



Notice is hereby given that an ordinary Meeting of the Council will be held on:

Date: Thursday 12 August 2021

Time: 9.30am

Meeting Room: Council Chamberand Audio Visual Link

Venue: Municipal Building, Garden Place, Hamilton

# Council

**ATTACHMENTS UNDER SEPARATE COVER (Part B)** 

Item 12: Plan Change 5 - Peacocke Structure Plan

# 12 August 2021



٧.	TTACHMENT TA	BLE OF CONTENTS	PAGE
	7.	Peacocke-Nukuhau Cultural Values Assessment	1019
	8.	Peacocke Structure Plan Urban Design Report	1068
	9.	Peacocke Structure Plan Archaeology	1091
	10.	Long-tail Bat Report	1136
	11.	Peacocke Biodiversity Framework Report	1180
	12.	Ecological Significance Assessment Report	1232
	13.	Peacocke Structure Plan Retail Assessment	1276
	14. Demand and Fe	Greenfield Housing Policy Options Assessment for Hamilton - Dwelling easibility Assessment	1304
	15.	Landscape Assessment - Peacocke Structure Plan Review	1439
	16.	Peacocke Structure Plan - Integrated Traffic Assessment (ITA)	1487
	17.	Peacocke Structure Plan - Lighting Memo	1529
	18.	Peacocke Structure Plan Yield Assessment	1535
	19.	Peacocke Community Infrastructure Memo	1555
	20.	Inclusive access & mode shift Recommendations & Issued	1563
	21.	South Hamilton and Peacocke Public Transport Review - working paper	1580
	22.	Peacocke Transit Plan Report	1615
	23.	Peacocke Structure Plan - Esplanade Report	1691
	24. Investigations -	Mangakootukutuku ICMP - Geotechnical and Hydrogeological Stage 1	1709
	25. Investigations -	Mangakootukutuku ICMP - Geotechnical and Hydrogeological Stage 2	1745
	26.	Mangakootukutuku ICMP - Watercourse Assessment	1769
	27.	Peacocke Plan Change - Proposed Plans and Maps	1905
		0	T302

Attachment 7



Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

# Cultural Values Assessment Project Name: Nukuhau Whenua: Review of Peacockes Structure Plan Report Author(s): Te Haa O Te Whenua O Kirikiriroa Title of Report Cultural value assessment for Nukuhau Whenua (Peacockes area) Date of Report: February 2021 Authorised signatory: Sonny Karena: Chairman Te Haa O Te Whenua O Kirikiriroa

### 1. Project Description

This Cultural Values Assessment (CVA) presents a Maaori cultural framework which Hamilton City Council (HCC) and developers must apply to any proposed development of the area currently designated as the Peacockes area. In this context, it must be recognised, that traditional Maori "boundaries" do not correspond to Local Authority boundaries. For this reason, this CVA deals with a much larger area, which has relevance in terms of Maori history and values, which includes the area designated by HCC as Peacockes area.

In addition, the name Peacockes does not have any relevance to Maaori as it records and commemorates the confiscation and subsequent sale/use of their traditional lands. This report therefore refers to the area under its traditional Maaori name of Nukuhau Whenua.

This CVA provides relevant information to inform:

- The Review of the Hamilton City Council's Peacockes Structure Plan to give effect to:
  - The development of approximately 740 hectares of land in the Peacockes area to be rezoned Medium Density Residential to allow construction of homes for +/- 20,000 people over the next 30 years, with associated development of utilities, infrastructure, Parks and Recreational areas and Public amenities.
  - Recognition and protection of "Key areas of Vegetation" (Mangakootukutuku Gully and Waikato River esplanade) and "Key areas outside the gully network that support biodiversity".

# **Purpose of Report**

This CVA has been prepared to:

- Inform the review of the Peacockes Structure Plan (PSP) and future development within the Peacockes Structure Plan Area (PSPA).
- Identify what needs to be done in the PSPA to recognise and provide for Maaori and their culture and traditions within their ancestral lands, waters, sites, Waahi Tapu and other taonga and;
- Identify and understand the meaning of Kaitiakitanga and assist Mana Whenua to exercise Kaitiakitanga over their traditional lands.

### Scope of Report

This CVA identifies:

- The lwi and hapuu that exercise traditional Maaori authority over the PSPA, and organisations that represent them.
- Statutory requirements relating to recognising and providing for Maaori values and involving Maaori in decision making.
- Planning document provisions relevant to the purpose of this report.
- The effects of development of the PSPA on Mana Whenua cultural, ecological and social associations with the area.



- The types of measures that will be needed to avoid, remedy or mitigate the adverse effects of development of the PSPA on Maaori cultural values and to promote the realisation of Mana Whenua aspirations for the area.
- Mana Whenua cultural, economic, social and economic aspirations for the PSPA

### Methodology

This CVA has been developed by Te Haa O Te Whenua O Kirikiriroa (THaWK) from the information and feed-back gained from:

- Korero (consultation), Waananga (workshops) and Hui (meetings) between HCC, THaWK and Waikato Tainui about the proposed programme for the wider development of the Peacockes area.
- Measuring the PSP against applicable Treaty Settlements, the Waikato-Tainui Environmental Plan (Tai Tumu, Tai Pari, Tai Ao) the Ngaati Hauaa Environmental Plan and other relevant Local Authority policies and plans.
- Existing Cultural Values Assessments for the PSPA written, endorsed and supported by THaWK and the Waikato Tainui lwi Authority.

In accordance with the Waikato-Tainui Environmental Plan and the Ngaati Hauaa Environmental Plan, during the planning and implementation phases of the PSP, THaWK encourages partnership engagement with HCC and developers to ensure appropriate consideration is given t maters of importance to Tangata Whenua and Mana Whenua.

### 2. Mana Whenua

The planned development covers the traditional lands of five Waikato Tainui hapuu:

- Ngaati Hauaa,
- Ngaati Maahanga,
- Ngaati Wairere,
- Ngaati Tamainupoo,
- Ngaati Korokii Kahukura.

All of these five hapuu, who are members of Te Haa O Te Whenua O Kirikiriroa, have been consulted during preparation of this CVA and their opinions are coordinated and presented in this report. As part of the development of the CVA, the potential impacts of the proposed development have been measured by each hapuu against their individual Strategic Environmental Plans.

# 3. Waikato Tainui Engagement

Te Haa O Te Whenua O Kirikiriroa (THaWK) is made up of, and represents, the five hapuu (identified in "2" above) upon who's traditional lands Hamilton City has been constructed. Whilst each of these hapuu are part of the Waikato Tainui tribe, neither they, nor THaWK, represent, or speak for, the Waikato Tainui Tribal Authority. Hamilton City Council (HCC) and developers must therefore engage separately with the Waikato Tainui Tribal Authority.

### 4. Planning documents informing this Assessment

The following strategic and planning documents are relevant to this project and have been considered when preparing this report.

Te Ture Whaimana O Te Awa O Waikato (vision and strategy for the Waikato River)
Tai Tumu, Tai Pari, Tai Ao; Waikato Tainui Environmental Plan
Te Rautaki Tamata Ao Turoa O Hauaa: Ngaati Hauaa Environmental Management Plan
The relevant provisions of these planning documents, along with a precis of the processes and procedures necessary for this project to comply with these provisions, are attached in Appendix to this report.

### 5. Catchments

Mangakootukutuku Gully and Waikato River esplanade.

### 6. Description of the environment

The area defined in the Peacockes Structure Plan (PSP) comprises approximately 740 hectares of predominantly rural land on the southern fringe of Hamilton. It lies approximately three kilometres south of the city's central business district and is broadly oval in shape, extending approximately 4.5 kilometres from north to south and three kilometres east to west. The south-west and south-east boundaries of the PSP is Hamilton City Council's administrative boundary with Waipa District along Ohaupo, Peacockes and Gainsford Roads. To the east and north-east the Peacockes area is bounded by the Waikato River, and to the north-west by the Glenview and Fitzroy residential areas of the city.

Land use within the structure plan area is predominantly agricultural, mostly dairying, with some horticulture and recent residential development in the Dixon Road area. There are a few buildings on lifestyle blocks and farms sited along the road network. The south-western side of the growth cell is separated from Peacockes Road by the Mangakootukutuku gully and is serviced by Hall, Waterford and Dixon Roads.

The area was brought into the city in 1989 as one of a number of large growth areas that would, in due course, contribute to accommodating city growth. It is part of the Waikato Basin that encompasses the Hamilton urban area. Geologically, the area is a large basin filled with alluvial sediments, and some ash deposited by volcanic eruptions. Topographically the area is flat, with low rolling hills. There are some ridges, formed by harder sediments protruding through the surrounding softer sediments. There were once extensive peatlands and wetlands across the basin, but most of these were drained or heavily modified for farming.

The northern and eastern boundaries of the growth cell are defined by 4.5 kilometre river frontage, which is the most significant landscape feature of the area. The deeply incised nature of the central section of the Waikato River is susceptible to localised bank erosion as evidenced by localised slips seen along the river banks in the Peacockes area.



### 7. Relevant Cultural Narratives

The cultural narratives are presented in the Section entitled "Nga Korero Mai Waikato Ki Punui – The History of the Area" attached in Appendix to this report. These Korero have major significance as they tell of the undertakings and relationships of the people who lived, fought, bled, died and were buried in the land. It is this history that explains the significance of the land to Mana Whenua and thereby defines the mitigations and commemorations that are appropriate for the proposed development of this land.

# 7.2: Site and Environments of significance to Mana Whenua in the area (See Appendix 4):

- NUKUHAU PAA
- KAIROKIROKI PAA
- WHATUKORURU PAA
- TE PUHI A TARAO PAA (Tiireke)
- HAHAWARU PAA
- TE NIHINIHI PAA (Dillicar Park)
- TE PARAPARA PAA
- TE PAA O RUAMUTU
- MANGANUA PAAA
- BORROW PITS.
- PUNA FRESH WATER SPRINGS
- URUPA (cemeteries)
- WATERWAYS, STREAMS AND GULLIES
- MANGAKOOTUKUTUKU STREAM AND CATCHMENT
- WAIKATI RIVER

### 7.3: The Mana Whenua of the area:

- Ngaati Hauaa,
- Ngaati Maahanga,
- Ngaati Wairere,
- Ngaati Tamainupo,
- Ngaati Korokii Kahukura.

More detailed information about these hapuu is presented in the Section entitled "the People of the Area" attached in Appendix 2 to this report.

### 8. Mana Whenua Aspirations Relevant to the Nukuhau Whenua (Peacockes) area

Given that return of the land to Mana Whenua is not an available option, the following are the only aspirations available to Mana Whenua:

Exercise of Kaitiakitanga over their traditional lands

Participation in the planning and implementation of the development of their traditional lands

Opportunities to once again live on their traditional lands



Recognition, commemoration and dissemination of the pre-European Mori history of their traditional lands

From that promotion of community understanding of the significance of this land to Mana Whenua.

9. Mitigations, Commemorations and Enhancement Measures Mana Whenua wish to be implemented when the area is developed.

The reasons underpinning the identification of broad mitigation and commemoration categories/strategies, along with examples of the practical implementation of these strategies, is presented in the Section entitled "Maori Aspirations" attached in Appendix to this report. They are précised below:

### MITIGATING AND BALANCING THE EFFECTS OF THE PROPOSED DEVELOPMENT.

Irrespective of who currently owns this land, Mana Whenua's fundamental aspirations for this land is;

- · Kaitiaki (protection and guardianship) of the Whenua and Awa
- · Living on their traditional whenua
- Recognising and commemorating the Maaori history of the land.

As Mitigation and Balancing damage done to the land and awa are the only option available for Mana Whenua to achieve this aspiration then implementation of Kaitiaki can only be based on the following broad mitigation categories:

- Recognising the Maaori values (history, people and environment) associated with this land and commemorating/recording it appropriately and in a way that will be recognised and understood by none Maaori.
- Mitigating the damage which the development will cause to the Wairua and Mauri of the land.
- Protecting any/all sites of significance to Maaori (Waahi Tapu), including those currently identified and any that might be unearthed during the development.
- Mitigating any physical damage done to these sites of significance. In the greater Waikato region, including Peacockes, there are many Waahi Tapu sites of significance that have undergone a range of topographical and ownership changes. These sites and areas of significance are associated to the history of its people, its environment and culture this is illustrated in the Sections about the history, people and sites of significance attached in Appendix 2 and 3 to this report. Because of the land confiscations and subsequent land development many known sites of significance were destroyed, and the ownership and management passed to private land owners. Given that land in private ownership will become part of this area to be developed, then these must also be subject to the terms and conditions identified in this CVA and this paragraph.
- Identifying, protecting and enhancing the environment of the area (fauna and flora on land and in the waterways)
- Protecting the Waikato River and all local waterways from any damage during and after the development phases and
- Enhancing the water quality in the area so that it meets the Waikato Tainui defined A+ scorecard.



These broad mitigation categories will be achieved by application of practical measures such as, but not limited to, the following examples:

- Incorporating Maaori ceremonies before, during and after any physical work done on the area
- Incorporating Maaori designs and artwork into structures developed in the area
- Incorporating native and indigenous plants into all planting schemes and setting aside areas of land as reserves in which the pre-European flora of the area can be regenerated.
- Incorporating surveys of land fauna (bats, birds, molluscs etc.), water fauna (fish, crustacea, molluscs) and flora (land and water) as part of the planning and implementation of the development.
- Based on the results of these surveys, develop "environmental" enhancement and
  protection strategies. One such strategy should address removing "exotic", introduced
  fish species and reintroducing challenged or "at risk" indigenous fish species into the
  waterways and lakes in the area.
- Investigate and identify opportunities for Maaori employment as a priority in the development process.
- Incorporate historical Maaori names associated with this area for places, recreational areas and streets.
- Recognising sites of significance and Waahi tapu sites by erection of carved Pou Whenua, Pou Rahui, story boards, whata etc.
- Given that Nukuhau Paa, probably the most significant Paa in the area, was a centre for training and meetings, adopt an education theme for development of the area:
  - Involve students off all levels and ages (Kura, Kaupapa Maaori, other schools and Waananga's) in surveys and documentation of protection and enhancement strategies of Fauna and Flora in the area.
  - As part of the development of the Public facilities, incorporate a Library/Convention Centre – named Nukuhau Paa Centre – to record/mirror the historical use of Nukuhau Paa for important meetings/discussion by pre-European Maaori (see the Section on Sites of significance in Appendix). The Centre should incorporate Maaori designs, art work and an area depicting the Maaori history and people associated with Nukuhau Paa and this area, as told in this CVA.

In addition to mitigations which support Kaitiakitanga aspirations, Mana Whenua aspire to re-establish their connection to the life they lived on this Whenua before the confiscations. These include:

Housing: Mana Whenua ancestors were borne, lived and died on this land for centuries before the arrival of the British. Mana Whenua therefore want an opportunity to again live on their traditional lands. To implement this, a strategy whereby a number of sections created in every subdivision are dedicated for Hapuu housing should be developed.

In this context, it must be noted, that as this document is a Cultural Values Assessment (CVA), then the mitigation categories and implementation strategies exemplified above only provide broad mitigations for Maaori aspirations. They are designed to give developers some indication of the potential mitigations which Mana Whenua consider appropriate for development of the whole Peacockes area. Not all of these potential mitigations will apply to every individual development. Which mitigation(s) will apply to a particular development in a specific area of Peacockes will be identified within the Cultural Impact Assessment



(CIA) which THaWK will prepare for each specific development. The korero (Maaori history) identified in Appendix 5: Maaori Aspirations of this CVA, will inform which mitigation(s) are appropriate for individual developments.

The following are the types mitigation and enhancement measures Mana Whenua require to be incorporated into the development of the PSPA to:

- Avoid, remedy or mitigate any adverse effects any development might have on their values and relationship with their ancestral landscape or other taonga
- Recognise, protect and/or commemorate/provide for those values and relationships,
- · Have regard for, and provide for Maaori to exercise their traditional kaitiaki of the land
- Take into account the principles of Te Tiriti O Waitangi (Treaty of Waitangi)
- Give effect to Waikato-Tainui's Vision and Strategy for the Waikato River.

Table 1: Summary of mitigation and enhancement measures Mana Whenua may require to be implemented when the area is developed

### Fauna and Flora

- Measures to protect, restore and enhance indigenous biodiversity, including restoration pf ecosystems, habitat and wetlands, and the establishment or enhancement of ecological corridors
- · Measures to manage animal and plant pests
- Measures to protect, and enhance the abundance of Taonga species: tuna, whitebait species, smelt, piiharau (lamprey eels), kanae (yellow eyed and grey mullet), paatiki (flounder), koura (freshwater crayfish), and Rongoa (indigenous plants) for long term harvest.

### Natural Form and Character (including Fauna and Flora Ecosystems)

- Measures to protect or enhance the natural character, features and amenity of the PSPA
- Measures to enable the scheduling of sites in the HCC District Plan as a Significant Natural Area.

# Access

 Proposed new or enhanced public access to/in gullies and alongside waterways, wetlands and the Waikato River to enable cultural tourism, recreational and customary activities

### Waikato River, Streams and Gullies

- To promote the development and implementation of an integrated catchment Management Plan (ICMP) that promotes habitat restoration
- To design and install sufficient wastewater infrastructure capacity to prevent overflows into the waterways and gullies in the PSPA
- Implementation of measures to manage and remediate the effects of stormwater discharge from the land into waterways and water bodies to the level which allows/supports swimming and harvesting of food. This will include controlling soil erosion and discharge of contaminants into the water and ecosystems by maximising the use of swales, rain gardens and stormwater treatment wetlands.
   Promotion of rainwater collection and grey water non-potable reuse

# **Urban Development and Housing**

 Partnering with Mana Whenua to develop affordable housing opportunities for Maaori and the wider community



- Develop and implement measures to enable housing and papakainga development, including more permissive planning rules to empower such developments.
- Devise measures to improve safer access to and from schools and commercial areas within the PSPA, particularly for Tamariki and Rangataahi
- Promote development of industrial activities outside of the PSPA
- Promote the use of water-sensitive techniques (collection of roof water into water tanks) to reduce the demand for water supply and to manage wastewater and stormwater disposal.

### Recognition of Mana Whenua ancestral relationships with the land

- Protection, promotion, preservation and enhancement of Waahi Tapu and sites of significance to Mana Whenua, including improving access to them.
- Producing and erecting structures such as Waaharoa, Paataka, Pou Whenua, Pou Rahui to commemorate Waahi Tapu and sites of significance to Mana Whenua.
- Maaori protocols to be followed in the event of any accidental discoveries of Taonga (artefacts), Koiwi (human remains), or archaeological remains.
- Cultural ceremonies to be performed by Mana Whenua prior to and during any development within the PSPA
- Whakairo (carving), and the use of Maaori art and design should be used to recognise and commemorate Mana Whenua's relationship with this land.

### Hauanga kai/ Mahinga kai/ Cultural activities

 Measures to protect, restore, and/or enhance cultural activities, including access to area for these purposes.

### Maatauranga Maaori

Measures to recognise and apply Maatauranga Maaori in developments within PSPA

### Mana Whenua development

 Measures to support Mana Whenua development (commercial, social, cultural) within the PSPA

### Te Reo Maaori

- Te Reo Maaori to be incorporated in the PSPA and in developments within the PSPA
- Traditional Maaori names associated with the area should be used when naming roads, parks, sub-catchments, facilities, recreational areas etc.

# Mana Whenua involvement

- Inclusion of for Mana Whenua in planning or implementing any of the above measures, including involvement in decision-making, monitoring and service provision.
- Commission THaWK of behalf of Mana Whenua to development Cultural Impact Assessment Reports (CIA's) for all future developments within the PSP area.
- The appointment and resourcing of Mana Whenua as kaitiaki to monitor the impacts
  of future developments in the PSPA.

### **Other Measures**

 Any other measures to improve the health and wellbeing of the Waikato River, implement Te Ture Whaimana and lwi Management Plans or to realise Mana Whenua and Waikato-Tainui aspirations.

### 10. Recommendations

### **Structure Plan Development**

That Hamilton City Council, Waikato-Tainui and THAWK work in partnership to:

- a) Ensure the mitigation and enhancement measures recommended in the CVA are reflected and enabled within the PSP.
- b) Address any opportunities and/or resolve any issues that may arise throughout the development and finalisation of the PSP from pre-notification through to the formal adoption by Council.

# **Structure Plan Implementation**

That Hamilton City Council and developers work in partnership with Waikato-Tainui and THAWK to:

- a) Implement the PSP in accordance with this CVA.
- b) Ensure appropriate resourcing and support to develop and implement CIA Reports recommendations for specific developments within the PSPA.

# 11. Appendices

Appendix 1 - NGA KORERO MAI WAIKATO KI PUNIU: THE HISTORY OF THE AREA

Appendix 2 - PEOPLE OF THE AREA

Appendix 3 - SITES OF SIGNIFICANCE IN THE AREA

Appendix 4 - MAAORI ASPIRATION

Appendix 5 - RELEVANT LEGISLATION CONSIDERATIONS

Appendix 6 - REFERENCES



# **APPENDIX 1**

### NGA KORERO MAI WAIKATO KI PUNIU: THE HISTORY OF THE AREA

### 1 INTRODUCTION: A Time of disruptions for the people of the area

Around the 1650's Te Putu (King Pootato Te Wherowhero's famous forbearer) captured Ngatokowaru (Raukawa Chief) who was travelling up the Waikato River from South of Maungatautiri. Te Putu took him back to his Paa (Mata-o-Tutonga at the foot of Taupiri mountain) and in an ensuing scuffle Ngatokowaru killed Te Putu. In retribution Te Putu's warriors killed Ngatokowaru. Te Putu was buried beneath the earth floor of his whare (house) - his people subsequently vacated the Paa and moved elsewhere. From then on Taupiri mountain became the burial ground for the Waikato Tainui people.

This single event gave rise to an ongoing mistrust, dislike and multiple disputes between Waikato Tainui and Raukawa tribes for the next 200 years. Many of these disputes took place in the Northern Maniapoto tribal rohe (Maniapoto ki te Raki) This gave rise to the formation of the Waikato – Maniapoto Alliance which was based primarily on survival (safety and protection of both lwi) but also on Utu.

Over the next 200 years, there was a series of events that disrupted the living arrangements of the people living in the Kirikiriroa rohe (including the Peacockes area):

- As a consequence of the Waikato Maniapoto Alliance, people from different Waikato tribes (hapu) constantly travelled from Taupiri, through Ngaruawahia, and from that point where the Waipa River joins the Waikato River:
  - Along the Waipa River to Whatawhata, Pirongia, Ngaaroto, Matakitaki, Huiputea, and Kaawhia, or
  - Along the Waikato River to Kirikiriroa (Hamilton) and then on foot across to Ngaaroto, Matakitaki, Huiputea, and Kaawhia.

