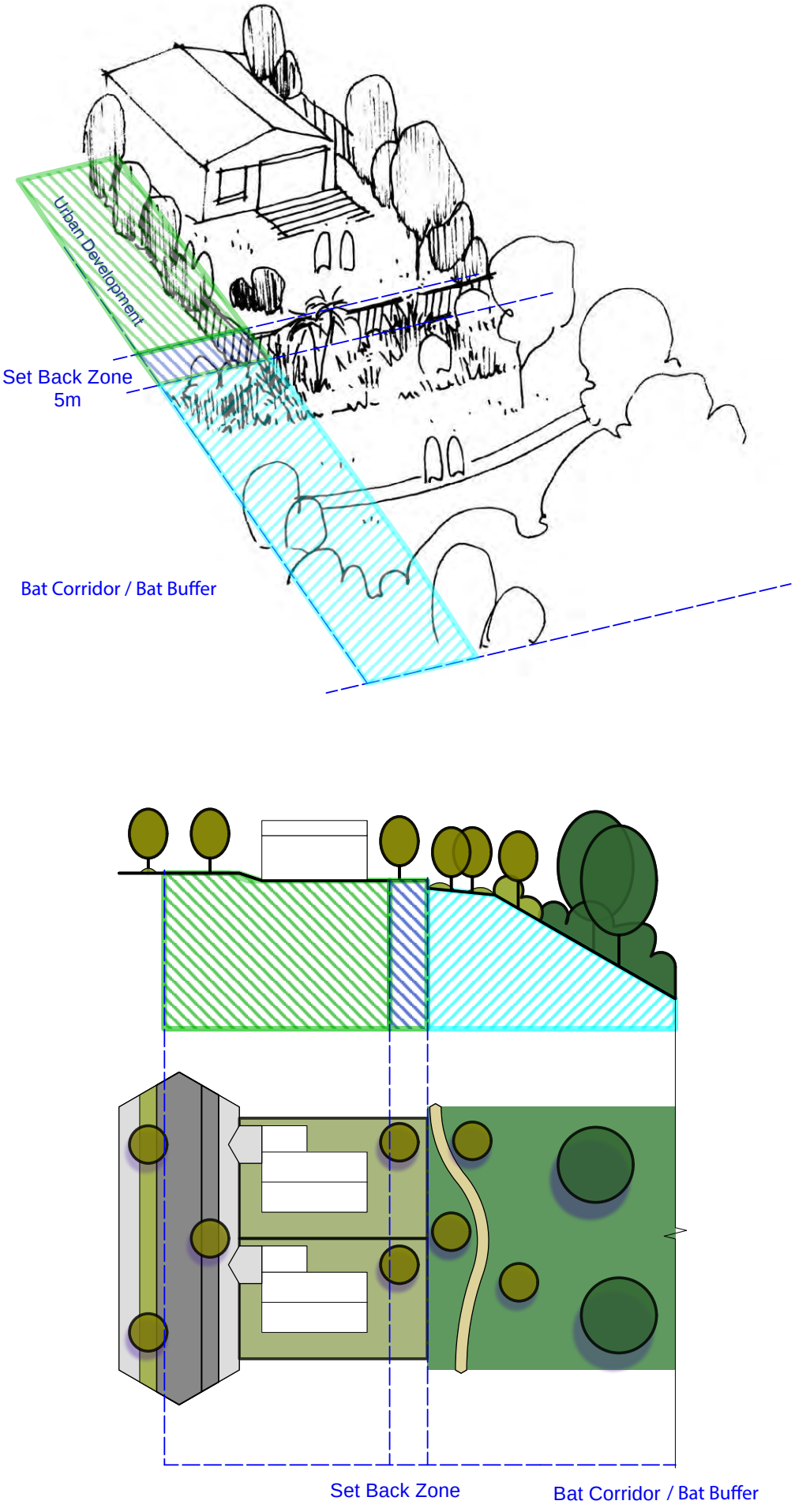


Figure 16b Examples of the anticipated relationship of development adjacent to the tiered buffer zone

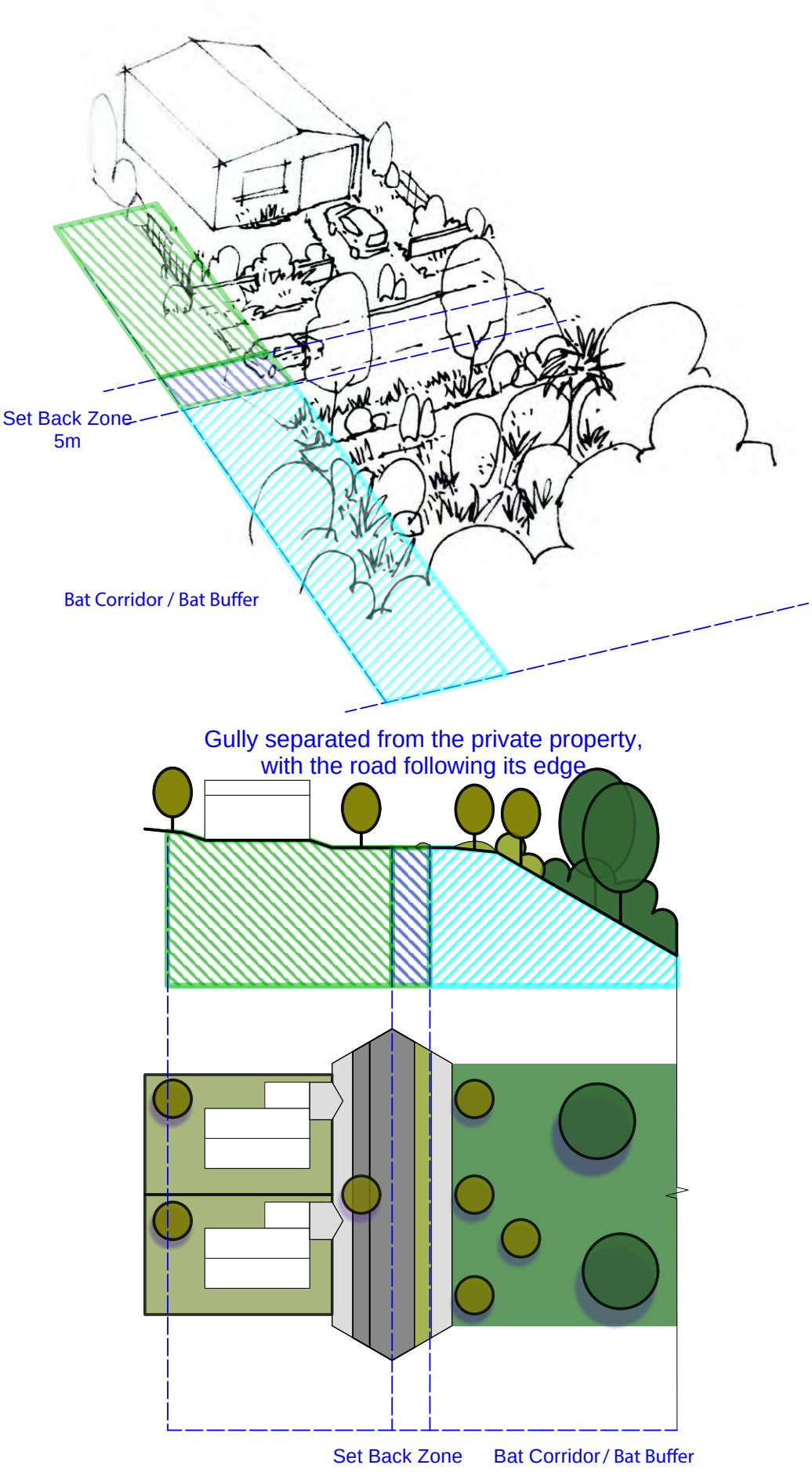


Figure 16c; Examples of the anticipated relationship of development adjacent to the tiered buffer zone

6. DEVELOPED STRUCTURE PLAN

In consideration of the findings and recommendations of this report, two iterations of a Developed Structure Plan have been prepared.