Hence there was a continual influx of Waikato hapu and whanau from other areas, coming to the Kirikiriroa district for extended periods. This continually disrupted the living arrangements of the people who already lived in the Kirikiriroa area.

- Another major forced disruption was cause in the 1820's by the incursion of Ngapuhi armed with guns (Pu) into, and through, the area. As the local people did not have guns, they were forced to vacate the area and seek other, safer, places to live.
- Further forced disruption was caused by the Waikato wars (1863-1864) which resulted in the loss of much of Waikato Tainui's tribal lands and the consequential exile of the local communities elsewhere.

# 1.1 1750-1760

This korero is from Ngati Te Konawa-Maniapoto history concerning the Waipa district from:

- Moeawha (Waikeria) to Wharepuhunga, Rangitoto to Kakepuku and Pirongia,
- the Waipa river in the south to the Waikato river in the north and
- the establishment of the Waikato-Maniapoto authority within that district and

During the early to mid-1750's Te Konawa and his Maniapoto and Rereahu hapū established a strategic military alliance with the Waikato tribes (mai Manakau ki Rangitoto) from the Manukau to Ngaaroto, and Ngaaroto to Rangitoto district. This alliance was formed to counter the imminent danger from:

- Pikau-Te-Rangi tribe to the east,
- · Raukawa at Maungatautari, and
- Toa Rangatira (Te Rauparaha) and Ngati Te Ariari in the west at Kaawhia

who were all hostile and aggressive towards Waikato and Maniapoto. The Waikato-Maniapoto alliance tribes continued to live together for safety and protection against the constant aggravation from Raukawa at Maungatautari, Toa-Rangatira and Ngati Te Ariari at Kawhi and attacks from other marauding war parties from other tribes.

Around this time, Te Kanawa's only daughter called Paretekawa (mother Whaeapare), married the Raukawa Chief Te Momo-o-Irawaru. They and their Uri (descendants) lived on Te Momo's ancestral tribal lands in Wharepuhunga and later around Te Awamutu, Te Ararimu (Kihikihi), Pukekawakawa (in the Tokanui land block), Rangitoto, Kawa, and Kakepuku, and around the Mangapiko, Mangaohoi, and Puniu rivers, and the Wharepuhunga and Kakepuku maunga (mountains).

### 1.2 1780's

Te Konawa had several sons - Te Riri-o-Rangawhenua was the eldest (te matamua) and his heir apparent. In the 1780's he was killed in his home by Ngati Te Atiari, hence his own son Te Ikahaungata became Ariki Rangatira of Te Konawa-Maniapoto. Te Ikahaungata established his Te Konawa-Maniapoto base in the Kakepuku district (mountain between Te Awamutu and Otorohanga) and constructed their kaainga (village) and fortifications there, but later moved with Waikato to Oturu in the Taupiri region to ensure the security of the district. By Waikato allowing Te Ikahaungata to move there enhanced and strengthened the alliance between Te Konawa – Waikato alliance.

The people of the Waikato - Maniopoto alliance became aware that Pikauterangi (Raukawa), Toa Rangatira of Kaawhia, and a number of other tribes from through-out the motu (island/country), were making plans to overthrow the Waikato - Maniapoto Tainui alliance once-and-for-all.

On the return of Te Ikahaungata (Chief of Maniopoto) from Oturu to Mangatoto Paa near Otorohanga, he encountered in the Waipa- Rangitoto district the "Tahuraho" ope taua (small scouting war party) from the southern districts (Wanganui). He repelled these invaders to neutralise any threat that they would return later with a bigger war party. Despite this, they returned several years later which resulted in the battle of Hingakaakaa.

To address this threat, the chiefs of Waikato (Rauanganga) and Maniapoto (Ikahaugnata, Pehi Tukorehu) agreed to build a series of Paa Pahu (sentinel Paa) - Te Rauangaanga was the famous fighting chief of Ngati Mahuta who resided at Kaitohetohe Paa on the eastern side of taupiri mountain and married Parengaope of Ngati Koura. These "sentinel Paa" formed an alarm system to warn the people of the Rohe of any invasion from other iwi of the motu. They were called Paa Pahu because they used "Paahu" (large hollow wooden alarms) to raise the alarm of an approaching war party.



### The Paa Pahu were:

- Mangatoatoa was the first Paa Pahu built on the northern banks of the Puuniu River between Te Awamutu and Otorohanga, followed north by
- Waiari, on the southern banks of the Mangapiko stream, Ohaupo, which probably runs out of Lake Ngaaroto,
- Ngaaroto above Ngaaroto Lake,
- Nukuhau on the southern bank of the Waikato in the Mangakootukutuku-Korakonui district, and
- Maniapoto Paa in the Tamahere area, by State highway 1 and thence on to others (unrecorded) to Taupiri.

Mangatoatoa was designated as the Paa where Taua (warriors) congregated in the event of an attack or threat to the rohe. Mangatoatoa became the centre of activity for the area, and became part of the whakatauki describing the Tainui boundaries:

 Mokau ki runga (Mokau on top), Tamaki ki raro (Tamaki on the bottom), Mangatoatoa ki Waenganui (Mangatoatoa in the middle), Pare Waikato (the tribes of the Waikato), Pare Hauraki (the tribes of Hauraki), me te Kaokaoroa o Patetere (and the Kaimai's are the armpit) - in those days the map was upside down as Maori thought the South Island was in the North. This is a saying known by every Tainui tribal member describing the Tainui waka boundaries.

### 1.3 1790's

The first invasion occurred in 1791 when tribes from:

- Kaawhia in the west,
- Raukawa of Maungatautari (Pikauterangi), and
- · Kahungunu, Tuhoe, and others from the East, and
- Taranaki, Whanganui,

came via Mookau over the lands of Maniapoto, and descended upon the Waikato-Maniapoto army in the Waipa region of Ngaaroto (Te Mangeo).

The first karere (message) warning of the invasion came from Wahanui (Maniopoto Chief) in Mokau who was the southern boundary sentry. When it was received at Mangatoatoa Paa the alarm was sounded and "passed on" along the line of **Sentinel Paa:** Waiari Paa, Ngaaroto Paa, Nukuhau Paa to Maniapoto Paa, and then on to the rest of the Waikato tribes, particularly Te Rauangaanga at Taupiri.

Taua (warriors) from Maniapoto, Waikato and Ngati Whaatua (Auckland) made their way Southwards by River and land and assembled at Mangatoatoa Pa. They agreed to engage the invaders in a battle called Hingakaakaa, fought on a series of hills called Te Mangeo near the Ngaaroto lakes (just north of Te Awamutu). This site was chosen because it was a swamp area – the invaders did not know where the solid ground was and hence became bogged down and could not run away. The Waikato-Maniapoto warriors, led by Te Rauangaanga (Waikato) and Ikahaungata Wahanui (Maniapoto), defeated the invaders, including groups lead by major chiefs of Ngaati Te Ariari and Ngaati Toa (Te Rauparaha's tribal chiefs/tupuna).

This battle set the Kaupapa tikanga for the Waikato-Maniapoto alliance relationship for the next 160 years.

### 1.4 1800 -1810: Post Hingakaakaa battle

"Pena ano nga tupuna o Waikato kua hinga, kei te timata nga whakatupu ki te tu rangatira ai, ko Te Rauanganga ka heke kia Te Wherowhero, ki Tokohihi ka heke kia Te Paewaka, me etehi atu me etehi atu..."

"Chiefs have children who will go on and take over such as Te Wherowhero from father Te Rauangaanga, Te Paewaka from Tokohihi, Te Rauparaha from ......, and Wiremu Tamehana from Te Waharoa."

After the death of Te Ikahaungata (son of Te Riri-o-Rangawhenua who was the son of Te Konawa) his mana passed to his son Mahue-ki-te-rangi.

Ngaati Hikairo, Ngaati Maahanga, Ngaati Hinetu, Ngaati Apakura and other Waikato tribes had shared interest in the territories to the north of the Mangaotama and Mangaoohoi Rivers (around Pirongia). Ngaati Te Konawa, Ngaati Ngutu, Ngaati Unu, Ngaati Ngaawaero, Ngaati Makahori, Ngaati Kahu, Ngaati Huuiao, and other Ngaati Maniapoto and Raukawa tribes had shared interest in the lands to the south of the Puuniu river (Otorohanga).

During this same time, despite the defeat suffered by Toa Rangatira and Raukawa at the battle of Hingakaakaa, their heirs, including Te Rauparaha, were re-establishing their power base. Hence, peace did not last for long in the district. In addition, Ngaati Kauwhata (Raukawa) from the southern side of Maungatautari and Hauraki tribes were starting to have skirmishes in the Waikato and Maungatautari regions.

Despite this "unrest" in the region, there were no more major battles but the inter-tribal skirmishes between the Waikato-Maniapoto alliance and Raukawa and Ngaati Toa continued for the next two decades.

# 1.5 1810-1820 Period: The period of upheaval

1800-1818: During this period Te Rauparaha led an attack on Mangatoatoa Paa. The attackers were repelled by Peehi Tuukoorehu and his hapuu, Ngaati Te Kaanawa, Ngaati Ngaawaero, Ngaati Unu, and others. Te Rauparaha went back to Kaawhia and Peehi Tuukoorehu settled peace terms with the remaining Ngati Raukawa (Wharepuhunga: West Raukawa/East Maniopoto) at "Pouaiti". Raukawa never attacked Mangatoatoa again.

In the following years the Te Kaanawa region was divided in two - Maniapoto populated south of lake Ngaaroto and Waikato Tainui north of lake Ngaaroto.

1819-20: Several events started in these years which ultimately became closely interlinked by subsequent events.

At this time, an Amio Whenua (a war party of mercenaries on a killing spree, usually for revenge), led by Te Apihai Te Kawau (Ngaati Whaatua) and Kukutai (Ngati Tipa) set out



to take revenge by punishing the tribes who fought against them at Hingakaakaa. Peehi Tukorehu joined the Amio Whenua when it got to Wharepuhunga where he lived.

In 1820, tired of the constant attacks and skirmishes, Te Wherowhero led 3000 Waikato, Maniapoto and Hakairo warriors, plus another 1500 Maahanga warriors from Whaingaroa (Raglan), who were led by Te Awataia, against Ngaati Toa positions at Te Arawai Paa (Tarahoa) on the South side of Kaawhia. After several days fighting Ngaati Toa, led by Te Rauparaha, were defeated and the survivors, including Te Rauparaha, escaped by sea, travelling south to Taranaki, and on to Kapiti. Te Wherowhero pursued Te Rauparaha down the coast by land. On arriving at Pukerangiora, on the Waitara River, he rescued Peehi Tukorehu and the Amio Whenua (who were on their way back from their hikoi) from the clutches of the Waitara tribes.

# 1.6 1820-1830 period of events

1820-21: Peehi Tukoorehu settled Ngaati Naenae, Ngaati Haehaeora, and Te Patu Kooko (Wero Kooko) tribes at Otaawhao and Paiaka Paa under Chief Te Paewaka. Ngapuhi raids on Ngati Whatua and Waikato forced them southwards to the Te Awamutu / Ngaaroto rohe.

May 1822: Te Wherowhero returned home from pursuing Te Rauparaha in Kaapiti in time to lead the defence against the Ngapuhi. Ngapuhi, who had guns, won the battle and consequently Te Wherowhero retreated to Mangauika Paa (6 kms south of Matakitaki by Pirongia mountain). Subsequently Ngapuhi attacked this Paa causing Te Wherowhero and his warriors to escape and scatter south to Otorohanga, west to Kaawhia (vacated by Te Rauparaha), and east to Wharepuhunga. Ngapuhi then settled at Huiputea near Otorohanga (Huiputea is named after Te Huiputea, Hongi Hika's second in command).

1823: Ngaati Kauwhata living at Wharepunga (West Raukawa/East Maniopoto) started their one-way overland Heke (migration) not expecting or intending to return. They travelled through Taupo Tuwharetoa down to Kaapiti to join up with their Raukawa relation Te Rauparaha (Ngaati Toa), to become what is now known as "Raukawa ki te Toonga" (Southern Raukawa). This Heke left a major gap in the boundaries of the Waikato – Maniopoto alliance.

1823-1825: Te Hokinga O Ngapuhi: The return (home) of Ngapuhi

By the end of 1822, after Matakitaki, the Ngapuhi invaders were settled, unchallenged, at Hui Putea, close to Otorohanga. Their guns prevented further direct attack, hence guerrilla tactics were adopted. Warriors came by canoe down the Waipa river under the cover of darkness and killed the Ngapuhi one-by-one or often in groups. This guerrilla warfare ended when Te Wherowhero negotiated a peace treaty with Ngapuhi which saw them return home. The exact terms of the peace deal are unknown, but may have included Ngapuhi taking some of the local people with them as slaves/concubines.

1825-1826: Land settlements - filling the gaps.

After Ngapuhi had left, Te Wherowhero (still a young warrior) and Peehi Tukoorehu called a hui at Nukuhau Paa to discuss the resettlement of the lands vacated by Raukawa/Hauwhata and Ngaati Toa/Te Rauparaha when they migrated south to Kaapiti. Most of the Chiefs of the tribes who participated in, or were affected by, the tribal wars were in attendance. This hui took place at Nukuhau Paa.

Consequently, the mana (importance) of Nukuhau Paa increased dramatically from being just sentinel Paa before the wars to being the centre of the land resettlements after the war. This resettlement was necessary to fill the gaps left in the rohe boundaries by the migration of Ngaati Kauwhata and Ngaati Toa Rangatira southwards. The closing of the gaps re-established the ring of protection around Tainui lands.

The hui resulted in the following allocation/settlement of land:

- Ngaati Hikairo, Ngaati Mahuta, Ngaati Ngutu were allocated land at Kaawhia and elsewhere.
- Te Paewaka and his hapuu Ngaati Waenganui, Ngaati Paremaemaeora, Ngaati Ruru, Te Patu Koko/Wero Koko, Ngaati Naenae, settled at Te Ureparawera, Owairaka and Panehakua (marae) at Wharepuuhunga district. That blocked off that part of the Maniopoto/Waikato boundary.
- Ngaati Mahuta settled with Te Wherowhero at Maketu, Kaawhia
- Peehi Tukoorehu settled Tarei Waraki and Maniapoto at Aoao, on the southern shores of Kinohaku, Kaawhia
- Ngaati Hikairo re-settled at Aotea harbour (Ngaati Apakura as well)
- Ngaati Nguutu settled on the lands at Te Waitere and Kinohaku, (south Kaawhia).

Not all tribes and lands were allocated at that hui, others happened later. After settling Ngaati Mahuta at Kaawhia, Te Wherowhero settled Ngaati Hinetu at a Taurangaatahi Paa and Kaipaka Paa and then later went back to Taupiri.

In this period (1826) there was a further disruption caused by a second Ngapuhi incursion. In 1822 Hongi Hika came with his guns via the Waikato-Waipa river route thereby "missing" and hence sparing those in and around Kirikiriroa. By contrast, in 1826, the second Ngapuhi incursion, led by Pomare, also with guns, travelled down the Waikato river through Kirikiriroa and onto Te Parapara (Hamilton Gardens) Paa. There he was met by Tioriori and Te Rauroha from Nukuhau Paa. Bloodshed was avoided based on a peace settlement made with Hongi Hika, 4 years earlier, after Maataakitaki. That peace was based on Kati (Te Wherowhero's brother) marrying Matire Toha, the daughter of Rewa (a whanaunga of Hongi Hika) and thus cementing peace between Waikato and Ngapuhi.

### 1.7 1863 – 1864: The Waikato Wars.

The next upheaval and disruption came to the Kirikiriroa rohe via the Waikato Wars. The resultant Raupatu (theft of 1.2 million acres of Waikato Tribal lands) caused the exile of Te Wherowhero south of the Punui River, thereby destroying the fabric and lives of the Maori communities of the region.

### SUMMARY

The history of the people of Kirikiriroa over the last 200 years has been characterises by them having to deal with, and survive, a series of events that caused major disruption to their lives and lifestyles. In some cases, these disruptions disinherited and exiled them from their tradition tribal lands. In other cases, the disruptions brought new people to live in the area, thereby setting up new groupings in Kirikiriroa and changing the structure of the society of the people living there.

In addition, prior to the 1840 Treaty, the tribal wars caused much angst and disruption to the Manawhenua tribes throughout the lower Waikato and Kirikiriroa rohe. Whanau and Hapuu

Attachment 7



Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

welcomed and looked after (Manaakitanga) their whakapapa relations, and married others. This also inevitably created new sets of groupings within Kirikiriroa.

The incursions of Ngapuhi (1822 and 1826) carrying guns and later the colonial wars (1863/64) created significant disruptions to lifestyle and separation from their lands for the people of the

The Raupatu (confiscation/theft) of the lands resulting from colonial Waikato wars caused additional major disruption as the Mana Whenua hapuu could not return to the lands they believed to be theirs. Finally, the impacts and disruptions upon the whanaunga (relations) hapuu who took in to manaaki (look after) those exiled were also harrowing.

All these disruptions to the people of the Waikato-Maniapoto alliance and their lands over the 100 years to 1880 created a pot-pouri of tribes who could each claim to having been the Manawhenua of the area for the period of time whilst they "stoked the fires" (ahi kaa).

However as identified above, with so many disruptions over a relatively short period of time, it is difficult to conclusively identify any one hapuu with Mana Whenua rights over and above all others. Based on the koorero tuuku iho in this section, 5 hapuu (Ngaati Maahanga, Ngaati Wairere, Ngaati Hauaa, Ngati Korokii Kaahukura and Ngati Tamainupoo) accepted each other's claim to be Manawhenua and therefore agreed to act collectively as Manawhenua for these lands.



# **APPENDIX 2**

### 2 PEOPLE OF THE AREA

Whilst the whole of the Waikato region is the traditional lands of Waikato Tainui, each of the individual hapuu (tribe) who make up Waikato Tainui have their own traditional land areas within the region. Tiikanga Maaori prescribes that it is "correct" to give mention to all groups that were present (in an area), particularly with recognition of the overall "mana". (Hayward and Samuels 2015). Today, the descendants of the people who have lived in the Mangakootukutuku catchment (Peacockes area) over the past five hundred years affiliate to Ngaati Maahanga, Ngaati Tamainupoo, Ngaati Wairere, Ngaati Korokii Kaahukura and Ngaati Hauaa.

The information presented below identifies some of the koorero (verbal history) recalled by members of the hapuu who have lived in the Nukuhau Whenua (Peacockes) area at different times. In most cases the hapuu are named after a renowned ancestor who started the genealogical line of that hapuu.

Hapuu hold Mana over their rohe (region), whenua (lands), ngaahere (forests), awa (rivers), waahi tapu (sites of significance), taonga (treasures), whanau (family) and hapuu (sub-tribes). This mana is held by the people and exercised through Rangatira (chiefs) and Tohunga (high priests) appointed by the people. Some of these are described in the sections below.

In the following section some of the accounts appear to be contradictory in their description of the inter-relationships between hapuu and hapuu groups and relationships of hapuu to particular land and Paa. This is well exemplified by the differences in the koorero about Ngaati Koura in the narratives by Ngaati Maahanga and Ngaati Wairere below. In this context, it must be recognised that none of the descriptions are wrong and none take precedence over the others. Rather they are the history of the area as perceived and recalled by different people who have lived in this area at different times over the past five hundred years. In addition, as indicated by Hayward & Samuels, in many cases the intermarriage between people of different hapuu has blurred the definition of hapuu over that five hundred years. In other cases, hapuu names have been actively "retired" in favour of becoming part of a larger hapuu grouping in order to access the protection afforded by being part of a larger group.

It must also be recognised that whilst today hapuu tend to be clearly identified and separated, they are all descended from voyagers on the canoes that brought Maaori to Aotearoa. Hence, they are all closely inter-related. Historically they lived in large "family" groupings, and the men of the group had multiple wives, often at different locations. It was only when one of the family became "recognised" (Leadership, fighting prowess etc) that his/her descendants identified themselves by association with that name. For example, Wairere's daughter Tumataura married Korokii and they had two sons Haape and Hauaa. During their lives the two sons identified themselves as Ngaati Korokii and Ngaati Wairere, from their father and mother's lineage. However, because of the fame they developed by their deeds in adult life, their descendants identified themselves as Ngaati Hauaa (Hauaa's lineage) and Ngaati Korokii Kahukura (Haape's) lineage.



### 2.1 NGAATI MAAHANGA KOORERO

Maahanga, from whom the Ngaati Maahanga lineage is descended, lived in the 1500's - his father Tuheitia was a direct descendent of Hoturua, the captain of the Tainui canoe. He had four wives and had 7 children to Paratai, 1 son to Wharewaiata, 1 son to Hine-te-pei and 3 children to Te Aka Tawhia (Hayward 2017). One of his daughters Tukotuku, married a warrior named Tamainupoo and they had a son named Wairere. This was the start of Ngati Wairere.

Historically Ngati Mahanga is an lwi in its own right. However, in recent times it has been referred to as a hapuu of Waikato Tainui lwi because it was administratively part of the 33 hapuu that made up the structure of the former Tainui Maaori Trust Board.

Today, Ngaati Maahanga is an lwi made up of some 30 hapuu. Many of these hapuu were separate until the early 1900s, but have now consolidated under the general name Ngaati Maahanga. This has been caused by historic forces, particularly land loss, and prolific intermarriage, which has seen the distinctions between the different hapuu gradually disappear. (Hayward & Samuels 2015).

Before the consolidation, prominent Ngaati Maahanga hapuu were Ngaati Hourua, Ngati Ruateatea (Mahanga's son), Ngaati Kuku, and Ngaati Tonganui. These hapuu were in turn made up of smaller hapuu. There were also splinter groups from other lwi, that became part of Ngaati Maahanga through intermarriage, the most notable ones being Ngaati Ruru and Ngaati Ngaamurikaitaua. Ngaati Ruru also consisted of smaller factions of Ngaati Patupoo, Ngaati Werokooko and Ngati Koura.

Ngaati Hourua, often termed, Ngaati Maahanga-Hourua, the main hapu who occupied Hamilton was made up of smaller sections: Ngaati Hourua Tuuturu, Ngaati Whare, Ngaati Ngaarape, Ngaati Ngaamurikaitaua, and a section of Ngaati Ruru. Intermarriage with Ngaati Hourua probably explains why a section of Ngaati Ruru occupied land in Ngaati Maahanga country.