Version 1 of the Developed Structure Plan (refer figure 16) focusses on the development of a complying Structure Plan consistent with the permitted yield expressed in the *ODP*;

a. The layout and configuration respond to the increased extent of identified infrastructure, *Significant Ecological Habitat* and *Proposed Bat Corridor.*

b. It reflects the final rehabilitation of the *Significant Ecological Habitat* and *Proposed Bat Corridor* .

c. It integrates development as a 'best fit exercise'.

d. It reflects the anticipated controls within the buffer zone.

e. It provides vehicular connectivity throughout the site avoiding *Significant Ecological Habitat* and *Proposed Bat Corridor* generally but assumes some bridging will occur as part of the *Southern Links* road network.

f. It proposes a linked walkway/cycle within the reserve area providing connectivity throughout the wider area.

Version 2 of the Developed Structure Plan develops Version 1, (refer figures 17a and 17b) additionally applying the principles of *intensification* and *rationalisation*

a. Introduces areas of greater yield through minimum lot size reduction and increased density.

b. Releases additional areas of developable land through the anticipated offsetting of ecological works, because of removal of selective *remnant rural vegetation,* and landform modification to infill emergent gully heads. Note: this approach has not been propagated through the entire area.

c. It assumes that improvements will be available to enhance the configuration of developable areas to result in the creation of more lots.

d. d. It concentrates intensification in areas adjacent to high amenity such as the *Significant Ecological Habitat* and *Proposed Bat Corridor* system.

Both *Developed Structure Plans* include assumptions in respect to the extent of topographical modification, integration with the existing road network and the proposed southern links development. They also assume no limitations on staging throughout the *Structure Plan Area.* As a result, both *Developed Structure Plans* respond to the topography of the site, existing land cover and features to create a responsive development.

a. The road network is generally located along contour lines where possible avoiding steep gradients.

b. Natural ground level is preserved and protected around *Significant Ecological Habitat* and *Proposed Bat Corridor* areas.

c. A connected street network is utilised following an organic grid framework which responds to the natural landform and the location of protected features and landforms.

d. Street hierarchy is legible and easy to navigate street network.

e. Open space reserves and parks are developed around

significant locations including landscape features.

f. Open space and street network are integrated to provide for accessible neighbourhood network.

g. Lot development is intensified around open space amenity areas, with larger lots to the periphery of the site and conventional and smaller lots generally located on internally around open space amenity areas.

h. Lot size allows for a range of dwelling typologies.

i. Potential for further intensification is designed into development with a larger than minimum lot size built into the scheme.

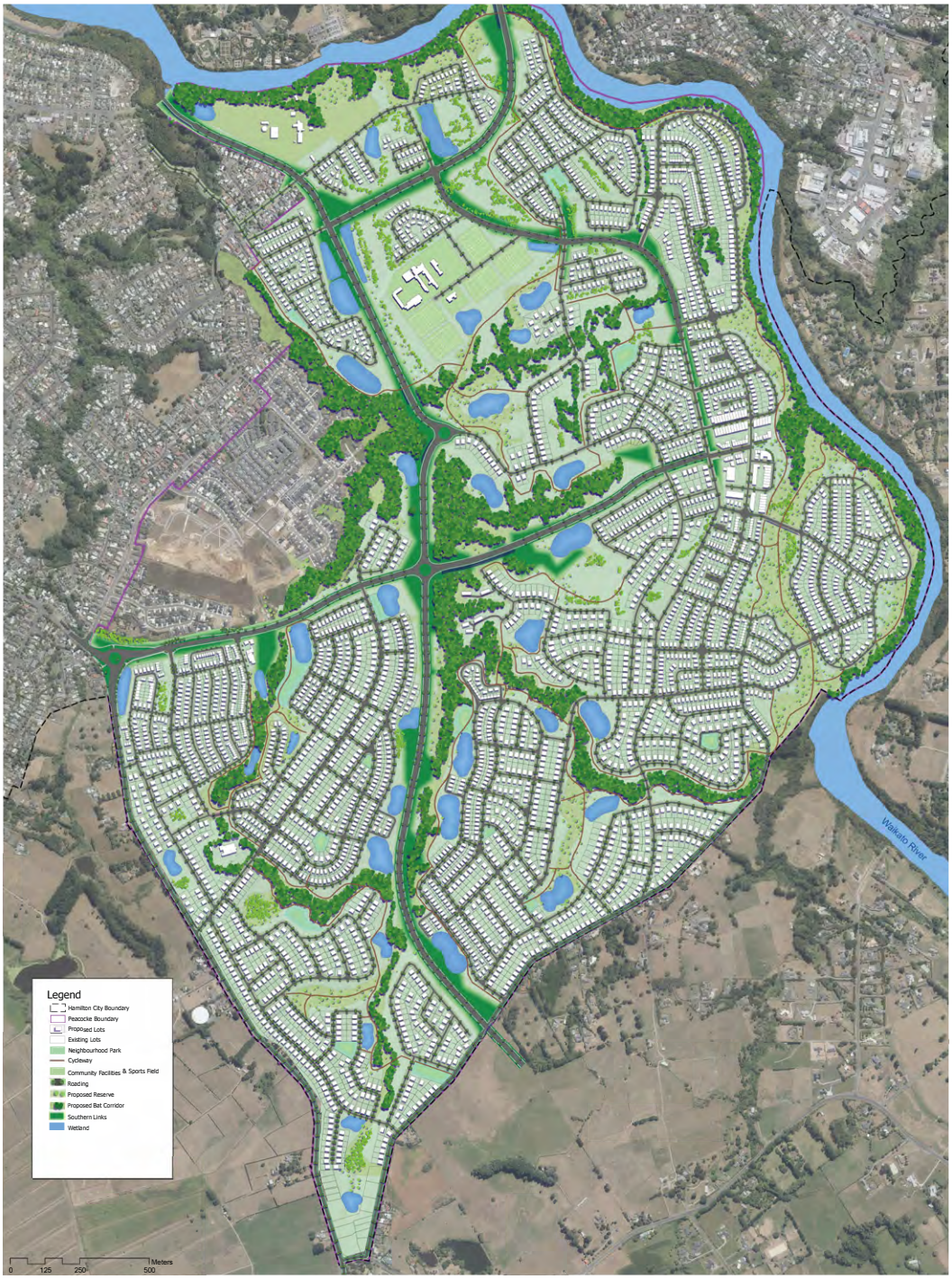


Figure 17, Developed Structure Plan consistent with the permitted yield expressed in the *ODP*;