The most notable example of this was Te Mokorou, a renowned Ngaati Ruru chief; who married Mihi Aotea, who was the daughter of Uehoka, a Ngaati Hourua chief. After Mokorou's conversion to Christianity in the early 1840s, he left Ootawhao (Te Awamutu) and moved to Whatawhata (Ngati Mahanga rohe), where he stayed for the remainder of his life. His descendants retained their Ngaati Ruru identity, but they were allowed to live on the Ngaati Maahanga land at Whatawhata because of his wife's (Mihi Aotea) Ngaati Hourua/Maahanga lineage. Thirty years later, an 1874 census recorded this section of Ngaati Ruru still living at Piitakataka, a kaainga at Whatawhata. The Census also shows Ngaati Ruru and Ngaati Ngaamurikaitaua as hapuu of the Tribe of Ngaati Maahanga.

An illustration of smaller groups giving up their name and becoming part of Ngaati Maahanga is given in a well-known account of the late Pouwhero Kihi, a Ngaati Ruru elder, who was one of the last occupants at Nukuhau Paa. He laid the name of Ngaati Ruru [ki Whatawhata] to rest, so that they would no longer be separate in name, but would hence forth come under Ngaati Maahanga. In this way, when reference is made to Ngaati Ruru, Ngaati Ngaamurikaitaua, or any of these smaller hapu living within the Ngaati Maahanga rohe, it refers to the specific lines of those hapu that became part of Ngaati Maahanga, and not to the main population of these hapuu who live in other places.

Ngaati Koura is another example of this process. The entity of Ngaati Koura has become largely historical and obscure. Ngaati Koura was not in the list of 33 hapuu consolidated

(administratively) as Waikato-Tainui in 1946. At this time, remnants of smaller hapuu were absorbed into their natural larger groups. Hence, Ngaati Koura remnant lines can be found in Ngaati Hauaa, Ngaati Ruru, Ngaati Wairere (originally from the branch of Ngaati Hauaa) and Ngaati Maahanga (Hayward & Simons 2015).

Koura, from whom Ngaati Koura descended, is an ancestress of most, if not all, of Waikato Tainui. Hotumauea (Koura's grandson) is a tuupuna belonging to Ngaati Hauaa, Ngaati Korokii, Ngaati Maahuta and some parts of Ngaati Maniapoto. As both Koura, and Hotumauea, lived many generations ago, and because of inter-marriage, they are the tuupuna of everyone in Waikato Tainui. In any case, many generations had passed before the name Ngaati Koura came into general usage. Ngaati Koura as a distinct hapuu began in the time of Te Ironui, who was Ngaati Hauaa and Ngaati Ruru. He rose to prominence in the Battle of Rangipootiki, a battle fought primarily by Ngaati Maahanga and Ngaati Te Wehi against the people of Te Rauparaha. This is estimated by Pei Jones to be during the very early 1800s. In the documentation of Nga Tapuwae O Hotumauea reference is made to the battle of Rangipootiki, but Te Ironui is confused with Iranui the son of Wairere. Te Ironui was a contemporary to Te Waharoa and Te Tiwha, Chiefs of Ngaati Hauaa and to Te Rauparaha. This chronology demonstrates this confusion, as Iranui, a son of Wairere (who lived in the 1600's) could not have fought in the Battle of Rangipootiki which occurred in the 1800's. (Hayward & Simons 2015)

Whilst Ngaati Hourua is clearly part of Ngaati Maahanga, it is sometimes recorded with other affiliations. For example, because Ngaati Hourua fought with other Iwi and hapuu, in military contexts Ngaati Hourua is often referred to as part of Ngaati Hauaa, particularly in reference to the battles at Kaipaka and Taumatawiiwii. This assumption is also made because Hourua's husband Puukauae, was the son of Hauaa. Similarly, Ngaati Hourua is also referred to as part of Waikato Tainui, because the Ngaati Houra Chief Te Awaitaia led the Southern Waikato tribes in battle. This clearly illustrates the flexibility of relationships in the hapuu structures of Waikato Tainui. Another example is Ngaati Hourua (Mura Section) which was originally part of Ngaati Hourua tuuturu, but later became part of Ngaati Korokii.

When the British arrived in the Hamilton area Te Awaitaia (Te Awaitaia Wiremu Nera) was Chief of Ngaati Maahanga – he was known as Te Awaitaia until he assumed the name Wiremu Neera when he converted to the Wesleyan Faith in 1836. He was the great grandson of Maahanga, and ruled most of the western areas of Kirikiriroa along the Waipa river towards Ngaruawahia.

His principle hapuu were Ngaati Hourua and Ngaati Ngaarape. He was often called Pootatau's (Maaori King) Fighting General. History remembers him as the chief who slayed the Ngaati Tama Chief, Raparapa, an ally of Te Rauparaha, at the Battle of Taharoa. Along with other Waikato Chiefs, he was instrumental in the expulsion of the West Coast tribes, and the conquering of that Territory. He played a large role in the battle at Kaipaka. Te Awaitaia, lived the later years of his life at Whaingaroa (Raglan), though his mana over the Hamilton West lands remained constant.

Predominantly located to the west of the Waikato River, Ngaati Maahanga have had a long standing presence alongside Tamalnupoo, Wairere, Korokii, and Hauaa within the Hamilton rohe (district). Like these other hapuu, Ngaati Maahanga experienced significant land losses during the colonial confiscation period. In the 1850's, to encourage trade and good relations, Ngaati Maahanga made their land available for settlement and use by immigrant Europeans. From this a strong trade network developed in the agricultural and horticultural industry. However, Ngaati Maahanga expected the Europeans would comply with the laws of the Maaori community and values of manaakitanga (serving and looking after others). Instead Ngaati Maahanga's lands were confiscated under deeds of sale and the Reserves set aside



for Ngaati Maahanga were also subsequently taken. With the introduction of various Crown laws, Ngaati Maahanga saw almost all their land lost to the Crown.

Following the land confiscations, Ngaati Maahanga moved "outwards" to the Whatawhata, Te Pahu, Waitetuna, Whaingaroa, Aotea, Ohaupo and Pirongia areas.

The land, which includes the Peacockes area and the three Paa (Nukuhau, Hahawaru and Whatukooruru) located there, has always been significant to Ngaati Maahanga. The Mangakootukutuku stream, which runs through the area into the Waikato River, provided access to the Waikato River and hence to Hamilton for trading and transport of people and goods.

### 2.2 NGAATI TAMAINUPOO KOORERO

Tamainupoo, probably the most famous of Kokako's sons, was borne in Kaawhia. On a journey to look for his father, he met and married one of Maahanga's daughters Tukotuku. They settled on the Waipa River, between Whatawhata and Ngaruawahia, and from them Ngaati Tamainupoo are descended. One of their sons, Wairere, had two daughters, Kaahurere and Tumataura, both of whom married Korokii (Ngaati Kauwhata) – a warrior who lived near what is now Cambridge.

Korokii and Tumataura had two sons Haape and Hauaa – Haape gave rise to Ngaati Korokii Kahukura and Hauaa to Ngaati-Hauaa.

Korokii and Kahurere had a daughter called Ruru who married Koorako, one of Wairere's grandsons. They had a son named Waenganui who married a woman called Koura. These unions gave rise to a group of hapuu now known as Ngaati Koura, Ngaati Waenganui, Ngaati Ruru, and Ngaati Ngaamurikaitaua,

Thus, early in the 17th century, in the district south of the Huntly Gorge, Ngaati Tamainupoo lived on the bank of the Waipa between Whatawhata and Ngaruawahia, Ngaati-Korokii on the Waikato between Maungatautari and Hamilton, and the families of Maahuta and Paoa near Taupiri.

# 2.3 NGATI WAIRERE KORERO

Most of the following information is extracted from "Nga Tapuwae O Houtumauea", (authored by W. Puke: 2002) and deals only with the hapuu who were related to Ngaati Wairere who lived in, or had some association with, the riverside Paa within the Hamilton City boundaries. Exhaustive descriptions of Ngaati Wairere are provided in other documentation elsewhere.

Kokako was a Chief whose origins linked to the Mataatua canoe. Kokako was blamed for the drowning of Tuheitia, Maahanga's father. As a result, Maahanga and Kokako were continually in dispute. Tamainupoo, the most famous of Kokako's sons, married Maahanga's daughter Tukotuku. They had one son named Wairere.

The birth of the son Wairere was so significant that Kokako and Maahanga made peace at Purakau Paa. To mark Wairere's birth the ancient name of the river was changed from Te Awanui O Taikehu to Waikato - Waikato means "to pluck water" and refers to the motion of sprinkling water on the child during the Toohi (baptism ritual).

Wairere's baptism ritual was performed at Taipouri Island near Huntly. In later life Wairere had several wives who produced several sons, daughters and numerous descendants. In his old

age, Wairere travelled southwards to the Taupoo district and married Hikataupo a Chieftainess of Ngaati Tuuwharetoa.

Of the many hapuu associated with Ngaati Wairere, the following had particular association with the Riverside Paa, including those in the Peacockes area.

- 2.3.1 Ngaati Koura: Paoa (mid 1600's) a Tainui Chief, lived at Kaitotehe Paa opposite Taupiri mountain with his first wife Tauhakari. They had three children: two sons Toapoto and Toawhane and one daughter, Koura after whom this hapuu was named. Koura married Waenganui, a mokopuna (grandson) of Korokii and his wife Kahurere (herself a daughter of Wairere). On the death of her two brothers Toapoto and Toawhana, Koura and her mokopuna Hotumauea set about conquering the Ngaa lwi people (indigenous Pacifica people before Maaori) who were living along the western side of the Waikato River from Taupiri to as far south as Te Raapa Paa, (by what is now Waikato Hospital).
- 2.3.2 Ngaati Haanui: Wairere and his third wife Tukapua had a son named Maramatutahi. He married Paretahuri and their third child was named Haanui. Haanui became one of Ngaati Wairere's greatest hand-to-hand combat warriors. It was Haanui and Hotumauea who set about conquering the Ngaa Iwi people of this region and claimed large areas of their lands for Ngaati Wairere and their sub-tribes. On his death Haanui was buried at Karamu Paa in Gordonton. In the late 1880's his bones, and those of Hotumauea, were exhumed under the supervision of King Taawhiao and Te Puke Waaharoa, to protect them from possible degradation during the land wars. They were reburied at Taupiri mountain. The location of these burial sites is still known to a few of their living descendants. Ngaati Haanui constructed a number of Paa throughout their lands, but the remnants of only one, Miropiko Paa on River Road, is still visible today.
- 2.3.3 **Ngaati Ngamurikaitaua:** There were two people called Ngaamurikaitaua. As they were both famous they are referred to as Ngaamurikaitaua 1 and 2.

The ancestor Ngaamurikaitaua 1 descended from Maahanga's sister-in-law Tikitiki. Ngaamurikaitaua 1 married Puuruhi (early 1600's) who descended from Maahanga's son Ruateatea. Their daughter Ngaamurikaitaua 2 gave birth to Te Tipi who in turn had a child called Inuwai, who was part of the construction of Hahawaru and Nukuhau Paa.

This hapuu derives its name from an event which occurred in the time of Ngamurikaitaua 1, sometime during the 1600's. Following an unidentified battle, a number of dead warriors' bodies were placed in a canoe moored on the Waikato River to await their burial. However, the canoe broke its mooring and floated down stream, where it was seized by the people of this hapuu as it floated by. They cooked the decomposing bodies in a specially constructed Umu (oven) and ate them. From then onwards this group were known as Ngaamurikaitaua, the name describing the eating of these decomposing warriors bodies. Ngaati Ngaamurikaitaua warriors took part in the famous Hingakaakaa battle (1791), fought near Ohaupo close to the shores of Lake Ngaaroto.



### 2.4 NGAATI KOOROKII KAHUKURA KOORERO

Ngaati Korokii Kahukura has connections to both Waikato Tainui and Raukawa lwi. The traditional rohe (region) of Ngaati Korokii Kahukura extends north to Horotiu Paa (Te Raapa region of Hamilton), west to Puahue, east to Puketutu and south through Waipa, Huihuitaha, Waotu North, Waotu South, Matanuku, Maraetai, and Wharepuuhunga to Waipapa.

Throughout this area different hapuu have different levels of Mana (interest in or claim to) in blocks of land. Ngaati Maahanga have dominant mana whenua interests in their homeland area, which includes:

- in and around Cambridge and
- from Te Tiki o Te Ihingarangi (an historic Paa site on the north western side of Karapiro) and Te Taurapa o Te Ihingarangi (eastern side of Karapiro)
- through Pukekura, Horahora and Maungatautari land blocks to the south eastern corner of the Maungatautari blocks where the Owairaka river and the Waikato River, meet at Waotu North.

Ngaati Korokii Kahukura has shared (with Ngaati Maahanga) interests in:

- the eastern side of the Waikato River from Te Taurapa o Te Ihingarangi to where Owairaka and the River meet at Waotu North and
- the areas outside their homeland with their relations of Waikato to the north and Raukawa to the south.

Ngaati Korokii Kahukura are a river lwi, as are the majority of Waikato Tainui hapuu. Their relationship with the Waikato River has endured for centuries. The spiritual and cultural wellbeing of the Ngaati Korokii Kahukura people is inherently linked to the wellbeing of the Waikato River and the tributaries which feed it.

Ngaati Korokii is descended from Haape, one of Korokii's two sons – the other was Hauaa. The hapuu Ngaati Kahukura were dominant in the Waotu and Waipapa areas (South Waikato). They intermarried with Ngaati Korokii; thus the collective hapuu of Ngaati Korokii Kahukura was formed.

Tioriori (Ngaati Korokii) and Te Waaharoa (Ngaati Hauaa) as well as being kinsman, were the recognised leaders of their hapuu and were skilled tacticians in warfare.

Tioriori was the recognised leader of Ngaati Korokii. He was a nomadic leader, skilled in the art of war. He was taught to read and write English in addition to the traditional education he received in the Whare Waananga. He lived at a number of locations including Cambridge, Arikirua, Tamahere, Te Parapara Pa (Hamilton Gardens), Kirikiriroa, Rangiaowhia, Kihikihi, Arititaha, Te Tiki o Te Ihingārangi, Tane and many other places at the base of Maungatautari. He became a native magistrate and school governor. He was captured at the battle of Rangiriri and held prisoner until the end of the Waikato colonial invasion.

# 2.5 NGAATI HAUAA KOORERO

Korokii (Ngaati-Kauwhata) married two of Wairere's daughters Kaahurere and Tumataura. Tumataura had two sons Haape and Hauaa. Haape gave rise to the Ngaati Korokii Kahukura lineage and Hauaa to Ngaati Hauaa.



Ngati Hauaa is an Iwi in its own right – the hapuu of Ngaati Hauaa are: Ngaati Te Oro, Ngaati Werewere, Ngaati Waenganui, Ngaati Te Rangitaupi and Ngaati Rangi Tawhaki.

During the early 1800's Ngapuhi invaded the Hauraki carrying guns. The people of the area fled and sought refuge at Karapiro. This disrupted and displaced the Ngaati Hauaa people living in this area and they left to find refuge with their whanaunga (relations) in Tauranga, Maungatautari, Cambridge, Tamahere and Kirikiriroa (Nukuhau).

During the 1840's and 1850's Ngaati Hauaa established a strong economy centred at the thriving Christian community of Peria. Their Rangatira (Chief) Wiremu Tamehana attempted unsuccessfully to develop a relationship with the Crown on issues of Maaori governance. Because this was unsuccessful he supported the establishment of a Maaori King to provide order and laws within Maaori communities. He anointed the first Maaori King. From that time onwards Ngaati Hauaa have played a prominent role in the establishment of the Kingitaanga (Maaori King Movement). Wiremu Tamehana, and his descendants, hold the position known as Tumuaki or "Kingmaker" and it is their task to find and anoint each new Maaori King or Queen. They are also prime advisors to the King or Queen.

Relationships between the Crown and the Kingitaanga deteriorated over the early 1860s and in July 1863 Crown forces invaded the Waikato. As part of the Kingitaanga, Ngaati Hauaa opposed the invasion of 1863 and 1864, and many of their people were killed or wounded in ensuing battles.

In February 1864, Crown forces attacked the unfortified agricultural settlement of Rangiaowhia which was a refuge for women, children and the elderly. In 1865 the Crown confiscated a large area of Waikato land, including the western part of the Ngaati Hauaa rohe. This raupatu (theft) destituted Ngaati Hauaa and left the lwi virtually landless. In May 1865 at Tamahere, Wiremu Tamehana laid his taiaha at the feet of a British officer and signed 'he maungarongo' ('the covenant of peace'). Until his death in 1866 he sought the return of the confiscated Waikato lands and an investigation into the causes of the war. In the late nineteenth and early twentieth centuries in his role as Tumuaki, Wiremu's son Tupu Taingakawa, continued to seek justice for this Raupatu.

From 1866 the Native Land Court converted customary "land title" into "title derived from the Crown". Legislation derived from this change which was in force until 1873 limited the ownership of any land block to ten or fewer individuals. This meant that land previously held by multiple Maaori owners passed to individuals or small groups. This lead to large areas of land previously awarded by the Court to Ngaati Hauaa being sold by the (new) individual owners, without any reference to the original hapuu or lwi owners. Consequently, by the 1880's private people had acquired a large quantity of Ngaati Hauaa land. Crown purchasing activity further reduced Ngaati Hauaa land holdings.

Ngaati Hauaa lost further land in the nineteenth and twentieth centuries through public works takings for roading, railways, schools, and hydroelectric purposes. Ngaati Hauaa also had a grievance relating to the Crown using the Public Works Act in 1951 to take their land at Waaharoa to construct the aerodrome.

Hamilton City Council
Te kaunihera o Kirikiriroa

Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

# **APPENDIX 3**

### 3 SITES OF SIGNIFICANCE IN THE AREA

There is a long and extensive history of Maaori occupation of the lands of the Hamilton City Council area. This occupation is evidenced by sites of significance, such as Pa and Urupaa which have been documented in Council documents such as District Plans. This information is available because the pressure for development has largely been in the more populated areas of the city. This has promoted investigation and research into the Maaori occupation of the City as part of the RMA consenting process. Hence there is now a wealth of information about the Maaori history of those areas.

By contrast, until recently, there has not been any demand to develop green field areas such as Peacockes and hence there has been little research into the Maaori history of the area. It is only now that predicted population expansion and the associated housing pressures are driving the Hamilton City Council to identify new green field areas where such expansion can occur. This in turn is now driving the need to document the Maaori history and cultural associated with these new areas to ensure that this is not damaged by planned development of the area. However, because to date, there has been little research into these areas, the current information about the Maaori history and sites of significance within the Peacockes area is sparce. This CVA presents what is currently known, but also identifies the necessity to fund further research into the Maaori history of the area, before large developments begin.

In terms of "sites" such as Paa, it is essential to recognise that the area of "significance" of a Paa is not defined by the outer defensive ditch or where the wooden fortifications stood. Maaori records demonstrate that the activities that were essential to the everyday life of the people of a Paa stretched far beyond the limits of the Paa's fortifications. Indeed, there were extensive farming activities in a vast area around most Paa. Many people lived in the area around the Paa, rather than inside its fortifications, only retreating inside the Paa in times of threat from invading war parties. Crops were planted, Koiwi were buried, religious and ceremonial ceremonies involving burying Talismen and Taonga, were all carried on outside of the Paa. Hence for Tangata Whenua, the area of significance of a Paa cannot be defined by a line drawn to identify the fortified perimeter of a Paa, but must include an extensive area of land around the Paa

Indeed, the whole of the land in its entirety is of importance to Maaori. Many activities were carried out well away from centres of habitation. Hunters and food gatherers travelled considerable distances from Paa (fortified village) and Papakainga (none fortified village) and often set up temporary camps close to seasonal food sources. They carried out various rituals and ceremonies associated with their everyday life and food gathering activities during their travels and at their temporary camps. Whilst the actual location of many of these sites are now lost, buried human remains (Koiwi) and artefacts(taonga) that attest to their presence may still be buried in the soils of the area.

In the following section, several of the sites discussed are not within the area defined by HCC as the "Peacockes" district, and could therefore be considered as irrelevant to the current study. This highlights the difference between Maaori and European concepts of Districts and boundaries - Local Authority boundaries do not match Maaori areas and boundaries. Local Authority districts are administrative areas defined by boundaries drawn on a map. Maaori Districts (rohe) are defined by the tribal affiliations of the people who lived in the area and the narratives of the events that occurred at, and around, particular sites. Hence, as Local



Authority Districts are very much smaller than Maaori Districts, several Local authority districts are often contained within one Maaori "district".

Hence, if the Maaori narratives (koorero) which define a rohe are confined to only what happened in a particular Local Authority District within that rohe, the koorero does not make sense. This is best illustrated by some of the koorero about Nukuhau Paa, which comes within the Peacockes district.

(Extract from Nga Tapuwae O Hotumauea: 2002):

"In an interview in 1998 the late Mr. Waea Mauriohoho (Ngaati Raukawa and Ngaati Haua) recounted that "Mahinarangi and her husband Turongo crossed the Waikato River at the Narrows, whilst travelling to Nukuhau Paa. The name Tamahere is derived from the way Mahinarangi tied Raukawa, her infant son, to her back whilst she swam across the river - Tama (son) Here (to bind)."

In terms of the Maaori concept of a District, this narrative about an event that took place at and around Nukuhau Paa makes perfect sense Nukuhau Paa is close to the narrows where Mahinarangi crossed the river on the way to Nukuhau Paa to visit relatives. However, in terms of Local Authority boundaries, if the story is restricted to what happened within the HCC defined Peacockes district:

- Mahinarangi and Turongo started on the east bank of the river in the Waikato District Council area (Tamahere),
- They swam across the river and emerged on the west bank into Waipa District Council
- They entered the Paa in the Waipa District Council area
- However, as the boundary between Waipa District Council area and Hamilton City Council runs through Nukuhau Paa, then once in the Paa, they were in Waipa or Hamilton City Districts, depending upon which part of the Paa they were in.

Hence, if the narratives for this current study are confined to only the HCC defined Peacockes area, then this story does not make sense and could be classed as irrelevant.

Similarly, in terms of Local Authority boundaries, the Paa on the West side of the river (Nukuhau, Whatukoruru, Hahawaru) are within the HCC "Peacockes" area. These are therefore quite separate from the Paa on the other east side of the river, as they are in another HCC district - some are also in Waikato District Council's area. By contrast, as far as Maaori are concerned these are all river Paa and as the river was their prime source of travel and transport, they are all within the same rohe (district), just on either side of the river. They are/were not distinguished by their particular location, but by who lived there and their tribal associations. For this reason, the following section documents the Paa "within the Nukuhau Whenua rohe" rather than in the Peacockes District.

### PA IN THE NUKUHAU WHENUA ROHE 3.1

Pre-European Maaori commonly sent war parties to invade other areas to settle old scores, take prisoners as slaves, or to access the natural resources of the area. Consequently, settlements were usually centred on/around fortified Paa. These were built in strategic positions, such as steep-sided promontories on riverbanks or gullies, which could be fortified with a minimum of construction, and easily defended. While some people lived within the Paa,



others had their home outside the fortifications and only retreated to the Paa when under attack or threatened.

### 3.1.1 NUKUHAU PAA

Nukuhau Paa was the most important and significant Paa in the area. It was not only a place where people lived, but was also a meeting place where waananga were held and Taua (warriors) from various Hapuu congregated prior to going into battle

Ngaati Wairere koorero associated the Paa with Ngaati Wairere and records that the Paa was established by Korokii as fighting Paa and a fortress that protected the people and surrounding whenua in times of inter-tribal warfare.

Ngaati Maahanga koorero associates the Paa with Ngaati Maahanga and records that it was Tipi who built Nukuhau Paa (Hayward & Samuels 2015). Te Tipi is the acknowledged origin of Ngaati Ngaamurikaitaua as a distinct hapuu and his lineage demonstrates the association between Ngaati Maahanga, Ngaati Ngaamurikaitaua and Nukuhau Paa.

The area surrounding the Paa was extensively cultivated. The narrowness of the Waikato River close to the Paa (now known as the Narrows) allowed the people of the Paa and the surrounding whenua easy access to the eastern bank of the river. This thereby expanded their horticultural (Maara kai or food gardens) and trading area and activities. The Maara Kai in this wider zone were extensive and highly productive.

People from different hapuu lived at and lead the people of the Paa in times of war and peace. Tuhikitia was a Ngaati Hauaa Chief who led the occupants of Nukuhau Paa in his time. Pouwhero Hiki, a descendant of Te Tipi (who Maahanga identify as the builder of the Paa) and Inuwai, was one of the last to occupy the Paa (Hayward 2017). Ngaati Wairere Chiefs Te Apipainga, Te Ironui, Iraia Patoto, and other hapuu Chiefs such as Porokoru and Tatangi Te Roore lead their respective Taua (warriors) in the defence of Nukuhau Paa during attacks by both Ngaati Taukaawa and Te Rauparaha prior to the 1820's (extract from HCC Draft District Plan change: Maaori Heritage Section).

In 2002, Nga Mana Toopu O Kirikiriroa (NaMTOK) prepared a report, authored by Wiremu Puke, entitled "Nga Tapuwae O Hotumauea" (the footsteps of Hotumauea), which detailed some of the Maaori history of the Paa sites along the Waikato River. Whilst this dealt primarily with sites within the Hamilton City boundaries it made brief reference to the Peacockes area. In 2006, as part of preparing a structure plan for the Peacocks area to determine strategies for future Urban development, the Hamilton City Council (HCC) requested NaMTOK to review that report and add any further comments or information regarding additional sites that may have been missed as part of the 2002 investigation. That information was documented in "A Cultural Evaluation by Nga Mana Toopu O Kirikiriroa: Assessment of Tangata Whenua Historical and cultural sites in the Peacockes area." Author Wiremu Puke. The following is extracted from both those NaMTOK reports:

"Gainsford Road, which marks the boundary between Hamilton City Council and Waipa District Council, cuts through Nukuhau Paa. Whilst the district now known as Tamahere is on the other side of the Waikato River from Nukuhau

Paa, the derivation of the name has some relevance to the Paa. In an interview in 1998 the late Mr. Waea Mauriohoho (Ngaati Raukawa and Ngaati Hauaa) recounted that "Mahinarangi and her husband Turongo crossed the Waikato River at the Narrows, whilst travelling to Nukuhau Paa where Ngaati Koura, Ngaati Ngaamurikaitaua and Ngaati Ruru were living. The name Tamahere is derived from the way Mahinarangi tied Raukawa, her infant son, to her back whilst she swam across the river - Tama (son) Here (to bind)."

This location, where the Narrows Bridge crosses the Waikato River, is the narrowest point of the Waikato river in this area. It was therefore a place of great significance to pre-European Maaori as they could cross the River here, thereby giving access to and from Nukuhau Paa. There was a canoe landing point on the west bank of the river, where war canoes were pulled onto the riverbank and hidden under the scrub and ferns. Ancient Maaori commonly declared such strategic places of importance tapu. Designating and identifying a place as tapu was done in various ways including:

- Painting the trunks of large trees with red ochre.
- Establishing a place of ritual where offerings were made to various tribal deities to ensure travellers safe passage.
- Placing a carved stone or rock to mark the location as tapu.

There were a number of canoe landing sites along the Waikato River. These were generally considered to be sacred places particularly when the bodies of slain warriors that had been transported by canoe were landed at one of these landings.

The canoe landing site and river crossing at the Narrows were very busy in pre-European times. Hence items such as stone talismans, discarded stone tools and other Taonga may well be buried in the river bank or river bed and hence may be unearthed during any earthworks that might be undertaken near the riverbanks.

### 3.1.2 KAIROKIROKI PAA

This Paa is located on the west bank of the Waikato River, between Wai Ora Terrace, Peacockes Road and the Waikato River. It is directly across the river from the Te Parapara Paa site in the Hamilton Gardens and the Managakootukutuku inlet into the Waikato River.

The Paa site runs parallel to, but slightly elevated above, the River. At its eastern end it was protected and defended by a ditch and trench structure which is well preserved and visible today.

In 1993, a partly carved Patu (hand held fighting club), made from medium grain, green-grey, volcanic rock, was unearthed in the eroding river bank close to the Paa. When found, the Patu was in two pieces. In 2005, segments of an ancient waka (canoe) were also unearthed near to the Paa. Two sections of the hull of a waka were also recovered from the Waikato River also close to the Paa.



Muskets and other weapons have been found within the Paa site, wooden artifacts were found to the south of the Paa and musket balls close by in the Waikato River. A large burial ground (Urupaa) has also been recorded near to the Paa site.

### 3.1.3 WHATUKORURU PAA

This Paa is located in the Managakootukutuku Valley with Hall Road to the West and Peacockes Lane to the East. The a is surrounded on three sides by the gully and double ditch and bank style defences. It is classed as an "horticultural" Paa as borrow pits and modified Maaori-made garden soils have been found in the area around it.

The following additional information is extracted from an Iwi Consultation report prepared by NaMTOK (author Wiremu Puke) in February 2003, for an RMA resource consent application for a property in the Dixon Road area.

"The application falls within the traditional lands of Ngaati Koura and Ngaati Ngaamurikaitaua, sub-tribes of Ngati Wairere who occupied the nearby Whatukoruru Paa prior to 1864. The Whatukoruru Paa is situated off Peacockes Lane and derives its name from the large gully system that extends through the area."

The Hamilton City Council recently returned ownership of Whatukoruru Paa to Waikato Tainui.

# 3.1.4 TE PUHI A TARAO PAA (Tiireke) & HAHAWARU PAA (Glenview, Deanwell).

The following account is extracted from page 15 of "Ngaa Maara O Muriwhenua – Ngaati Maahanga Sites of Historical Significance in Hamilton West." Compiled by Paretutaki Hayward (Ngaati Maahanga, Ngaati Houra) for Te Haa O Te Whenua O Kirikiriroa, April 2017.

"Te Puhi a Tarao was a Paa at the foot of Tiireke maunga (mountain). Tiireke maunga, was the rise where the Paa stood and is now known as Resthills Park. An old map shows Tiireke was near the source of the Mangakootukutuku river. As the name suggests, Ngaati Tarao were associated with this Paa, as well as Ngaati Ruateatea (groups who have descent from Ngaati Koura, Ngaati Waenganui and Ngaati Ngaamurikaitaua). Ngaati Hourua also had a Kaainga nearby, known as Hahawaru Paa (also known as Takakura Kaainga). The location of this Paa has been estimated near to what is today called Chinaman's Hill. Tiireke was the site of the largest Maaori owned flour mill during the 1840s – 1850's. Ngati Ngamurikaitaua has been associated with this mill."

### 3.2 EAST BANK PA

The following information is extracted from "Nga Tapuwae O Hotumauea" Maaori Landmarks on Riverside Reserves Management". The Maaori content in this Management Plan was

prepared by Nga Mana Toopu O Kirikiriroa to assist in the management of traditional Maaori sites situated on reserves along the Waikato River within Hamilton City boundary. NaMTOK identified seventeen significant riverside landmarks within the boundaries of the Hamilton City Council. The following sites are located on the east side of the Waikato River, but in Maaori culture they are relevant to the Nukuhau Whenua area.

### 3.2.1 Te Nihinihi Pa: (Dillicar Park) – other side of the river opposite Peacockes Reserve.

Little is known about this Paa except that Ngaati Koura and Ngaati Haanui occupied it at various times during its existence. It is believed that the elongated shape of this Paa resembled, and hence commemorated, Hotumauea's footprint.

Most of the Paa is located in Dillicar Park but a portion is on privately owned land. This park is named after Councillor Dillicar who was in Council from 1935 until he resigned in 1945.

### 3.2.2 Te Parapara Paa

Te Parapara Paa is located in what is now the Hamilton Gardens. It was occupied by Haanui and his Ngaati Wairere descendants. The Paa was particularly renowned as a site of sacred rituals associated with harvesting of food crops and the collection of the first berries from forest stands in the area. There was a Tuahu (sacred altar or shrine) called Te Ikamauroa at the Paa.

As the then representative organisation for Mana Whenua, Nga Mana Toopu O Kirikiriroa designed and developed Te Parapara Maaori garden at Hamilton Gardens. This commemorates the association of Tangata Whenua with this, their traditional lands, the location of Te Parapara Paa and illustrates pre-European Maaori horticultural practices – particularly cultivation of Kumara.

# 3.2.3 Te Paa O Ruamutu - Hammond Park Reserve; East bank, below Balfour Crescent

This Paa was named after Ruamutu, the Chief of the Ngaa lwi people who constructed the Paa and occupied it until Ngaati Wairere dispossessed them. Ruamutu was killed in the battle for the Paa. Ngaati Wairere occupied the Paa until the arrival of the British. This was a large boundary Paa, certainly one of the largest Paa within the Hamilton City area. It was sited close to, and guarding, the boundary between the lands of Ngaati Wairere and Ngaati Hauaa. The Paa was rectangular in shape, built on a headland close to the Waikato River, just upstream from the Mangaonua gully (Tamahere). Balfour Crescent crosses what was the ditch fortification of the Paa, but this ditch is now unrecognisable as it was filled in during the development of Balfour Road. The ridge upon which the houses at the end of Balfour Crescent, closest to the river, are built was the original central raised terrace of the Paa. There are no remnants of any of the original structures remaining today.

During the wars with Ngaati Raukawa in the mid 1600's a number of battles were fought at Te Paa O Ruamutu, and along the riverbank close to the Paa. At one time during these wars the warriors of Ngaati Raukawa, led by their Chief Ngaa Tokowaru,

Attachment 7



Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

came up river by canoe. The canoe was spotted by the people of Te Paa O Ruamutu Paa. They abandoned the Paa in a ploy to convince the invaders that they were in unopposed control and possession of the area. This ploy worked and the Ngaati Raukawa warriors passed by the Paa and continued up the river to Taupiri where they were defeated by the combined forces of Ngaati Maahuta, Ngaati Maakirangi and Ngaati Wairere.

Whare Koata, a paramount chief of Ngaati Wairere, lived at Te Paa O Ruamutu Paa. He was killed by an invading war party from Hauraki whilst on a bird hunting expedition at Tauhei. Upon the news of his death this Paa was abandoned, and following ancient Maaori custom, became an Urupa (cemetery). King Taawhiao is reported to have visited this Urupa when he travelled through Hamilton in 1881.

Human bones (Koiwi), and numerous green stone artefacts have been found at this site by the bulldozer drivers who constructed Balfour Crescent and subsequently by house owners digging in their gardens.

### Mangaonua Paa - Mangaonua Esplanade Reserve, East bank, below Riverlea Road.

Not a great deal is known about Mangaonua Paa. It was a small boundary Paa occupied by the people of Ngaati Wairere. The Paa marked and guarded the boundary between the lands of Ngaati Hauaa to the south and Ngaati Wairere to the north. Mangaonua Paa is close to Te Paa O Ruamutu and the two Paa were joined by a walking track.

### OTHER FEATURES OF SIGNIFICANCE IN THE AREA

There are a number of historic and environmental features in the Peacockes area that are of considerable significance to Tangata Whenua. The following information is extracted from "A Cultural Evaluation by Nga Mana Toopu O Kirikiriroa: Assessment of Tangata Whenua Historical and cultural sites in the Peacocks area February 2006".

### 3.3.1 **BORROW PITS.**

Pre-European Maori cultivation involved excavating soil from an area and spreading the excavated soil over the surrounding area. This was then fertilised with wood ash and other components and the crops planted in this surface layer of soil. The surface layer of soil is now referred to as a "modified soil" and the hole from which the modified soil was excavated is a borrow pit. This soil excavation process was usually accompanied by pagan religious rituals that included burying a talisman (carved wooden or stone artefact) in the borrow pit. The Peacocks area was a major site of such pre-European Maori cultivation. Hence borrow pits and modified soils existed throughout the District with the largest concentrations along the river terraces and near major Paa and Papakainga sites.

Borrow pits could still be seen on various properties within the Mangak0otukutuku catchment (Peacockes) and along the river terraces of the area in aerial photos from 1943 and 1954. Many of these borrow pits have since been modified or filled in during development of subdivisions and allotments. However, extreme care must be taken during any earthworks in the Peacocks area as these borrow pits, and the Taonga that are buried in them, may well become exposed during such works.

Artefact find sites and Maori place names are further evidence of Tangata Whenua's use of this catchment. More artefacts, Koiwi, Urupa, borrow pits, and modified soils may well be discovered as the Mangakootukutuku catchment is developed.

### 3.3.2 PUNA - FRESH WATER SPRINGS.

There are a number of Puna (fresh water springs) recorded in this area, but most of them are on private property. Puna were particularly important to pre-European Maori because water from a Puna that was particularly clear and pure was used for ceremonial purification in various rituals and religious ceremonies. This water was never used for domestic (drinking, cooking) purposes. Less "pure" water from other springs was used for domestic purposes, or for drinking water, depending on clarity and taste. Often kete (bags) containing Karaka, Tawa or Hinau berries were placed in the water of the Puna to ferment, or to remove toxins from the berries in preparation for their consumption.

At some puna, Paru was formed in the area where the water flowed out of the ground. Paru is a black mud, the colour being produced by the decaying vegetation and traces of iron oxide it contains. Flax fibres and carvings were immersed in the Paru to dye them black.

Human remains (Koiwi) and Taonga (talismen, wooden carvings) were sometimes buried in or near Puna.

### 3.3.3 URUPA (burial grounds)

There are records of many ancient Urupa (burial grounds) in this area - the location of some is known, but most have now been lost or destroyed. It must be recognised therefore, that pre-European Maaori did not bury their mate (bodies) in specific areas similar to European cemeteries. Rather they were buried in land which had significance to the whanau (family) or hapuu (tribe) of the deceased, often at unmarked sites. Consequently, Koiwi (human remains) may be encountered at any location or depth below the surface (Koiwi were recently unearthed at a depth of 16 feet) during development of Peacockes.

# 3.4 THE ENVIRONMENT

The following account is extracted from documentation by NaMTOK (Wiremu June 2007 from RMA application report for Dixon Road, Peacockes)

Attachment 7

Hamilton City Council

Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

"Properties on Dixon Road fall within the traditional lands of Ngaati Ruru, Ngaati Parehaehaeroa, and Ngaati Koura who are the Tangata Whenua for the area. Documents from the 1860's record that the hill ridges in this area were once covered in Totara, Kauri, Rimu and Manuka scrub along with stands of Kahikatea, Raupo, toetoe, and native flaxes along the swampy margins and nearby gullies. Springs were also evident that contained artifacts and clear suitable drinking water. The Ohaupo Road heading south is constructed upon and ancient Maaori walking track that was commonly used by war parties."

In the 1850's, local hapuu cultivated extensive areas of wheat and maize and had established a mill to process their harvested produce. These lands were confiscated by the Crown in 1865.

### 3.5 WATERWAYS, STREAMS AND GULLIES

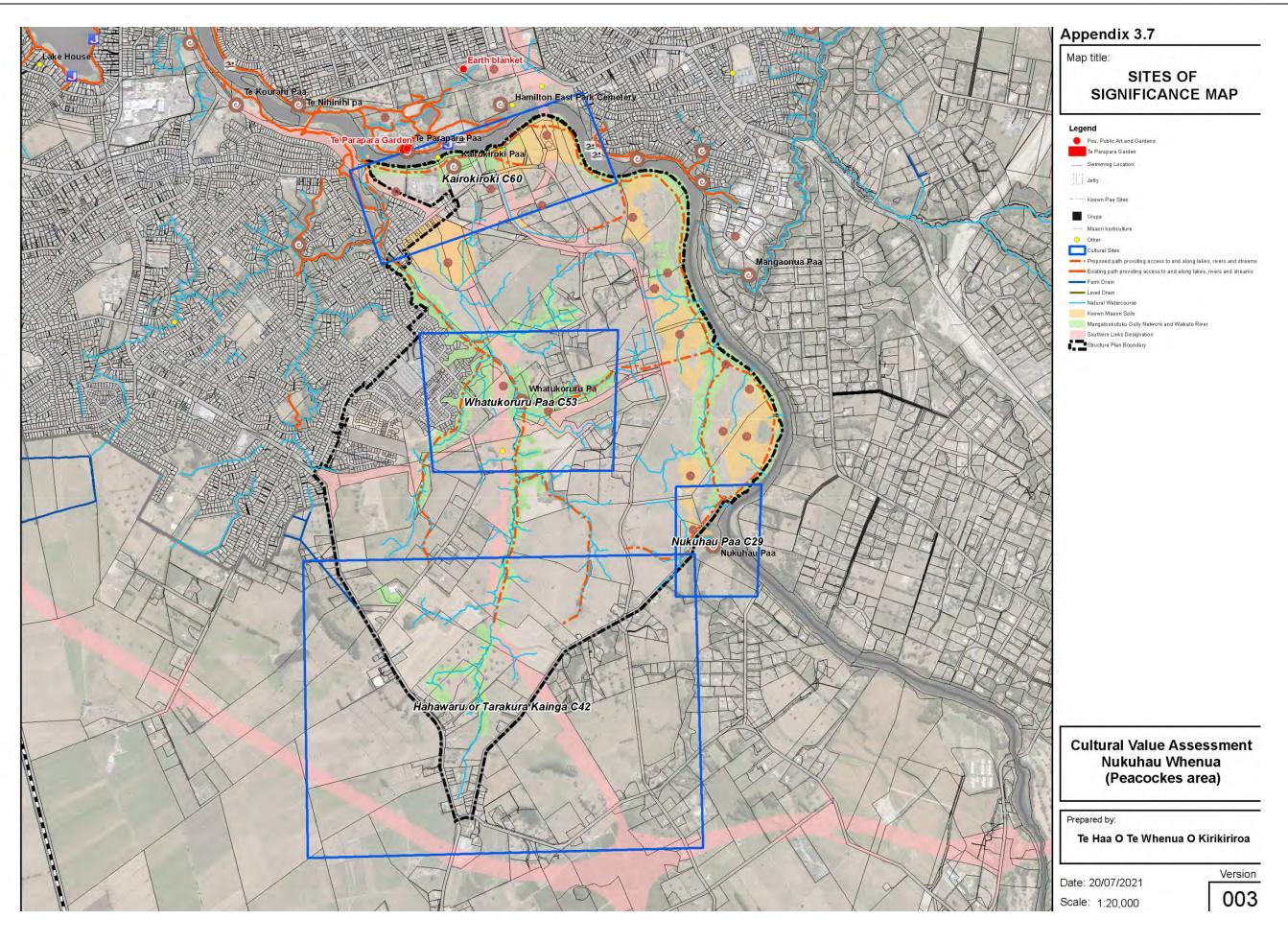
The Waikato River is the prime waterway in the area and defines the eastern boundary of the Peacockes district. The Mangakootukutuku catchment within the Peacockes District collects water and feeds it, via the Mangakootukutuku, into the river. On the other side of the river (east bank) the Mangaonua stream flows into the river from Tamahere.

Mangakootukutuku means tree Fuchsia stream - Manga means a watercourse or stream and Kotukutuku is the tree Fuchsia (Fuchsia excoticata). Ngaati Maahanga koorero is that these trees grew close to the area known as Tiireke and their edible berries were a traditional food source.

3.6 Mangakotukutuku stream and Catchment (extracted from Tangata Whenua section of the Mangakotukutuku Integrated Catchment Management Plan (ICMP) September 2019).

The abundance of natural resources in the Hamilton basin sustained the Tangata Whenua in the area. They obtained most of what they needed to support their material requirements from nearby bush, wetlands, the Waikato river, streams and what they could cultivate from the land.

The Waikato River, streams, lakes and extensive wetlands in the district teemed with life. Tuna (eels), whitebait species (inanga, banded kokopu and giant kokupu) smelt, piharau (lamprey eels), kanae (yellow and grey eyed mullet), kakahi/kaeo (fresh water mussels), and koura (fresh water crayfish). Some of these species were identified in the Mangakootukutuku catchment in a 2017 survey. Prior to European settlement, the Mangakootukutuku stream and Waikato river and all of its tributaries had high water quality, free from contaminants other than those naturally occurring (vegetation litter, sediment from erosion and scour).





## APPENDIX 4

## 4 MANA WHENUA ASPIRATIONS

#### 4.1 INTRODUCTION

Through whakapapa (genealogy) Tangata Whenua are related to Ranginui (Sky Father) and Papatuanuku (Earth Mother) and this relationship is recorded in Karakia (prayer), Kawa (ritual) and Waiata (song). They return the Whenua (afterbirth) to the earth in recognition of this origin, and their eventual return to the earth after Mate (death). Because of this association Tangata Whenua align cultural, physical and spiritual wellbeing with Te Taiao (the environment). Consequently, all Maaori people are charged with the duty of care for the environment (land and water): this is the essence of the concept of Kaitiakitanga.

- "Kaitiakitanga is a principle incorporating the cultural, physical and spiritual values
  of Maaori. It includes the rules and practices Maaori have used for centuries to
  control and manage their natural resources, along with exercising their traditional
  responsibilities of guardianship and protection (Marsden & Henare, 1992)".
- Kaitiakitanga is a traditional practice system which has been passed down through generations through oral and artistic history. The traditional stories of Ranginui and Papatuanuku are embedded into the younger generation for the sole purpose of passing on the customs and sustainable practices for the care of the environment (Moko Tauariki 2020).