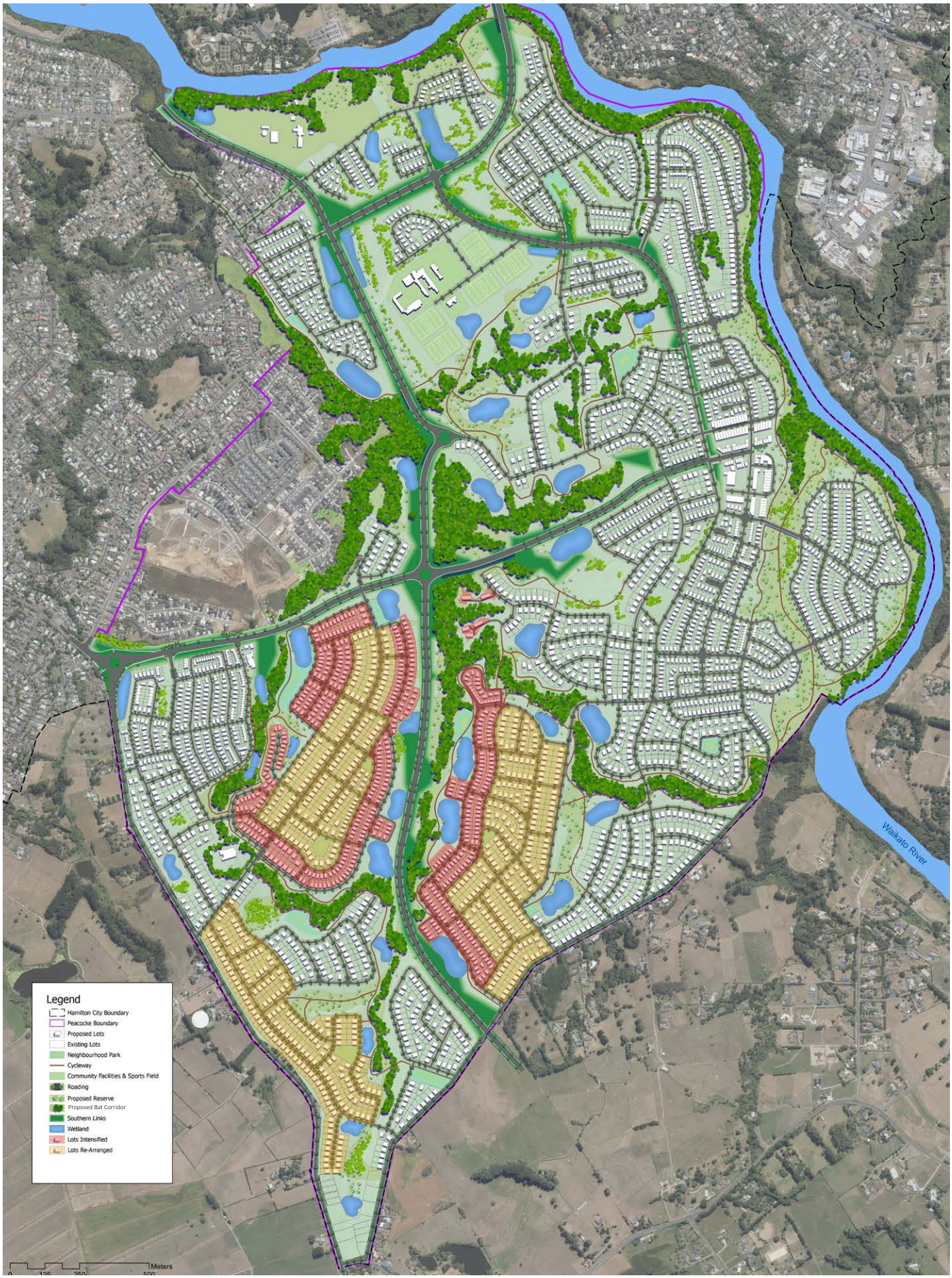


Figure 18a, Developed Structure Plan additionally applying the principles of *intensification* and rationalisation, areas highlighted;