KAITIAKITANGA (guardianship and protection of the environment: land, water, sea and air) IS THEREFORE A FUNDAMENTAL MAORI ASPIRATION.

## 4.2 ENVIRONMENTAL PLANS: giving effect to KAITIAKITANGA.

Dr. Hare Puke (Ngaati Wairere), Chairman of the Tainui Maaori Trust Board, said:

"The Resource Management Act 1991 allowed Maaori to once again put their hand back on their traditional lands."

In recent years, settlements of Maaori Treaty Claims have returned some land back to Maaori, and given them access to resources to further purchase/acquire surplus Crown land. This, coupled with the requirement of Sections 6 to 8 of the RMA, has empowered Maaori to have their voices heard in regard to any proposed land development within their Rohe (district). Consequently, to inform developers, local authorities and the general public, Waikato Tainui lwi Authority and some individual hapuu of Waikato Tainui lwi, have documented strategic policies defining their values in regard to land and water. These policies define and give effect to their aspiration of Kaitiakitanga. The proposed Peacockes PSP has been measured against these plans.

Mana Whenua aspirations for the land of Nukuhau Whenua are identified by applying these policies to that whenua.

#### 4.2.1 NGATI HAUAA ENVIRONMENTAL PLAN

Ngaati Hauaa developed an environmental plan which contains policies that guide/instruct developers and decision makers about how to meet Ngaati Hauaa's aspirations of Kaitiakitanga. Section 6 of the plan outlines these aspirations and priorities to include:

Sustainable Land Use and Development: Use and Development of Lands: Te Wai
(Water): Ngaa Repo (Wetlands): Maahinga Kai (Fisheries): Te Ararangi (Air):
Cultural Heritage: Customary Activities: Ngaati Hauaa Tangata (Kaitiaki).

#### 4.2.2 TE TURE WHAIMANA O TE AWA O WAIKATO

The Waikato Tainui Raupatu Claims (Waikato River) Settlement Act 2010 heralded a new era of co-management and co-governance of the Waikato River. This is underpinned by Te Ture Whaimana o te Awa o Waikato (Waikato Tainui's Vision and Strategy for the Waikato River). This vision is;

"for a future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn, are all responsible for restoring and protecting the health and wellbeing of the Waikato River, and all it embraces, for generations to come."

The Vision and Strategy includes commentary on urban and rural development, water use and discharge, water take and recreational use. Every project must comply with the terms of Te Ture Whaimana and contribute to the restoration and protection of the health and well-being of the Waikato River including its tributaries.

## 4.2.3 WAIKATO TAINUI ENVIRONMENTAL STRATEGY: Tai Tumu, Tai Pari, Tai Ao

The visions for Waikato Tainui's environmental strategy are documented in "Tai Tumu, Tai Pari, Tai Ao". The plan has three priority areas which define;

- Te Mana o Te Wai (freshwater): The Waikato river within the Tainui rohe will receive an A+ report card rating.
- Te Mana o Te Whenua (land): Waikato-Tainui double the ownership of lands every generation, and ensure all Waikato-Tainui Land Holding is culturally and economically sustainable.
- Te Mana Whakahaere (customary and cultural activities): All marae and tribal members are supported by tribal partnerships to fulfil priority kaitiaki responsibilities.

# 4.3 APPLICATION OF THESE ENVIRONMENTAL PLANS TO DETERMINE MANA WHENA ASPIRATIONS RELEVANT TO THE PEACOCKES AREA

Section 8.2.1 of the Waikato-Tainui Environmental Plan provides an hierarchal, priority-based framework which can be applied to identify Maaori aspirations for the land in the Peacockes area. It states:

"In managing the effects of a resource use or activity, regardless of the magnitude, frequency, or duration of the effect, Waikato-Tainui considers that it is necessary to provide a net benefit when considering social, economic, environmental, spiritual and cultural impacts – to strive for environmental enhancement. Therefore, it is necessary



Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

to suitably manage any effects so that they are avoided, remedied, minimised, mitigated, or balanced.

For Waikato-Tainui, this is essentially a hierarchy where the premium way to manage an effect is to avoid it, the second way is to remedy it, and so on through to suitably balancing the effect, (offset mitigation).

"In managing effects consideration needs to be given to:

Avoid: manage the effects so they can be avoided - no effect occurs;

Remedy: managed to the point that the effect is eliminated (e.g. cleaning discharges to water so that the water of a suitable quality);

Minimise: manage frequency or magnitude of the effect to a point where it does not cause concern to Waikato-Tainui;

Mitigate: if the effects cannot be adequately avoided, remedied, or minimised, is there something that can be done to mitigate or offset the effect to create a benefit not directly linked to the proposed resource use or activity. (e.g. an effect of discharge to water being offset by additional riparian planting or wetland restoration).

Balance: when taking all the effects into consideration, and considering the relative weight of the effects to Waikato-Tainui, do the positive effects adequately balance out the negative effects, and provide environmental enhancement? Only Waikato-Tainui can determine whether effects are suitably balanced for Waikato-Tainui.

If this framework is applied to the Peacockes area it defines the "aspirations" that are available to Mana Whenua in terms of the proposed development of Peacockes area:

Avoid: (manage the effects so they can be avoided);

Abandoning the proposed development, leaving the land unaltered and returning it to Mana Whenua would give action to this requirement. However, whilst the Hamilton City Council recently returned the site of Whatakoruru Pa to Waikato Tainui, return of the whole area, much of which is in private ownership, is "unlikely".

Remedy: (manage to the point that the effect is eliminated).

Given the planned development of the area to incorporate a significant housing development with associated shopping precinct(s), recreational facilities, utilities and roading systems, it will be impossible to meet this requirement.

Minimise: (manage frequency or magnitude of the effect to a point where it does not cause concern to Waikato-Tainui).

For the same reasons as in "b" above, this option is not available.



Mitigate: (if the effects cannot be adequately avoided, remedied, or minimised, is there something that can be done to mitigate or offset the effect to create a benefit not directly linked to the proposed resource use or activity).

Given that options a, b and c above are not available, this option is the "highest" priority available to Mana Whenua in dealing with the proposed development of the Peacockes area. Mitigation (and commemoration) based on:

- Application and hence practical demonstration of Maaori environmental and cultural values in the planning and implementation of the development and
- Installation of structures to recognise the pre-European Maaori history and people who lived on this land,

will allow Mana Whenua to exert some amount of Kaitiaki over this whenua.

Balance: (when taking all the effects into consideration, and considering the relative weight of the effects to Waikato-Tainui, do the positive effects adequately balance out the negative effects, and provide environmental enhancement?).

Whilst this is the lowest priority option, because of its focus on environmental outcomes, it should be included as part of the implementation of option "d" above.

# 4.4 MITIGATING AND BALANCING THE EFFECTS OF THE PROPOSED DEVELOPMENT.

Irrespective of who currently owns this land, Mana Whenua's fundamental aspirations for this land is;

- Kaitiaki (protection and guardianship) of the Whenua and Awa
- Recognising the Mauri of the land and commemorating the Maori history of the land.

As Mitigation and Balancing any damage done to the land and awa by development are the only option available for Mana Whenua to achieve this aspiration then implementation of Kaitiaki will have to be based on the following mitigation categories:

- Recognising the Maaori values (history, people and environment) associated with this land and commemorating/recording it appropriately and in a way that will be recognised and understood by none Maaori.
- Mitigating the damage which the development will cause to the Wairua of the land
- Protecting any/all sites of significance to Maaori (Waahi Tapu), including those currently identified and any that might be unearthed during the development.
- Mitigating any physical damage done to these sites of significance this must apply to all land whether in "public" or private ownership.

"Once Waikato-Tainui sites are altered or lost, they cannot be replaced and there is no mitigation or compensation that can restore its original significance. Therefore, Waikato-Tainui must protect their Waahi tapu (sacred sites) and Waahi tupuna (ancestral sites) for the benefit of future generations and to acknowledge the sacrifices of tuupuna" (Waikato-Tainui, 2020).

Hamilton City Council

Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

- Identifying, protecting and enhancing the environment of the area (fauna and flora on land and in the waterways)
- Protecting the Waikato River and all local waterways from any damage during and after the development phases and
- Enhancing the water quality in the area so that it meets the Waikato Tainui defined A+ scorecard.

These broad mitigation categories will be achieved by application of practical measures such as, but not limited to, the following examples:

- Incorporating Maaori ceremonies before, during and after any physical work done on the area
- Incorporating Maaori designs and artwork into structures developed in the area
- Incorporating native and indigenous plants into all planting schemes and setting aside areas of land as reserves in which the pre-European flora of the area can be regenerated.
- Incorporating surveys of land fauna (bats, birds, molluscs etc.), water fauna (fish, crustacea, molluscs) and flora (land and water) as part of the planning and implementation of the development.
- Based on the results of these surveys, develop "environmental" enhancement and protection strategies. One such strategy should address removing "exotic", introduced fish species and reintroducing challenged or "at risk" indigenous fish species into the waterways and lakes in the area.
- Investigate and identify opportunities for Maaori employment as a priority in the development process.
- Incorporate historical Maaori names associated with this area for places, recreational areas and streets.
- Recognising sites of significance and Waahi tapu sites by erection of carved Pou Whenua, Pou Rahui, story boards, whata etc.
- Given that Nukuhau Paa, probably the most significant Paa in the area, was a centre for training and meetings, adopt an education theme for development of the area:
  - Involve students off all levels and ages (Kura, Kaupapa Maaori, other schools and Waananga's) in surveys and documentation of protection and enhancement strategies of Fauna and Flora in the area.
  - As part of the development of the Public facilities, incorporate a Library/Convention Centre – named Nukuhau Paa Centre – to record/mirror the historical use of Nukuhau Paa for important meetings/discussion by pre-European Maori (see the Section on Sites of significance in Appendix 4). The Centre should incorporate Maaori designs, art work and an area depicting the Maaori history and people associated with Nukuhau Paa and this area, as told in this CVA.

In this context, it must be noted, that as this document is a Cultural Values Assessment (CVA), then the mitigation categories and implementation strategies exemplified above only provide broad mitigations for Maaori aspirations. They are designed to give developers some indication of the potential mitigations which Mana Whenua consider appropriate for development of the whole Peacockes area. Not all of these potential mitigations will apply to every individual development. Which mitigation(s) will apply to a particular development in a specific area of Peacockes will be identified within the Cultural Impact Assessment (CIA) which THaWK will prepare for each specific project. The koorero (Maaori history) identified in the "History, People and Significant sites" (Appendix 2) sections of this CVA, will inform which mitigation(s) are appropriate for individual developments.

## **APPENDIX 5**

## 5 RELEVANT LEGISLATION, ENVIRONMENTAL PLANS AND POLICIES

## 5.1 Treaty Settlement Legislation

This CVA identifies measures that should be incorporated in the Nukuhau Whenua (Peacockes) Structure Plan to give effect to the following legislation, Environmental Plans and Policies.

## 5.1.1 Waikato Raupatu Claims Settlement Act 1995

The Waikato Raupatu Deed of Settlement 1995 legislation is largely based around events that took place from 1863 onwards that relate to land confiscation and the impacts of the New Zealand Land Wars on Waikato-Tainui. The Waikato River was excluded from the 1995 Act. The land designated for the Peacockes development was confiscated from Waikato-Tainui.

## 5.1.2 Waikato Raupatu Claims (Waikato River) Settlement Act 2010

The Waikato River Deed of Settlement was signed by Tainui and the Crown in 2009 and enacted in 2010. It heralded a new era of co-management of the Waikato River and its tributaries (lakes, streams, wetlands, lands, waahi tapu and minerals). The overarching purpose of the Waikato River Settlement, is to restore and protect the health and wellbeing of the Waikato River for future generations.

Part 2 (Settlement redress through legislation), 8(3) of the Waikato Tainui Raupatu Claims (Waikato River) Settlement Act 2010 statement of significance of the Waikato River to Waikato-Tainui states the following:

"The Waikato River is our tuupuna (ancestor) which has mana (spiritual authority and power) and in turn represents the mana and mauri (life force) of Waikato-Tainui. The Waikato River is a single indivisible being that flows from Te Tahekeheke Hukahuka to Te Puuaha o Waikato (the mouth) and includes its waters, banks and beds (and all minerals under them) and its streams, waterways, tributaries, lakes, aquatic fisheries, vegetation, flood plains, wetlands, islands, springs, water column, airspace, and substratum as well as its metaphysical being. Our relationship with the Waikato River, and our respect for it, gives rise to our responsibilities to protect te mana o te awa and to exercise our mana Whakahaere in accordance with long established tikanga to ensure the wellbeing of the river. Our relationship with the river and our respect for it lies at the heart of our spiritual and physical wellbeing, and our tribal identity and culture".

In this regard Waikato-Tainui has sought to engage with the Crown and their respective delegated authorities to work collectively/collaboratively for the health and wellbeing of the Waikato River and its tributaries.



The Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 sets out Te Ture Whaimana o te Awa o Waikato (The Vision and Strategy for the Waikato River). The vision for the river is:

"for a future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn, are all responsible for restoring and protecting the health and wellbeing of the Waikato River, and all it embraces, for generations to come."

This is underpinned by the whakatauki (proverbial saying) of King Taawhiao;

"Tooku awa koiora me oona pikonga he kura tangihia o te mataamuri".

The river of life, each curve more beautiful than the last.

The streams in the wider Kirikiriroa rohe flow to the Waikato River. It is therefore the responsibility of all those who have direct and indirect interests with the Waikato River to ensure that the Vision and Strategy to restore and protect the Waikato River for generations to come is maintained and practiced at all levels. This includes, but is not limited to, plan changes, structure plans, urban and rural development, water use, water discharge, water take and recreational use. The Peacockes development must be consistent with Te Ture Whaimana and contribute to the restoration and protection of the health and well-being of the Waikato River, in its holistic form

## 5.1.3 Ngaati Hauaa Claims Settlement Act 2014

Whilst Ngaati Hauaa was one of the 33 hapu which administratively made up the Tainui Maaori Trust Board for the Raupatu Claim and settlement, Ngaati Hauaa is an Iwi in its own right. The Ngaati Hauaa Claims Settlement Act 2014 (The Settlement) therefore addressed the non-Raupatu elements of Ngaati Hauaa's historical Treaty claims. The Settlement recognises breaches of the Treaty of Waitangi and its principles in its dealings with Ngaati Hauaa. These breaches include:

- the operation and impact of the native land laws, which undermined the traditional tribal structures of Ngaati Hauaa, made their lands more susceptible to partition, fragmentation and alienation, and allowed individuals to sell land against the wishes of other owners.
- · the Crown's purchase of over 1,400 acres of Ngaati Hauaa land from individuals in the twentieth century, in disregard of the collective decision of the owners not to sell.
- $\cdot$  the cumulative effect of the Crown's actions and omissions, particularly in relation to raupatu, the operation and impact of native land laws, Crown and private purchasing, and public works takings, leaving Ngaati Hauaa with insufficient land for their present and future needs.

The settlement included an apology, an agreed historical account; cultural, financial and commercial redress.

### 5.1.4 Ngati Korokii Kahukura Claims Settlement Act 2014

The Ngati Korokii Kahukura Claims Settlement Act 2014 records the acknowledgements and apology given by the Crown to Ngaati Korokii Kahukura and gives effect to provisions that settles the historical claims of Ngaati Korokii Kahukura.



The settlement addresses the claims of the whole of Ngaati Korokii Kahukura not settled by the 1995 Waikato Raupatu settlement. The settlement includes:

· Crown acknowledgements and apology: Cultural redress – General, Waikato River, Maungatautari; Financial and commercial redress.

The Crown acknowledged its actions arising from interaction with Ngaati Korokii Kahukura whereby it breached the Treaty of Waitangi and its principles and apologised to Ngaati Korokii Kahukura for its actions and omissions which breached the Crown's obligations under the Treaty of Waitangi. The breaches include:

• the operation of the native land and public works legislation; the failure of the Crown to protect the traditional tribal structures of Ngaati Korokii Kahukura, the Crown's failure to recognise and provide for their relationship to Maungatautari and Waikato River: • Crown policies and laws which led to the economic, social, environmental and cultural degradation of the people of Ngaati Korokii Kahukura and their physical and spiritual resources.

## 5.2 Planning Documents

The following planning document provisions are relevant to the purpose of this CVA report and potential developers should familiarise themselves with the detail of these documents.

#### 5.2.1 Resource Management Act 1991

The Purpose of the Act is to promote the sustainable development of natural and physical resources. Significant sections in terms of Peacockes development are:

- Section 6 (Matters of National Importance) under which all persons exercising functions and powers in managing the use, development, and protection of natural and physical resources, must protect the natural features of national importance:
  - wetlands, and lakes and rivers and their margins, and outstanding natural features and landscapes from inappropriate subdivision, use, and development
  - areas of significant indigenous vegetation and significant habitats of indigenous fauna
  - maintain and enhancement of public access to and along the coastal marine area, lakes, and rivers:
  - the relationship of Maaori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:
  - the protection of historic heritage from inappropriate subdivision, use, and development:
  - o the protection of protected customary rights:
  - the management of significant risks from natural hazards.
- Section 7 (Other matters) under which all persons exercising functions and powers in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to;
  - kaitiakitanga:
  - the efficient use and development of natural and physical resources, and end use of energy

Hamilton City Council



Cultural Values Assessment for Nukuhau Whenua (Peacockes area)

- the maintenance and enhancement of amenity values, intrinsic values of ecosystems, the quality of the environment and any finite characteristics of natural and physical resources.
- Section 8 (Treaty of Waitangi) under all persons exercising functions and powers
  in relation to managing the use, development, and protection of natural and
  physical resources, shall take into account the principles of the Treaty of Waitangi
  (Te Tiriti o Waitangi).

## 5.2.2 Te Ture Whaimana – Vision and Strategy for the Waikato River

The Vision and Strategy for the Waikato River is set out in the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010. It is the primary direction setting document for the Waikato River and activities within its catchment affecting the Waikato River. It sets out how to achieve the restoration and protection of the health and wellbeing of the Waikato River for future generations.

Te Ture Whaimana responds to 4 key fundament issues:

- The degradation of the Waikato River and its catchment has severely compromised Waikato River iwi in their ability to exercise mana whakahaere or conduct their tikanga and kawa:
- Over time, human activities along the Waikato River and land uses through its catchments have degraded the Waikato River and reduced the relationships and aspirations of communities with the Waikato River;
- The natural processes of the Waikato River have been altered over time by physical intervention, land use and subsurface hydrological changes. The cumulative effects of these uses have degraded the Waikato River; and
- It will take commitment and time to restore and protect the health and wellbeing of the Waikato River.

All objectives and strategies of Te Ture Whaimana are relevant to the development of the Peacockes areas.

## 5.2.3 Tai Tumu, Tai Pari, Tai Ao: Waikato-Tainui Environmental Plan

The overarching purpose of the Plan is to provide a pathway that will return the Waikato-Tainui rohe to the modern day equivalent of the environmental state that it was in when Kiingi Taawhiao composed his maimai aroha. Key provisions of the Plan that are relevant to the Peacockes area and which developers should be familiar with are:

Section 7.1 - Towards Environmental Enhancement

Section 8.1 - Consent Terms - Precautionary Approach

Section 10.5 - Collaboration and Consistency - Resource management, use and activities within the Waikato-Tainui rohe are consistent Whakatupuranga 2050.

Section 11.7 - Te Ture Whaimana prevails

Section 13.3 - Papakainga development in rural and urban areas is enabled, sustainable and supported

Section 14.3 - Waikato-Tainui able to access and undertake customary activities

Section 15.3 - Indigenous biodiversity

Section 16.3 -Site management protocols, managing waahi tapu and waahi tuupuna, discovery of taonga (including archaeological sites), discovery protocols, protection of sites.

Section 19.4 – The relationship between Waikato-Tainui and water, water quality, integrated catchment management, water quantity and allocation.

Section 20.3 - Wetland mauri and condition, protection and enhancement, access

Section 21.3 – Effectively manage soil erosion, life supporting capacity of land and soils, effectively manage land contamination, achieve integrated catchment management, including floodplain and drainage management

Section 22.3.2 – taonga species are protected, restored and managed, consistent with the tikanga, kawa, maatauranga, and mana whakahaere of Waikato-Tainui.

Section 22.3.3 Fisheries management tools protect, restore, and manage taonga species.

Section 23.3 – Air Discharge quality and amenity. The quality and amenity of discharge to air is such that the life supporting capacity and quality of air within the rohe is retained at a level that does not compromise human health, amenity values, or property.

Section 25.3 - Approach to land use and development

Section 26.3 – Waikato-Tainui engagement in infrastructure development, upgrade and maintenance.

Section 26.3.4 – Transportation infrastructure is developed and managed in a manner that provides for social, cultural, spiritual, economic, and environmental needs.

Section 27.3.2 – Alternative electricity generation sources – Solar.

Section 29.3 – Recreation and Tourism. Adverse environmental effects of tourism or recreation activities are managed to a level acceptable to Waikato-Tainui.

#### 5.2.4 Ngaati Hauaa Environmental Management Plan

This environmentally focused plan was developed by Ngaati Hauaa lwi Trust in partnership with their five marae: Rukumoana, Kai a Te Mata, Raungaiti, Te Iti o Hauaa and Waimakariri. Ngaati Hauaa have developed the plan to articulate their values, aspirations and position statements in relation to the taiao (environment). The plan covers topics such as the health and wellbeing of the land, air, water, wetlands and fisheries as well as urban development in the rohe, cultural heritage and use of development of Maaori land including marae, urupa and papakainga. Provisions of the Plan that are relevant to the Peacockes development proposal are:

Objective 9.2 - Sustainable land use and development.

Objective 10.2 – Ngaati Hauaa Cultural, social and economic interests are recognised and enhanced. Ngaati Hauaa are prepared and resilient to natural hazards, disasters and climate change.

Objective 11.2 – Wai Maaori – The mauri of freshwater is restored and protected. Recognition of Ngaati Hauaa values, interests and maatauranga. Protection and revitilisation of traditional knowledge and practices.

Objective 12.2 – Ngaa Repo (Wetlands) – Protect, restore and enhance the mauri of wetlands and ecosystems.

Objective 13.2 – Maahinga Kai/Fisheries – Freshwater fisheries are restored, sustainably managed and enhanced. Traditional knowledge and practices are restored and revitalised.

Objective 14.2 - Te Ararangi/Air - Protect and enhance the mauri of air.

Objective 15.2 - Cultural Heritage - Ngaati Hauaa sites of significance

Objective 16.2 - Cultural Activities - Recognition of culture and traditions

Objective 17.2 – Ngaati Hauaa Kaitiaki – Empowered, prepared and provided with opportunities. Traditional knowledge collated and protected.



## 5.2.5 National Policy Statement for Freshwater Management

The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises: the health and well-being of water bodies and freshwater ecosystems; the health needs of people (such as drinking water); the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future in the following policies:

Policy 1: Freshwater is managed in a way that gives effect to Te Mana o te Wai.

Policy 2: Tangata whenua are actively involved in freshwater management (including decision making processes), and Maaori freshwater values are identified and provided for.

Policy 3: Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.

Policy 4: Freshwater is managed as part of New Zealand's integrated response to climate change.

Policy 5: Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.

Policy 6: There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.

Policy 7: The loss of river extent and values is avoided to the extent practicable.

Policy 8: The significant values of outstanding water bodies are protected.

Policy 9: The habitats of indigenous freshwater species are protected.

Policy 10: The habitat of trout and salmon is protected, insofar as this is consistent with Policy 9.

Policy 11: Freshwater is allocated and used efficiently, all existing over-allocation is phased out, and future over-allocation is avoided.

Policy 12: The national target (as set out in App 3) for water quality improvement is achieved.

Policy 13: The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.

Policy 14: Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.

Policy 15: Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement.

## 5.2.6 Waikato Regional Policy Statement

Several of the objectives detailed in this Statement are applicable to the planned Peacockes development:

Objective 3.4 - The health and wellbeing of the Waikato River is restored and protected and Te Ture Whaimana o Te Awa o Waikato (the Vision and Strategy for the Waikato River) is achieved.

Objective 3.9 - The relationship of Tangata Whenua with the environment is recognised and provided for, including:

b) the use and enjoyment of natural and physical resources in accordance with tikanga Maaori, including maatauranga Maaori; and

c) the role of Tangata whenua as kaitiaki.

Objective 3.14 - Maintain or enhance the mauri and identified values of fresh water bodies including by:

- a) maintaining or enhancing the overall quality of freshwater within the region;
- b) safeguarding ecosystem processes and indigenous species habitats;
- c) safeguarding and improving the life supporting capacity of freshwater bodies where they have been degraded as a result of human activities, with demonstrable progress made by 2030;
- d) establishing objectives, limits and targets, for freshwater bodies that will determine how they will be managed;
- e) enabling people to provide for their social, economic and cultural wellbeing and for their health and safety;
- f) recognising that there will be variable management responses required for different catchments of the region; and
- g) recognising the interrelationship between land use, water quality and water quantity.

Objective 3.18 - Sites, structures, landscapes, areas or places of historic and cultural heritage are protected, maintained or enhanced in order to retain the identity and integrity of the Waikato region's and New Zealand's history and culture.

Objective 3.19 - The full range of ecosystem types, their extent and the indigenous biodiversity that those ecosystems can support exist in a healthy and functional state.

## 5.2.7 Hamilton City Council's District Plan

The HCC District Plan has a series of Objectives and associated Policies designed to give effect to those Objectives. Those applicable to the Waikato River are as follows.

Objective 2.2.8 The health and wellbeing of the Waikato River is restored and protected and the River is celebrated as being at the heart of the region's identity and a feature of national importance.

Policy 2.2.8a - The natural character of the Waikato River, gully system and its margins is preserved and protected from inappropriate subdivision, land use and development.

Policy 2.2.8b - The natural, cultural, heritage and amenity values of the Waikato River are protected, enjoyed and enhanced.

Policy 2.2.8c - Access and connections with the Waikato River are maintained and enhanced.

Policy 2.2.8d - The relationship of Waikato-Tainui with the Waikato River is recognised and provided for, including through a Joint Management Agreement.

Policy 2.2.8e - Communities' relationships with the Waikato River, including their economic, social, cultural and spiritual relationships, are restored and protected.

Those applicable to the partnership between HCC and Waikato-Tainui:

Objective 2.2.9 - Resource management priorities are developed in partnership with Tangata whenua.

Policy 2.2.9a - The relationship Tangata whenua have with the City is recognised and promoted. Policy



2.2.9b - Development considers effects on the unique Tangata whenua relationships, values, aspirations, roles and responsibilities with respect to an area.

Policy 2.2.9c - As part of the development process, decisions on land use, subdivision and development include ongoing consultation and collaboration with Tangata whenua where appropriate. Policy

2.2.9d - Development and the decisions associated with developments where required are to consider any relevant lwi Management Plan.

Objective 2.2.10 - The health and wellbeing of the Waikato River is restored and protected so that it may sustain abundant life and prosperous communities

Policy 2.2.10a - Provide programmes of action to achieve targets to improve the health and wellbeing of the Waikato River. Policy

2.2.10b - Promote an integrated, holistic and coordinated approach to the management of the natural, physical, cultural and historic resources of the Waikato River. Natural Environment

Objective 2.2.12 - Protect and enhance natural character, natural features and landscapes, ecosystems and indigenous biodiversity.

Those applicable to the Waikato River Corridor and Gully Systems:

Objective 21.2.1 - The ecological, amenity, landscape and cultural values of the river corridor and gully system are restored and protected.

Objective 21.2.2 - The river corridor and gully system is used in a way that recognises and is sensitive to its social, cultural, spiritual and historical character.

Objective 21.2.4 - The health and wellbeing of the Waikato River and gully systems shall be restored and protected.

### 5.2.8 Heritage New Zealand Pouhere Taonga Act 2014

The purpose of this Act is to promote the identification, protection, preservation, and conservation of the historical and cultural heritage of New Zealand. Section 4 (Principles) defines that all persons performing functions and exercising powers under this Act must recognise:

- (a) the principle that historic places have lasting value in their own right and provide evidence of the origins of New Zealand's distinct society; and
- (b) the principle that the identification, protection, preservation, and conservation of New Zealand's historical and cultural heritage should:
  - (i) take account of all relevant cultural values, knowledge, and disciplines; and
  - (ii) take account of material of cultural heritage value and involve the least possible alteration or loss of it; and
  - (iii) safeguard the options of present and future generations; and
  - (iv) be fully researched, documented, and recorded, where culturally appropriate; and
- (c) the principle that there is value in central government agencies, local authorities, corporations, waahi tuupuna, waahi tapu, and other taonga.

Section 7 of the Act defines necessary recognition of the Treaty of Waitangi:

- Part 3 Protection of places and areas of historical and cultural value
- Part 4 Recognition of places of historical, cultural, and ancestral significance



## **APPENDIX 6**

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Hamilton City Council
Te kaunihera o Kirikiriroa

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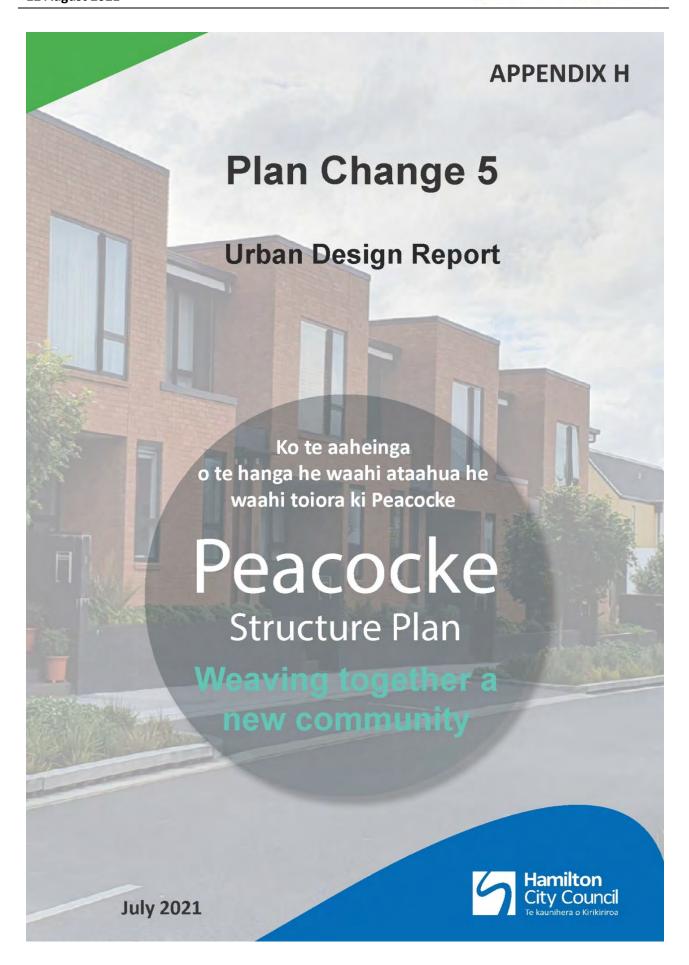
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| Peacocke Structure Plan Review - Urban Design Report |

## Contents

Ex	ecutive Summary	1
1	Introduction	1
2	Purpose	2
	Structure Plan Area	
4	Vista	3
	Urban Design Principles of the Structure Plan	
	Proposed Development Controls	
7	Assessment of Structure Plan Design Outcomes	14
	Assessment against the elements of Vista	



# **Revision History**

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Action	Name	Signed	Date
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Peanocké Structure Plan Review : Lichan Design Report | 4670370-1377164653-157 | 13 July 2017 | 10

Hamilton City Council
Te kaunihera o Kirikiriroa

Executive Summary

## **Executive Summary**

The Peacocke area to the south of Hamilton has long been recognised as a greenfield growth cell for the city. As a result of growth pressure, infrastructure investment and changes to the high-level policy direction from Central Government, Hamilton City has determined to review the Peacocke Structure Plan and associated planning provisions to enable more intensive development to occur. Along with enabling higher density development, Hamilton City Council wish to achieve an attractive high amenity environment that is well designed. In order to achieve this, a range of planning provisions are proposed.

This report provides a high-level urban design analysis and assessment of the Peacocke Structure Plan and proposed planning provisions, and how they will contribute to achieving the vision for Peacocke.

## 1 Introduction

The Peacocke area has long been identified as one of Hamilton's strategic growth cells and was brought into Hamilton City in 1989. A need for significant infrastructure investment has meant that the area has not seen substantial development, with only a small amount of development underway in what is currently identified in the Operative District Plan, as Peacocke Stage 1.

The securing of funding through the Housing Infrastructure Fund (HIF) has meant that Hamilton City Council (HCC) is beginning the process of unlocking the growth potential of the area, with the construction of a new bridge across the Waikato River and a wastewater pumping station.

To ensure the Peacocke area is developed to create an attractive and sustainable neighbourhood and the funding secured from the HIF is efficiently used, the Council are reviewing the Peacocke Structure Plan.

The current structure plan is over 10 years old and is being updated to reflect best practice outcomes for stormwater, biodiversity and ecology and the need to achieve a higher level of density, to achieve a compact urban form.

In response to the changes over the last 10 years and the identified need to ensure that land is developed in an efficient manner, HCC have identified that the Peacocke area should be developed as a medium density urban area with areas of higher density located around nodes of activity and public transport routes. The definition of medium density housing is not set within the New Zealand context, with a number of definitions being used. Typically, it is equated to multi-unit development such as duplex and terraced houses with an allotment size under 350m², although it can also include stand-alone town house style development on smaller sections.

Compact development is becoming more established within Hamilton, where medium density development in other areas of the city such as Ruakura and Rototuna has produced stand-alone houses on sections between 300-350m². As the market matures, more variety in typology is being seen, with duplex and terraced apartments being brought to market.

This urban design report has been prepared to support the development of the structure plan and the subsequent planning provisions, to assist in achieving the vision for Peacocke:

"Ko te whakakitenga moo te whenua Peacocke - Ko te aaheinga o te hanga he waahi ataahua, he waahi toiora ki Peacocke.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 1



| Purpose |

# To enable the development of an attractive and sustainable community in Peacocke."

The report addresses the urban design principles that have been embedded in the Peacocke Structure Plan and these have subsequently been conveyed into the planning framework that will inform future development of the area.

## 2 Purpose

Hamilton City Council has a clear vision for the development of the Peacocke Structure Plan area and want to develop an attractive, sustainable neighbourhood that:

- · responds to and enhances the natural environment,
- is well connected and encourages walking and cycling,
- · is well serviced with a range of community facilities,
- provides housing choice, encouraging a range of housing typologies that promote a diverse community.
- ensures landscape and urban design excellence.

The purpose of this report is to review the proposed plan provisions and the ability of these plan provisions to deliver good urban design outcomes.

## 3 Structure Plan Area

Peacocke is located in the southern end of Hamilton, adjacent to the established suburb of Glenview and Fitzroy. The entire structure plan area is approximately 740 ha of rural land and is approximately 7km from the central city at the southernmost end of the Structure Plan area. The area is approximately 4.5km from north to south and 3km east to west at its widest point. The area is defined by the City's boundary in the south and south west, the Waikato River to the east and the existing suburbs of Glenview and Fitzroy to the north and north west.

The Mangakootukutuku Gully bisects the structure plan area, running in a north to south direction, with arms to the east and west.

The Southern Links designation divides the area into four quadrants, with work currently underway on the design and construction of the road corridor, including the new bridge over the Waikato River connecting Peacocke to Wairere Drive, Hamilton's arterial ring road that provides vehicle access to the rest of the city.

The area is currently peri-urban and consists of a range of rural residential and rural land holdings. The topography varies throughout the site, from elevated flat river terraces, gullies, and undulating hills. Generally, the northern area is flatter, with the southern area exhibiting a rolling topography.

The proposed structure plan seeks to enable the urbanisation of the Peacocke area to provide a medium density residential environment, with high density development focussed on the Local Centre, identified public transport routes, areas of high amenity and in close proximity to the Central City.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 2

Hamilton City Council
Te kaunihera o Kirikiriroa

| Vista |

## 4 Vista

The Hamilton City - Operative District Plan was drafted as a "design led plan" with the aim of creating a smart liveable city which is attractive, well-designed, and compact with a strong sense of place. The District Plan aims to implement Vista, Hamilton City's design guide which provides the overall vision for Hamilton's urban environment.

"Hamilton is a collection of places, each with their own special character. Each site in the city has its own opportunities and challenges that need to be considered as a development concept evolves, and the city has identified places that require particular care and consideration of their context."

Vista articulates this shared vision for the six key areas:

- The River
- City Heart
- Lakes

- Gateways
- Neighbourhoods
- Natural Features

The shared vision is relevant to the Peacocke Structure Plan and how it will manage development, ensuring that Peacocke becomes an attractive neighbourhood, with its own sense of identity forged on the natural topography and features, including the Waikato River. As Hamilton's new southern gateway, it should present a clear and inviting entrance to the city, announcing arrival into the City.

Of particular relevance to Peacocke are:

## The River

...Physically, historically and spiritually, the Waikato River helps define the city of Hamilton, and the city must, therefore, complement the river. The heritage value of the river cannot be underestimated, and aspects of the river's cultural links are an intrinsic component of a significant proportion of the city's environment...

The Peacocke Structure Plan acknowledges and responds to the river corridor, recognising the ecological importance of this corridor. The location of the Local Centre links with the River Corridor and the intention is that the centre is designed to respond to this location and highlight the connection with the River.

### Neighbourhoods

"Hamilton is a collection of neighbourhoods that reinforce a sense of local community. Memorable neighbourhoods have their own character, often based on the underlying topography, local ecology and notable landscape features. Introduced features such as buildings, street trees and public open spaces can enhance the local character of a neighbourhood while animating and enriching the city's streets. Within the city of Hamilton, precinct plans will be developed to protect and enhance the special character of important and memorable neighbourhoods and ensure that future change and development is consistent with the context and characteristics of a defined neighbourhood or character area. Designers and developers will need to consider these guidelines in any developments affecting special neighbourhood precincts."

The structure plan has been developed to respond to the Peacocke context and focus on creating a high amenity environment that responds to the defining features of the Mangakootukutuku Gully system, the Waikato River Corridor, and the rolling topography. Development will be required to respond to these features and establish an identity that is unique in Hamilton.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 3



| Vista |

#### Natural Features

"Hamilton's urban environment is enhanced by the existence of significant natural features including gullies and other such ecologically significant areas. Development in the vicinity of significant natural features will be expected to show due regard to the protection, preservation and enhancement of such features."

The Peacocke Structure Plan recognises and protects the Mangakootukutuku Gully. It establishes a range of planning mechanisms to ensure that the values of the gully system in particular are protected and enhanced.

#### Gateways

"Gateways signal arrival and for many people, present the "first impression" of the city of Hamilton. City gateways to the east and south offer landscaped boulevards, significant trees and wide-open spaces (particularly in the vicinity of Hamilton Gardens), providing an elegant transition from the surrounding countryside. City gateways to the north present a traffic-dominated commercial and industrial face that is of questionable quality and generally regarded as unsightly and unwelcoming. Future development associated with Hamilton's city gateways needs to be of good quality and more considerate in presenting an appropriate sense of arrival, thus reinforcing the impression of Hamilton as a visually appealing, important and memorable city."

Peacocke will become the southern gateway to Hamilton and will provide an attractive urban edge and gateway to the city.

The high-level direction for Peacocke, included below, is consistent with the principles of Vista.

#### **Built Environment**

The development of a unique and vibrant urban environment that responds positively to the natural environment, which still portrays liveability, diversity and safety.

### Social Wellbeing

Create an urban form and public realm that encourages strong and vibrant communities and neighbourhoods that are attractive, safe and well connected

### Natural System

Protect and strengthen the natural and ecological environment within Peacocke.

## **Cultural Environment**

Recognise sites of significance and through urban and environmental design recognise and celebrate historic and cultural features within the Peacocke area.

Peedocke Structure Plan Review - Urban Design Report | 17 July 2017 | 2

Hamilton City Council
Te kaunihera o Kirikiriroa

Urban Design Principles of the Structure Plan

## 5 Urban Design Principles of the Structure Plan

The structure plan and associated plan provisions have been developed to "enable the development of an attractive and sustainable community in Peacocke." The following principles have informed the development of the structure plan and the associated plan provisions:

- Enable the development of a range of typologies, enabling housing choice and a range of price
  points providing diversity in housing, catering for a range of occupants who require a range of
  housing sizes from one- and two-bedroom apartments to larger single dwellings.
- Create higher density walkable catchments, centred on public transport routes and activity nodes such as the local centre, neighbourhood centres and community facilities such as the sports park, and schools.
- Enable higher density housing to borrow amenity from areas of high amenity such as the Waikato River and Mangakootukutuku gully network.
- Require subdivision to create a connected, legible, and permeable transport network that enables
  access through the structure plan, particularly for active modes, allowing local trips to be
  undertaken without reliance on a private vehicle.
- Subdivision should be undertaken, (where topography allows) to maximise access to sunlight for allotments.
- The block pattern and lot arrangement should create streets that are lined with buildings, with public frontages, directing back yards to be located to the rear of the site creating private outdoor living areas.
- Ensuring road frontages are not dominated by carparking, garaging and vehicle access.
- Development should be well designed and provide a high level of on-site amenity for residents, maximising access to sunlight and privacy and a high-quality visual outlook.
- Developments use quality building materials, variation in architectural form and landscaping to contribute positively to the character of the area.
- Subdivision is designed to respond to the gully network and areas of open space ensuring that
  where these are accessible to the public and they are visible and safe.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 3

12 August 2021



| Proposed Development Controls |

## 6 Proposed Development Controls

HCC's current Medium Density Zones rely on the use of the Comprehensive Development Plan process. This creates a consenting framework that requires the comprehensive assessment of the development of a site and depending on the specifics of the medium density zone in question, considers land use and subdivision as a whole. A similar framework is embedded in the operative Peacocke Character Zone, which uses a masterplan framework. HCC is proposing to move away from the Comprehensive Development Plan / Master Plan approach as a consequence of decisions of the Environment Court and the difficulties in requiring a Master Plan to be developed in a location where land ownership is currently fragmented.

In order to achieve the vision: "To enable the development of an attractive and sustainable community in Peacocke." Council wishes to establish a planning framework that will create positive design outcomes and establish a well-designed urban neighbourhood that provides a high level of amenity for residents.

The following relate to the planning controls proposed to achieve a well-designed medium density environment.

## Density and design

The proposed provisions do not stipulate minimum density requirements. Removal of density standards encourages a "land-use first" approach, this means land use consent occurs prior to, or concurrently with, subdivision, enabling a design led response to development.

The rule framework allows for one dwelling per site as a permitted activity. Second and subsequent dwellings require Restricted Discretionary consent, with discretion restricted to a range of matters focussed on design outcomes.

To manage the development of buildings, the plan relies on development standards relating to bulk and location, site coverage and outdoor living space and service areas. These standards provide the expected level of on-site amenity and consequently, the amount of space allocated to a dwelling. This response enables a range of housing typologies and sizes to be constructed as subdivision and the cost of land does not promote a singular approach to housing based off allotment size.

In combination with discretion over design outcomes, it is considered that the proposed approach will enable development flexibility, whilst ensuring good design outcomes are able to be achieved.

## Subdivision

In order to enable well designed sites that provide a high level of onsite amenity for residents and contribute positively to the character of a neighbourhood, it is important that subdivision establishes a block pattern that facilitates good development. This means ensuring lot sizes and shapes are fit for the intended use or are of an appropriate size and dimension to provide for a range of housing typologies to be located on a site. It also means the overall block pattern is designed to establish a well-connected environment that is easy to navigate for pedestrians and cyclists.

The current medium density provisions throughout the city use a range of comprehensive development / master plan provisions to manage development. Hamilton City has decided to move away from this approach in Peacocke due to the complexities associated with the implementation of master plans in a land area with fragmented ownership and the uncertainty associated with the *vires* of how these provisions work.

In order to ensure good design outcomes for subdivision, a stronger policy framework, development standards and assessment criteria are proposed. These set a direction within the planning framework to:

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 4

| Proposed Development Controls |

Hamilton City Council

- Require subdivision to provide for high density land use around areas of activity, such as the local centre, neighbourhood centres, identified public transport routes and enable higher density around areas of amenity, such as public open space and the river front and gullies.
- Establish a north/south oriented block structure, where the topography allows, that creates lots that
  front and engage with the street front and enable the provision of private rear yards with access to
  sunlight.
- Create a block pattern that allows for ease of movement for pedestrians and cyclists by reducing block lengths and creating opportunities for mid-block connections.
- Manage the street frontage to ensure that it is not dominated by parking or garage doors by requiring lots or dwellings with narrow frontages to be accessed via a rear lane.
- Require connections between adjacent subdivision to avoid the creation of closed off developments and reinforce a walkable environment. This is particularly important in context of the Peacocke Structure Plan area due to the fragmented nature of land ownership in the area.
- Maximise connectivity by minimising the use of cul-de-sacs and rear lots and only creating these
  where there are no practicable alternatives to respond to the topography. If these are used, then
  connections should be provided for pedestrians and cyclists.
- Designing areas of open space to be activated by roads, providing surveillance of these areas and ensuring they are not hidden from view.