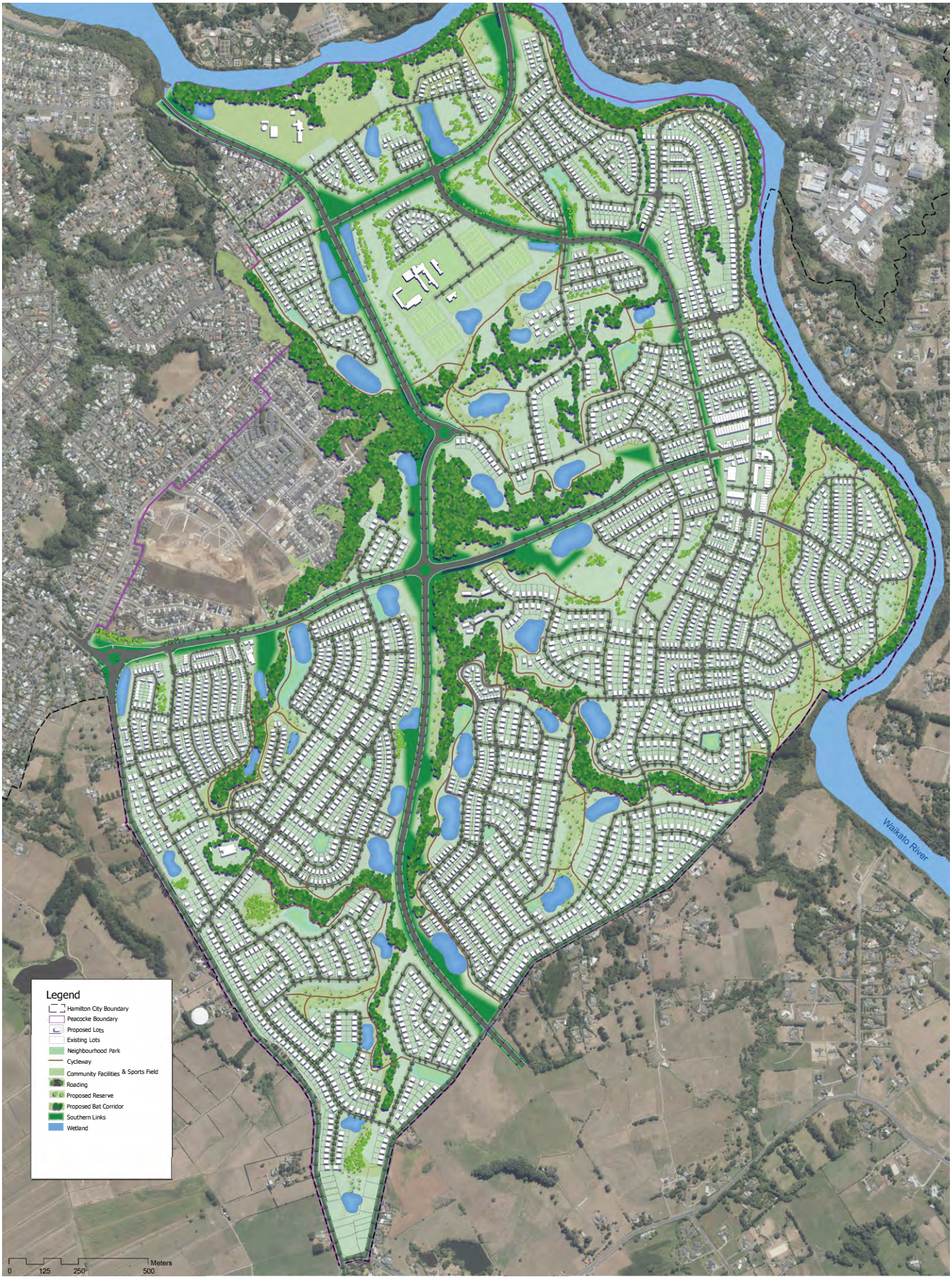


Figure 18b, Developed Structure Plan additionally applying the principles of *intensification* and rationalisation; highlight removed.

V. Conclusion

*This report reviewed the **Peacocke Structure Plan** based on further investigations and information provided since its inclusion within the **Operative Hamilton District Plan (ODP)**. Analysis of this information has led to the preparation of a **Developed Structure Plan** that responds to the implications of that information and reflects potential development scenarios for its integration. In addition to the development of the **Structure Plan**, guidance was prepared on landform retention, gully enhancement and the integration of urbanisation adjacent to **Significant Ecological Habitat** and **Proposed Bat Corridor's***

Further Information

The further information that was considered as part of this report includes:

1. Identification of *Significant Ecological Habitat* and *Proposed Bat Corridor's*
2. Identification of significant areas of geotechnical hazard;
3. An increase in extent of land identified as the Southern Links Alignment road network designation.
4. An increase in extent of land for Storm water Detention Areas.