As discussed above, there are no density controls proposed for residential land use. Provisions are however proposed to manage the size and shape of vacant allotments within the Peacocke Structure Plan. This will ensure that high quality outcomes are still able to be delivered through a more traditional development approach. The plan provisions require vacant lots to be a minimum lot size of 300m² with a minimum lot frontage width of 10m. 300m² provides sufficient space to enable the development of a complying residential development. A 10m frontage enables dwelling to be established with a width of 8m once side-yard setbacks are considered.

Subdivision also plays a part in the creation of safe and connected roads and streets. One of the desired outcomes for Peacocke is the creation of neighbourhood that encourages mode shift and is designed for walking and cycling. For this reason, subdivision is directed to ensure the safety of pedestrians and cyclists by minimising vehicle crossings along road corridors that provide shared paths or separated cycling facilities.

The initial subdivision pattern and layout has a strong influence on the final development outcome and influences outcomes such as connectivity and walkability. For this reason, controls are proposed that manage block size and shape.

To achieve a walkable environment, controls are proposed relating to setting limits for a maximum block length of 250m and block perimeter of 750m. This scale provides an appropriate level of permeability for pedestrian movement, while providing flexibility in block design to enable development to respond to site constraints such as topography.

Rear lane typologies are encouraged to achieve a high quality street environment and these are enabled through the subdivision provisions.

An example of a rear lane typology is shown in Figure 1 below.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 5



| Proposed Development Controls |

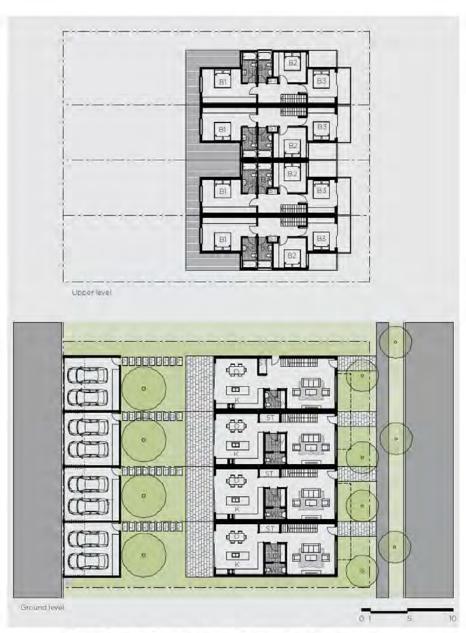


Figure 1: Example of Terrace Dwelling - Rear lane parking and servicing!

## Road Corridor and Cross sections

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 6

NSW Government - Department of Planning, Industry and Environment, 2020 Low Rise Housing Diversity Design Guide.



| Proposed Development Controls |

A key objective relating to the Peacocke Structure Plan is the creation of a highly walkable and cyclable environment. This aligns with broader objectives found in Access Hamilton and Waka Kotahi's Regional Mode shift plan. These plans seek to increase the number of trips taken by walking, blke, other micro-modes (i.e. e-scooters) or public transport to 29% of all trips by 2028. Objectives relating to short trips i.e. those less than 2km, are more ambitious, seeking up to 50% of all trips to be undertaken by foot.

The Regional Mode Shift Plan in particular, identifies the need to invest in high quality and inclusive infrastructure that is suitable for use by all ages and builds a network of safe routes. This highlights one of the key barriers to increasing the number of active mode trips, particularly by bike - safety. This has been identified as a key barrier to cycling, particularly for children moving to and from school and for those with less experience or confidence on the road.

In order to meet the mode shift targets and overcome the barriers to walking and cycling, the active mode network should be designed to maximise the users experience, providing a safe, pleasant journey for active mode users.

To achieve this, an emphasis has been put on prioritising the movements of active mode users throughout the structure plan. This includes modifying the typical roading cross section to cater more towards pedestrians and people on bikes, creating low-speed safe environments. This means prioritising the needs of people walking and on bikes.

The structure plan identifies the high-level network of arterial and collector corridors within the structure plan that will function as the key movement routes for cyclist, providing separated cycleways, i.e. cycleways that are physically separated from the vehicle carriageway. These will be supported by a range of walking and cycling paths that use the edge of the gully network. Due to restrictions on lighting within these areas and related safety issues, these paths are not considered suitable as the only routes available, particularly during winter months, where daylight is limited.

Local roads are to be low-speed environments, with a design speed of 30km/hour. This means using techniques such as narrower lanes and street trees to create the perception of a narrower carriageway by creating vertical friction. This low speed allows cyclists to share the lane with vehicles and allows pedestrians to move across the road corridor safely. Parking bays should be recessed and alternated with street trees, planting and stormwater treatment.



Figure 2: Local Road - Typical cross section.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 7



| Proposed Development Controls |

Collector roads provide more of a movement function than local roads and typically come with higher vehicle speeds and volumes. Some collectors will also be part of the identified public transport network, carrying large vehicles. For this reason, it is best practice to physically separate cycleways, decreasing risk and improving safety and importantly, the perception of safety for users. Parking bays should be recessed and alternated with street trees, planting and stormwater treatment.

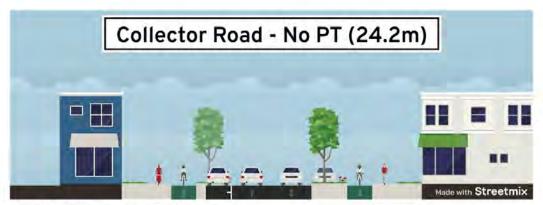


Figure 3: Collector Road - Typical cross section.



Figure 4: Collector Road - Typical cross section with public transport stop.

Arterial corridors have a high movement function and therefore carry more vehicles at higher speeds, with less opportunities to cross available. Cycleways and footpaths should be well separated from the carriageway in order to enable increased safety for people walking and on bikes. The current arterial corridors in Peacocke are being managed through the existing Southern Links Designation.

The proposed cross sections, in combination with subdivision controls relating to block size and provision of mid-block connections for pedestrians and cyclists, and restricting vehicle crossings where separated cycleways are located will create a high-quality, safe walking and cycling network within the Peacocke Structure Plan. It is considered that this will assist in achieving the mode-shift goals for Peacocke and Hamilton City.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 8

Hamilton City Council

Proposed Development Controls

## Residential Development Controls

The overarching objectives for the Peacocke Structure Plan seek to establish a well-designed, high amenity neighbourhood that provides a high level of amenity for residents, neighbours, the streetscape, and areas of public open space.

Due to the higher level of density enabled, it is important that the built form is well managed to provide appropriate levels of amenity. This means ensuring access to daylight, provision of outdoor living space, a sense of space or spaciousness, privacy, and a sense of security.

Amenity in relation to neighbouring sites, means controlling the bulk and scale of buildings to manage shading, privacy so that adjacent buildings are not overbearing or dominating.

In addition to subdivision and the road corridor cross-section, the amenity of the streetscape is affected by the combination of

- façades of dwellings
- setbacks
- landscaping
- management of vehicle access and parking
- fence and wall design and
- the provision of passive surveillance.

Similarly, the built form can influence the amenity of public open space through the public private interface and sense of surveillance provided.

These components and how they are designed will together influence the overall quality, amenity, and future character of the neighbourhood. Design controls are proposed to manage each of these factors and in turn provide the framework for a well-designed medium density environment.

## Housing Typologies

The Hamilton City Operative District Plan currently identifies three residential typologies: single dwellings, duplex dwellings, and apartment buildings. Single dwellings are by far the most prolific typology found in Hamilton and are located throughout the city. Apartment dwellings are generally located in the Residential Intensification and Centre Zones throughout the city. These are defined as three or more attached residential units, so include terraced houses joined by part wall as well as apartments separated by a floor. Duplex Dwellings (two attached residential units) were introduced during the most recent district plan review and have become an important tool for creating infill development and intensification throughout the city, being able to be consented in the General Residential Zone.

To support increased density within the Peacocke Structure Plan area, it is proposed to introduce two new definitions for the Peacocke Structure Plan area. *Terrace Dwelling (Peacocke Precinct)* and *Apartment Building (Peacocke Precinct)*. This will enable the creation of terrace-house style dwellings on larger sites, with more outdoor living areas than provided for by what is typically established in Hamilton as an apartment typology with a smaller amount of outdoor living areas. These definitions are incorporated with amendments to the development standards which are addressed in more detail in the section below. The new definitions also continue to enable the development of larger integrated apartment buildings to be developed.

## Density

The density provisions enable medium density development to occur throughout the Peacocke Structure Plan with high density development to occur around activity nodes, identified public transport routes and areas of high amenity such as parks and the gully network. As described above, the proposed density provisions encourage a design led approach, where Council's discretion includes consideration of design where two or more dwellings are proposed on a site. This enables a range of typologies to be established

Peacocks Structure Plan Review - Urban Design Report | 13 July 2017 | 9



| Proposed Development Controls |

on a site, with flexibility over net site area. Managing lot size through bulk and location and on-site amenity standards will provide development flexibility and enable a range of housing typologies. Maintaining discretion over design and layout of the development will encourage high quality design outcomes to be achieved.

#### Site Coverage

The proposed site coverage rules reflect the need to enable more development to occur on smaller sites, with more generous allowances for terraced houses and apartment buildings. This enables a higher level of building intensity on a site compared to the general residential zone provisions, while maintaining a sufficient amount of on-site amenity.

## Permeable surfaces and landscaping

Similar to site coverage, permeable surface requirements reflect the intended building intensity throughout the structure plan area. Less landscaping is required in the front yards of terraced dwellings, recognising the need for flexibility to achieve an efficient use of the site when a driveway and pedestrian access or patio are provided in the front yard on those terraces with vehicle access from the road corridor.

Landscaping is an important aspect in delivering amenity, particularly in medium and higher density environments, which typically have less vegetation and greenery. The requirement to include a specimen tree within the front yard of each dwelling will assist in softening the streetscape and with careful selection, provide shade in summer and allow light in winter and not compromise passive surveillance of the street. In combination with street tree planting, this will assist in delivering a high amenity streetscape.

More flexibility is afforded to terrace dwelling units with narrower frontages, recognising the frontage is restricted if parking is provided in the front of the unit without a garage.

### **Building Heights**

The proposed building heights enable more intensive development of a site, in turn enabling higher density. The majority of Peacocke allows for a maximum of 3 storeys to be constructed within a height limit of 12m. This ensures there is sufficient room for a pitched roof to be included within the design of the building providing for a more interesting and varied form than solely flat or mono-pitched roofing typologies.

Up to 16m of building height is provided for in the high-density overlay, which enables buildings up to 5 storeys to be constructed depending on the roofing style. This would enable the delivery of apartment buildings within close proximity to the Peacocke Local Centre and identified Public Transport Routes.

## Height in relation to boundary

The proposed height in relation to boundary rules manage overshadowing so that development does not adversely affect the amenity of adjacent dwellings.

The standards manage the height and location of buildings more strongly at the rear of sites and establish a less restrictive envelope at the front of the site achieving two positive design outcomes. Firstly, it encourages buildings to be built towards the street, helping to activate these spaces and provide passive surveillance, creating a domain for people. Secondly, it restricts height of buildings at the rear of the site, providing for sunlight and daylight access in these spaces, which are typically where outdoor living areas are provided. Figure 5 below shows the front elevation of how the height in relation to boundary would apply for a 10m wide allotment for a standalone dwelling and a 26m allotment containing, for example 3 x 8m terrace dwellings, Figure 6 shows the side elevation and how development is controlled at the rear of the site.

Peacocke Structure Flan Review - Urban Design Report | 12 July 2017 | 10



Proposed Development Controls

To manage the imposing effect taller buildings can have on the streetscape, buildings over 10m in height are required to setback the top floor by 3m. This will also assist in reducing overshadowing of the street.

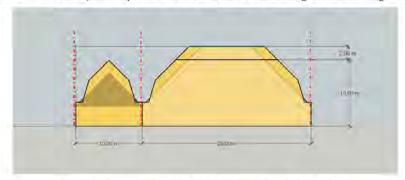


Figure 5: Height in relation to boundary envelope - Front elevation.

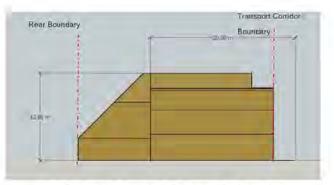


Figure 6: Height in relation to boundary - Side elevation

### Public Interface

Standards are proposed that manage how residential buildings will interface with the public realm. The intention of these provisions is the activation and passive surveillance of the street. This helps to create a high amenity street environment, with an increased level of safety.

This includes:

- a) Providing for separate pedestrian entrances to single dwellings, duplex dwellings and terraced dwellings and a clear entrance to apartment buildings. This provides a safe and clear connection for pedestrians accessing dwellings that isn't reliant on the vehicle crossing and the driveway. It also means that pedestrian entrances are provided from streets even where vehicle access may be provided by rear lane access.
- b) A requirement to have a habitable room overlooking the street. This contributes to passive surveillance onto the street and activation of the frontage through rooms and spaces that are occupied by people. Having a non-habitable room such as a laundry or bathroom overlooking the street would not create an active frontage, therefore it is important to manage the internal layout with respect to habitable rooms.

Peacocke Structure Plan Review - Lithan Design Report | 12 July 2017 | 11

| Proposed Development Controls |

c) Requiring walls facing the street to include a minimum of 20% glazing. This sets up a minimum area of glazing to provide passive surveillance and ensure a reasonable level of glazing is provided on street elevations.

## Parking and accessory buildings

The management of garages, parking and vehicle access is important to creating a high amenity street. Provisions have been established that manage the widths and setback of garaging and parking areas so that they do not visually dominate the streetscape.

All dwellings are required to be designed so that garaging forms less than 50% of the front façade. With the subdivision and setback standards proposed.

This enables a complying single dwelling to be constructed on a site with a front boundary width of 10m, 1m side yards (2m total), allowing for an 8m wide building frontage. This allows for a single garage, which can be stacked if two carparks are desired, up to 4m wide to be provided.

Terraced houses are managed separately, recognising that the terraced dwelling provides a longer façade and does not provide relief in the frontage with side yard setbacks. For this reason, where a terraced unit is less than 7.5m in width, access to garaging is to be provided via a rear lane. This also contributes to a street environment that is more pleasant for pedestrians and cyclists as the reduction in vehicle crossings reduces conflict locations, increasing safety.

Provision is made for a single outdoor carpark to be located in the front yard on narrower terraced dwellings. This is distinguished from the proposed garage rules, as the front can be designed to include a carpark, whilst maintaining an active street-front, through glazing and a high amenity environment through the use of well-designed landscaping. An acceptable solution is shown in Figure 7 below.



Figure 7: Acceptable outcome for front loaded carparking space with a narrow dwelling.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 12

Attachments



| Proposed Development Controls |

## **Living Space Outlook**

With smaller lot sizes and dwellings, it is important that the on-site amenity level for residents is maximised. This includes providing a sense of outlook and openness for habitable rooms, with an emphasis on the principal bedroom and living area. The proposed provisions require the main living room and the primary bedroom to provide an outlook either over a front yard and the street or over the rear yard, or an area of public space. In combination with the constraints of smaller lots, this will encourage buildings to be located to the front of the site, allowing outlook over the street, whilst still providing room to the rear of a site, which would typically provide for the outdoor living area. With a 2-storey building, this is readily achievable. The provisions recognise the ability to borrow amenity from public open space and allow for these outlook areas to be measured over a public street or public open space.

### **Outdoor living areas**

These are ideally located to the rear of the site, providing residents a private outdoor area they can enjoy. With proper orientation of the street block and buildings, these can be north facing, achieving access to daylight and sunlight. This is supported by height in relation to boundary controls over the rear of sites that encourage the bulk and mass of buildings to be located toward the front of the site.

Dimensions and areas are proposed that relate to the building typology and whether they are in the high-density overlay, where less area is required, recognising the need for more development flexibility to provide for density. This in turn means a high level of onsite amenity for residents while enabling the efficient use of the site. The smaller outdoor living spaces in the high density overlay and for apartment dwellings will be supported by a high level of accessibility to open space throughout the structure plan.

## Fences and walls

As part of creating a high amenity streetscape, the height of fences and walls is restricted to 1.2m high where they are forward of the front building line. This assists in the activation of the streetscape and the provision of passive surveillance. It also allows for the on-site landscaping to be visible and contribute to the amenity of the streetscape.

Fences adjacent to public open space are restricted to 1.5m in height which provides a balance between passive surveillance over these areas and privacy.

Privacy is enabled between dwellings by allowing fences/walls up to 1.8m in height behind the front building line.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 13



| Assessment of Structure Plan Design Outcomes |

# 7 Assessment of Structure Plan Design Outcomes

The urban design principles that have driven the outcomes of the structure plan are considered below.

Principle		Commentary
•	Enable the development of a range of typologies providing housing choice and a range of price points providing diversity in housing, catering for a range of occupants who require a range of housing sizes from one- and two-bedroom apartments to larger single dwellings.	The plan provisions enable a range of housing typologies at a range of densities, providing for housing choice.
•	Create higher density walkable catchments, centred on public transport routes and activity nodes such as the local centre, neighbourhood centres and community facilities such as the sports park, and schools.	The Structure Plan and associated planning maps identity areas near the Local Centre, identified Public Transport Routes and areas of amenity as part of the high-density overlay. This is reinforced by objectives and policies that require density to be provided in these locations.
•	Enable higher density housing to borrow amenity from areas of high amenity such as the Waikato River and Mangakootukutuku Gully network.	Density is enabled, through the objectives and policies of the plan change, to take advantage of areas of high amenity.
•	Require subdivision to create a connected, legible, and permeable transport network that enables access through the structure plan, particularly for active modes, allowing local trips to be undertaken without reliance on a private vehicle.	The structure plan sets out a clear network for collector and arterial corridors, which will provide for active modes and public transport. The rule framework establishes walkable block lengths and requires development to be well integrated with a street network that is permeable and provides connections throughout the structure plan.
•	Subdivision should be undertaken, (where topography allows) that maximises access to sunlight for allotments.	The plan provisions encourage subdivision to respond to the topography and maximise the level of daylight for individual allotments.
•	The block pattern and lot arrangement should create streets that are faced by buildings, with public frontages, directing back yards to be located to the rear of the site creating private outdoor living areas.	The plan provisions create a framework that encourages buildings to front the street and provide for private backyards. Rear lots are discouraged, enabling a public front/private back arrangement.
•	Subdivision is designed to respond to the gully network and areas of open space so	The plan provisions encourage gullies and areas of open space to be fronted by a road corridor,

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 14

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| Assessment of Structure Plan Design Outcomes |

	that where these are accessible to the public, they are visible and safe	activating these spaces, and providing for passive surveillance.
•	Ensuring street frontages are not dominated by carparking, garaging and vehicle access.	Plan provisions manage the width of garaging and require rear lane access to be provided where narrow building widths are proposed. Exceptions are made to provide design flexibility where one non-garaged carpark is provided in the front yard.
	Development should be well designed and provide a high level of on-site amenity for residents, maximising access to sunlight and privacy and a high-quality visual outlook.	The design standards encourage buildings to front the street, locate outdoor living areas to the rear and establish a high-quality streetscape through the management of garages, front yard landscaping and vehicle crossings.
1	Developments use quality building materials, variation in architectural form and landscaping to contribute positively to the character of the area.	Maintaining discretion over the design of buildings, enables council to ensure a level of quality in relation to building form, materiality and design establishing a high-quality urban environment.

Taking the above into account, it is considered that the proposed plan provisions relating to residential development and subdivision will result in outcomes that will be consistent with the vision for Peacocke.

Peacocke Structure Flan Review - Orban Design Faport | 12 M/y 2017 | 15



| Assessment against the elements of Vista |

# 8 Assessment against the elements of Vista

Design Element	Commentary
<ul> <li>Design Quality</li> </ul>	The Peacocke Structure Plan and Plan Change include direction to provide for well-designed buildings and public spaces. This will contribute to the design quality of the Peacocke area.
	The built environment will respond to the context of Peacocke, which has been defined in the structure plan document and various plan objectives and policies. It is considered that the suite of provisions will assist in achieving the vision for the Peacocke Structure Plan.
	The provisions set up the framework to contribute to high design quality.
Sense of Place	Peacocke has a clear character and presents an opportunity to deliver a clear sense of place within the neighbourhood. The built form will respond to the gully network, river corridor and topography of the area. Peacocke is signalled to be a medium density environment with areas of high density around nodes of activity, it is expected that development will begin to establish development of this scale and cement it over time.
- Access	The provision of access within the structure plan is an important component of its development. Priority has been given to encouraging walking and cycling through the area, with street cross sections developed for the Peacocke Structure Plan to provide safe and attractive active mode routes. Subdivision is expected to integrate with the adjacent sites, ensuring a high level of connectivity. Emphasis is placed on universal design and enabling people of all ages and abilities to move through Peacocke.  Public transport routes have been identified and density enabled along these corridors to support the provision of a frequent PT service.