Critical to the extent of *Significant Ecological Habitat* and *Proposed Bat Corridor's* identified was the presence of *long tailed bat (Chalinolobus tuberculatus*) activity within the site. The long-tailed bat is considered under threat of extinction and was ranked as *Threatened-Nationally Critical* by the Department of Conservation in 2017. While the identification of a community of an endangered species within the boundary of *Hamilton City* is to be celebrated, this comes with a responsibility to protect the species and maintain and enhance their habitat.

In response to identified S*ignificant Ecological Habitats* and *Proposed Bat Corridor's*, ecological enhancement of the gully system was proposed. These areas correlate strongly with areas identified as geotechnical hazards, determined as unsuitable for development. The geotechnical hazard was typically identified within the more steeply incised areas of the gully system and riverbank. The enhancement of Significant Ecological Habitats and Proposed Bat Corridor will improve the quality of the overall existing environment of the Structure Plan Area.

In combination, the implications of the further information resulted in a shift in the allocation of land use within the *Structure Plan* area. While both infrastructure and reserve area allocations increased, the gross developable land area within the *Peacocke Structure Plan* reduced by 13 %. This shift in land use also reflects an alteration to the pattern of land use within the *Structure Plan Area,* creating greater spatial separation between areas of developable land. Strategies for increasing potential yield within the Structure Plan Area were considered to offset the overall reduction in developable land, while suggested approaches for integration of the developable land were proposed with the areas of *Significant Ecological Habitats* and *the Proposed Bat Corridor .*

Proposed strategies focus on *intensification* of developable areas and *rationalisation* of the available areas for development. Review of the consented developments within the *Structure Plan Area* indicate that the minimum lot size within the *Hills Character Area* may be suitable for reduction to 400 m2 allowing for general *yield intensification.* In addition, given the spatial separation created by the pervasive gully system, increased density developments (terrace

housing or three or four storey apartments developments) should be considered adjacent to areas of higher amenity.

Rationalisation of areas developable land could also be achieved by considering small changes to the existing configuration such; as the removal of r*emnant rural vegetation*, potential infilling of emergent gully heads which are not *Significant Ecological Habitats* or *Proposed Bat Corridor* system. A modest increase in developable land could be obtained and more efficient development layouts achieved to further offset the redistribution of land use. It is recommended that *intensification* should be directed toward areas which provide offset amenity, such as the areas of *Significant Ecological Habitats* and *Proposed Bat Corridor.* It is also recommended that a localised transect approach should be maintained to ensure that larger lots are encouraged along the Hamilton City interface with rural land to the west and south of the *Structure Plan Area*.

Specific guidance and recommendations have been prepared for development sloping land, and the interface of infrastructure and residential development adjacent to *Significant Ecological Habitats* and *Proposed Bat Corridor .* The proposal of a structured buffer zone has been introduced to control some effects of development adjacent to these areas.

The combination of these suggested approaches and the incorporation of the specific guidance have been applied in a two-stage approach to produce the *Developed Structure Plan. Version 1* incorporates the outcomes of the further information and includes the spatial implications of the guidance and recommendations. *Version 2* applies the rationalisation and intensification to portions of the *Version 1* to result in a more resolved *Developed Structure Plan* for consideration.

In conclusion the *Developed Structure Plan* integrates an increased extent of reserve land and infrastructure with integrated residential development. Due to the pervasive gully system, associated *Significant Ecological Habitats* and *Proposed Bat Corridor* , the resulting spatial separation provides substantial amenity opportunity that can accommodate some *intensification*, both in density and yield within the developable land. The revegetation of the *Mangakotukutuku Gully* system and *Waikato Riverbank* provides an appropriate response to topographical challenges include *geotechnical hazards* within the site. While the resultant spatial separation provides some challenges in terms of connectivity throughout the site, it also offers an opportunity to reflect the character of the site through a road network that responds to the varying topography and site features. Overall, the *Revised Structure Plan* Area creates a balanced development with a strong sense of place, grounded by the response to the existing landform; it is location on the Waikato River and its response to the *Significant Ecological Habitats* and *Proposed Bat Corridor* framework it contains.