Peacocke Structure Plan Review - Urban Design Report | 13 July 2017 | 16

Attachment 8

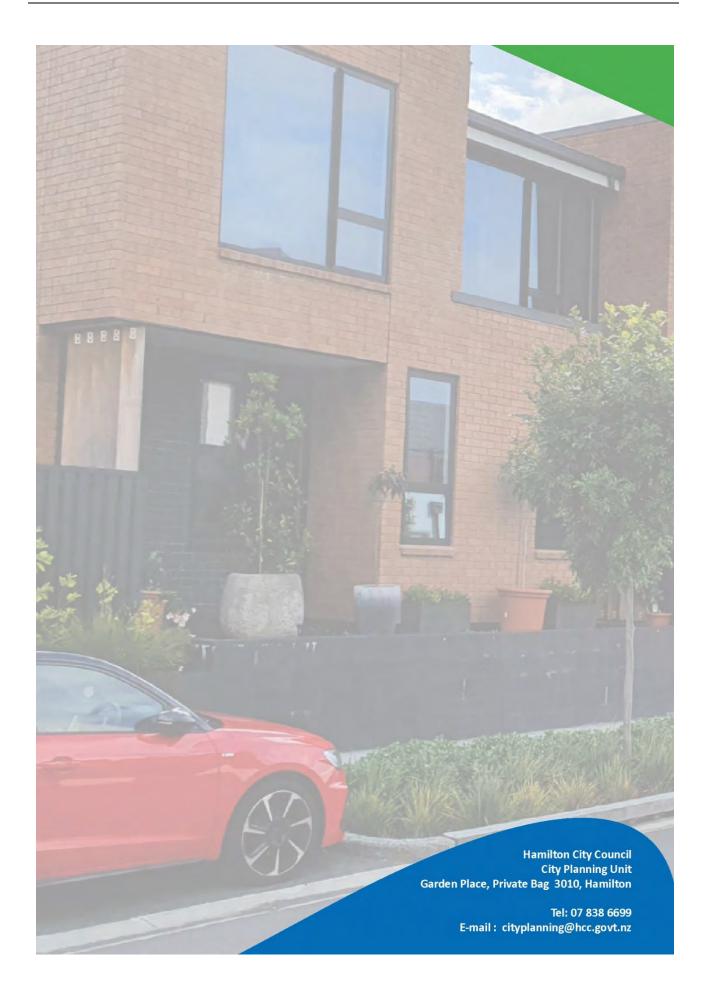
Assessment against the elements of Vista

Public Spaces	Public spaces within Peacocke will vary from the gully network, the sports park, community and neighbourhood parks and a town square in the local centre. These spaces are to be designed and developed to be high quality, safe places, fronted by roads and buildings, establishing passive surveillance.
• Lifestyle	The Peacocke Structure Plan provides for the needs of the community and includes a local centre, and seven neighbourhood centres that will provide for the day to day needs of the residents and provide opportunities for social interaction within the community. Density is enabled to support the vibrancy and vitality of the centres and the establishment of a frequent public transport service.
	A range of housing typologies are enabled in Peacocke which provides opportunities for people at all stages of their life to live in the area.
	Design of public spaces is to be carried out with input from mana whenua, reflecting the history and cultural value of the area.
Sustainable Environments	The plan encourages the efficient use of water as a resource and manages three waters through the Mangakootukutuku ICMP.
	A high level of emphasis has been placed on the natural environment and protecting and enhancing the role and function of the gullies which are important habitat for long tailed bats.

Overall, it is considered that the Peacocke Structure Plan and the proposed plan provisions will assist in delivering an outcome that is aligned with the six Vista design elements.

Peacocke Structure Flan Review - Orban Design Flaport | 12 My 2017 | 17





# **APPENDIX I**

Hamilton City Council
Te kaunihera o Kirikiriroa

# Peacocke Structure Plan: Archaeology

Warren Gumbley & Matthew Gainsford





## Contents

1	In	troduction	3
2	Ba	nckground	3
3	Sit	tes of Māori origin	5
	3.1	Pā	
	3.1	1 Kairokiroki Pā (S14/46)	7
	3.1		
	3.2	Māori horticultural sites	11
	3.2	2.1 S14/64, S14/174, S14/210, S14/224, S14/243, S14/318, S14/319, S14/320, S14/321.	,
	S1	4/322, S14/326, S14/327, S14/328, S14/475, S14/476, S14/477, S14/478, S14/479, S14/4	
	and	d S14/490	11
	3.3	Burial ground	19
	3.4	Findspots	20
	3.4	l.1 S14/193	20
	3.5	Unrecorded potential site	21
	3.5	5.1 Site 1	21
4	Ni	neteenth Century sites/areas	<b>2</b> 3
	4.1	Glencoe	24
	4.2	Weston Lea	25
	4.3	Korokonui/Acacia Hill	28
	4.4	Rukuhia Research Station	29
	4.5	Rothwell	29
	4.6	Smith	29
5	As	sessment of archaeological values	30
	5.1	Pā sites	30
	5.2	S14/164, Burial Ground/Urupā	31
	5.3	Pre-European horticultural sites	32
	5.4	Historical European	33
6	Su	mmary and recommendations	34
7	Re	eferences	36
8		tachment 1: Heritage New Zealand Pouhere Taonga Authority 2019/69 for	
A)	mber	field subdivision	38

Hamilton City Council

Peacocke Structure Plan: Archaeology

## 1 Introduction

Peacockes Structure Plan includes the area known colloquially as south west Hamilton. This area includes multiple identified and potential archaeological sites that relate to the period prior to the invasion of the Waikato and to the period of colonial settlement following 1864. As such the former relate exclusively to Māori settlement of the area and in the case of the latter these relate to the development of the area as European-style farms. These sites include two known pā, 20 areas of Māori horticultural practice, one identified urupā, several artefact/taonga fīnds (including a waka tiwai in the riverbed) and three 19th Century homesteads identified from records.

This synthesis provides a summary of known information relating to archaeological and historical sites within the Peacockes area. Archaeological and heritage values are expressed for all sites against the Waikato Regional Council criteria. Identified also in this report is the potential or need for further research concerning the sites within the Peacockes structure plan area.

## 2 Background

Hamilton City currently have one archaeological site within the Peacockes zone listed in schedules of the currently Hamilton District Plan. This is Kairokiroki Pā (S14/46), which is listed in Schedule B of the District Plan.

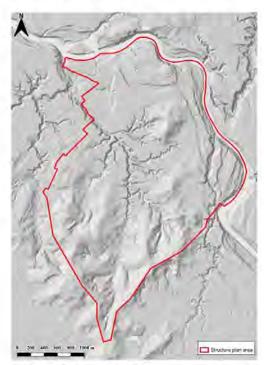


Figure 1: Lidar derived image showing the boundary of the Peacockes Structure Plan zone.

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The Hamilton CBD, Tamahere to the south, and the area immediately surrounding Peacockes Road is an archaeologically rich landscape, with 110 archaeological sites recorded within a four kilometre radius (Figure 1). Some general patterns are evident in the distribution of recorded sites in this area: (1) known Pā are distributed exclusively in connection with the footprint of the Waikato River and its tributaries; (2) Māori horticulture sites are better preserved south of the CBD and outside of Hamilton's suburbs; (3) these sites occur no further than three kilometres from the river and mostly within one kilometre, and; (4) that recorded post-European sites are largely located in and close to the Hamilton CBD.

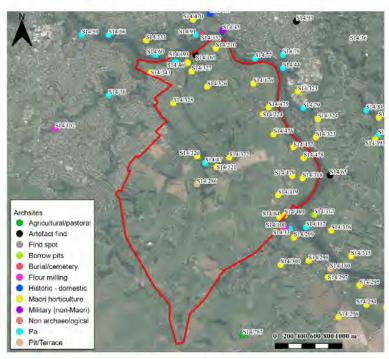


Figure 2: Distribution of recorded archaeological sites distinguished by general classes. It should be noted that Māori horticultural sites (shown as yellow dots) can be substantially larger in area than the symbols indicate. (Source: Archsite, WRAPS 2008)

As a general comment it is appropriate to note that early development of the Hamilton City has obscured or destroyed some of the cultural/archaeological landscape and that some site types are under probably under-represented as a result of this. This appears to be particularly true for sites relating to Māori agricultural/horticultural practice prior to the invasion of 1863–1864.

Site type frequency also gives an indication of the archaeological landscape. Sixty-one of the sites are related to Māori horticulture (e.g. gardening soils, borrow pits), 33 are pā sites, 2 are pits and/or terraces, 4 are find spots and 13 relate to 19th Century European occupation. As noted earlier, Māori gardening sites cluster southwards in predominantly undeveloped areas,

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pā follow the waterways and most historic sites manifest in the subject area as former homesteads.

Generally, the distribution of archaeological sites of Māori origin follows a predictable pattern with sites clustering strongly to the Waikato River and tributary waterways including lakes. Pā almost universally follow this pattern with horticultural sites also strongly clustered to waterways; approximately 50 percent of the sites of this class are found within 500 metres of the Waikato River and 80 percent within one kilometre of the river (Gumbley and Hutchinson 2013). The other principal predictor of Māori horticultural sites is the presence of high quality soils suitable for adaptation to growing kumara and to a lesser extent taro.

Sites from the 19th Century that relate to European settlement do not follow this pattern to the same degree but broadly tend to align to the river.

## 3 Sites of Māori origin

#### 3.1 Pā

Pā are a major component of the archaeological landscape surrounding the development area. The Peacockes Structure Plan area has two pā within its boundary area (S14/46 and S14/47) and is surrounded by another eight.

Nukuhau Pā (S14/33), although not within Hamilton City, is immediately outside the structure plan area and likely to have had historical links to sites within its area, specifically horticultural sites. The same relationship is probably also true for some of the six pā on the right-bank of the Waikato River. Nukuhau Pā remains a physically well-preserved site with associated borrow pits and associated horticultural (made) soils in its immediate vicinity. Historically Nukuhau Pā is associated with Ngāti Ruru, a hapū of Ngāti Mahuta. The pā was captured by Ngāti Raukawa during their expansion down-river in the early 18th Century but was seized back by Ngati Mahuta in a campaign led by Tawhia-ki-te-rangi following Ngāti Raukawa's defeat at Pepepe (Kelly 1940, Wilkes 2003). The continuity of occupation at Nukuhau seems uncertain after this but Tireke flour mill, situated in Nukuhau Stream adjacent to the pā, was known to be operative in the 1850s and early 1860s, which suggests that the pā was probably occupied at this time. The flour mill itself is a material representative of the flourishing agricultural revolution experienced by Tainui iwi in the period from the 1840s through to the invasion of 1863 and is an important site in this context.

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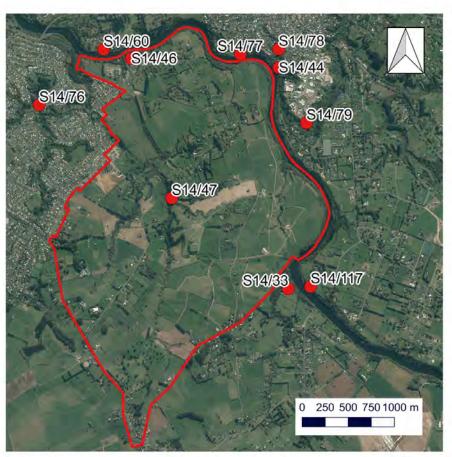


Figure 3: Pā within and surrounding the subject area (outlined in red).

As noted earlier, the location of these fortified sites corresponds to the distribution of waterways in the area. Pā are generally located on headlands or above waterway escarpments and include features such as ditch and bank systems, terraces, borrow pits and made soils. Given the general pattern for the locations of pā in the environs of the Waikato River the absence of an identified pā at the mouth of the Mangakotukutuku Stream is a conspicuous exception to this pattern.

Table 1. Recorded pā sites within (and adjacent) the Peacockes structure plan area.

Site	Type	Condition	Description
S14/46	Pā	Moderate/Good	Located on a small hill beside the river. Remains of former terraces and two ditch and bank systems. Partially covered in trees. Used by the Glenview club for sports and recreation.
S14/47	Pā	Poor/Moderate	A pā located on a peninsula in the Mangakotuku Stream system. Now densely covered in pine trees which have adversely affected the pā's condition. Promontory pā with double-ditch and inner bank system. Circular depressions in interior pā. Site damaged by pine plantation.

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#### 3.1.1 Kairokiroki Pā (S14/46)

First recorded in 1968 By K. Gorbey it was planted in large pine trees. Gorbey states that, apart from probable root damage, the site appeared to be in good condition. At that stage however, the site was still being farmed.

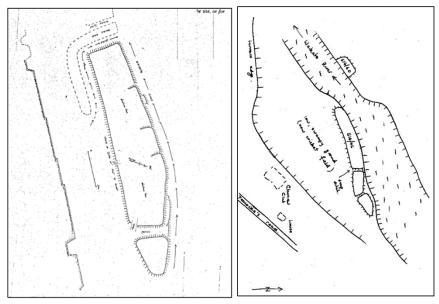


Figure 4: Plans of site S14/46. P. Morgan (1986) left and O. Wilkes (2000) right (Source: Archsite).

It is understood that the existing large specimen trees on the pā were first planted by the original European land-owner Colonel De Qunicey, probably in the 1870s. A number of modifications to the site are identified in the NZ Archaeological Association site record (SRF) (S14/46). These include the finding of a number of artefacts, including wooden items, when drainage trenches were excavated in the area immediately around the pā in the early 20<sup>th</sup> Century. Other modifications that have been identified are the formation of a cricket pitch, the construction of a toilet on the eastern ditch.

O. Wilkes, in the SRF, synthesises previous data on the site. The pā is situated above the river on a low ridge spur about 5–8 metres high. Further away from the river a low scarp bounds the ridge. A rectangular platform forms the centre of the pā (approximately 95 x 20–30 metres). Faint traces of stepped transverse terraces are visible on the western part of the pā and a 15 metre transverse ditch and bank runs along the eastern end. There are possible remains for a similar smaller defence structure at its western terminus.

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Figure 5: Eastern end of the site showing the bank and the westerns ditch. Site damaged is also noted in O. Wilkes annotations to the photographs (Source: Archsite).



Figure 6: Image shows the deeper upstream ditch and bank. The site is to the left of the image (Source: Archsite).

Although constant use of the site has damaged it, it is one of the more intact pā sites within the Hamilton City area. Wilkes noted in the SRF that the Kairokiroki Pā "is probably one of the four best-preserved pas within the Hamilton City boundaries...". Currently there does not appear to be a management plan for this site.

#### 3.1.2 S14/47

The NZ archaeological Site Record form for S14/47 ascribes the name Whatukorero although there is no information in the record on the source of the name. The form and location of this pā follows the typical pattern for the location of pā within the Hamilton Basin, it is located on a headland formed by the junction of stream with a smaller tributary.

A detailed plan was drawn of the pā by Neil Laurie in 1979 provides the most detailed description of the pā available. This plan shows the long axis of the pā is oriented approximately east-west, with the headland cut off from the adjacent land by two ditches separated by a narrow bank, with a second bank erected in the inside of the inner-most of the two ditches. The interior is largely flat with a large number of depressions interpreted as the remains of crop storage pits. The defensive features are shown to have been modified by a bulldozed track accessing the pa itself with another track through the outer ditch. The interior of the pā is 3000–3500 m². The pā is also associated with three identified adjacent horticultural sites (\$14/320, \$14/321, \$14/322).

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Peacocke Structure Plan: Archaeology

Since Laurie's sketch plan most of the pā was planted in pine trees<sup>1</sup> at high density. The growth of the pines will have had a significant negative effect on the preservation of the archaeological features and a visit by Gumbley and Gainsford in 2019 found that the pines were beginning to be subject to wind-throw. This process will lead to significant damage to what had been a well-preserved pā prior to their planting. The pines trees remain a significant threat to the fabric and general integrity of the site. The pā does not have a management plan.

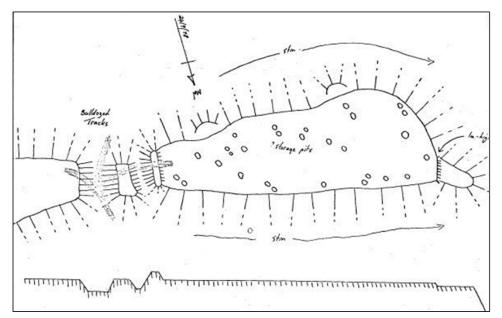


Figure 7: Site plan of S14/47 made by N.C. Laurie in 1979 and included in the NZAA site record. (Source: Archsite.)

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<sup>&</sup>lt;sup>1</sup> Gumbley was informed in 1997 by the then land-owner that the pines were planted in the mid-1980s.





Figure 8: Photograph by O. Wilkes (dated April 1990) looking west showing the defensive structures with the access track formed through them. Note the destruction of the southern half of the defensive bank separating the two ditches. (Source: Archsite.)



Figure 9: Photograph by O. Wilkes (dated April 1990) looking west across the pā from the inner defensive ditch. The depressions in the image are the remains of crop storage pits. This area has become overgrown with blackberry. (Source: Archsite.)

W. Gumbley Ltd 10 February 2021

Hamilton City Council
Te kaunihera o Kirikiriroa

Peacocke Structure Plan: Archaeology



Figure 10: A 2019 image of the eastern end of the pā showing the same area as the image above. The site is still covered in mature pines with the overgrowth of blackberry and other seral species, which had recently been cleared locally. (W Gumbley Ltd.).

#### 3.2 Māori horticultural sites

3.2.1 \$14/64, \$14/174, \$14/210, \$14/224, \$14/243, \$14/318, \$14/319, \$14/320, \$14/321, \$14/322, \$14/326, \$14/327, \$14/328, \$14/475, \$14/476, \$14/477, \$14/478, \$14/479, \$14/480 and \$14/490.

Māori-made soils are characterised by addition of transported alluvium quarried from borrow pits (Grange et al. 1939; Bruce 1978 & 1979; McLeod 1984; Gumbley et al. 2004; Gumbley 2009). These soils are classified as the Tamahere Series<sup>2</sup>, which is characterised as a sandy gravelly loam within a thickened charcoal-rich topsoil (A-horizon) formed after alluvium (sand and gravel) has been added. These anthropogenic soils were typically developed on Horotiu and Waikato Series soils (TH & THw) but occasionally are also found on associated Bruntwood and Te Kowhai soils (Grange et al. 1939: 39–40; Lowe 2010: 7; McLeod 1984; Bruce 1979).

Archaeological investigations over the last 25 years have produced an increasingly focused and well-formed understanding of the nature these sites and the agronomic processes behind the archaeological manifestation. Two forms of garden development and use have been identified as sub-units within the wider Waikato horticultural complex, both centred on the

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<sup>&</sup>lt;sup>2</sup> Originally these soil had been classified as Maori soils (Grange et al. 1939) but this was later re-named the Tamahere soil series (Bruce 1979).



modification or manufacture of soil environments with transported sand and gravel quarried from the substrate.

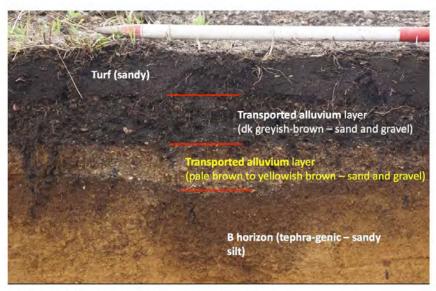


Figure 11: An example of an unmodified Māori-made soil horizon.



Figure 12: Example of the dimpled interface found at S15/374 at Ngaruawahia; a garden site located on Waikato series soil (Scale is 1 metre) (Gumbley & Gainsford 2018).

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Attachment 9

Peacocke Structure Plan: Archaeology

The first presents as a discrete and expansive layer of sand and gravel situated under the turf and overlying the upper element of the B horizon (subsoil). Typically, when well-preserved, this layer is divisible into to sub-units distinguished by soil colour rather than texture, with the upper unit often dark greyish-brown and the lower yellowish-brown. The interface with the B horizon is distinct but the surface is distinctively pock-marked and irregular as a result of the use of gardening tools and, in occasional places the moulds of tubers. The upper unit of the B horizon is also modified during the forest clearance phase and is darker than the underlying B horizon matrix with conspicuous charcoal, which is normally absent from the parent soils. It is proposed by Gumbley that the sand and gravel was used to form mounds in which kumara were grown and that the layer was formed after the mounds had been destroyed at harvest followed by ongoing weathering.



Figure 13: Photograph from \$14/201 (Chartwell, Hamilton) showing the sand-filled bases of puke dug into the subsoil. (Scale intervals: 0.5 and 0.25 metre.) (photo: Gumbley).

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Figure 14: Photograph from S14/195 (Horotiu) showing bowl-shaped hollows forming bases for growing mounds, with the sand and gravel removed (Scales are 1 metre.) (photo: Gumbley).

The second form is characterised by a series of bowl-shaped hollows dug into the upper surface of the B horizon and which are filled with sand and gravel. These features, when well-preserved, are arranged in regular rows and each hollow represents a single kūmara plant. It is assumed that the material removed from each hollows was used for the formation of the mound in which each plant was grown, and which, like those on type one was destroyed at harvest.

Often horticultural sites include pits for crop storage and also areas of domestic occupation (kāinga) where the gardeners lived while the gardens were being worked. As well as crop storage pits archaeological remains at kāinga include fireplaces and postholes representing cooking areas and the remains of structures.

Māori gardening sites are the most common site type within the region and form the most numerous site class within the Peacocke zone. Most garden sites in this area have been recorded initially using historic aerial imagery and LiDAR derived imagery. Consequently, recorded sites mostly consist of visible borrow pit clusters. However, within the Peacocke Structure Plan zone the remote sensing data has been supplemented with varying degrees of field investigation. This can range from soil survey with hand-auger to limited test investigations using hydraulic excavators. Preservation of the horticultural sites within the Peacockes zone has been found to be variable with the upper soil horizons affected in many places by ploughing and other recent activities. This affects the preservation of the gardening medium (the Māori-made soils) but does not necessarily affect other deeper elements of the sites. Modern cultivation can significantly affect the potential to recover information about the fine scale aspects agronomic process represented in these sites.

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Attachment 9

Peacocke Structure Plan: Archaeology

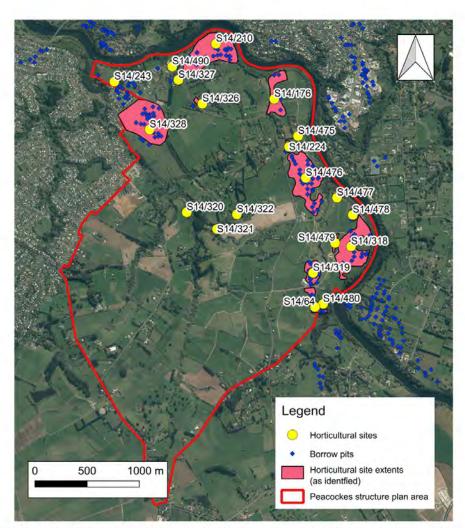


Figure 15: Areas of Maori-made soil (Tamahere loam) developed from interpretation of soil auger survey data along with test-pit results from the Amberfield project area (source: Archsite, WRAPS 2012).

Table 2. Recorded Māori horticultural sites within the Peacockes structure plan area.

Site	Туре	Description
S14/64	Māori horticulture	This site was originally recorded as a pā based on visible earthworks on aerial photography. Located on a ridge (river terrace) forming the northern bank of Nukuhau Stream. Field inspection determined that earthworks were a pair of borrow pits. Soil auger testing and excavation of test trenches in paddocks to the north confirmed that this is a Māori horticultural site with Māori-made soils (Tamahere loam). S14/64 and S14/319 were probably a continuous area of Māori made soils before the formation of Stubbs Road, the farm waste-water treatment pond and sand quarry.

W. Gumbley Ltd 15 February 2021

Page 1105 Attachments



S14/176	Māori horticulture	Located north and east of the Peacockes Road on part Lots 1, 2 & 4 DPS 81210 at the northern right-angle bend of Peacockes Road. An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. It includes six to eight identifiable borrow pits. This pre-European Māori horticultural site, which is located within the Amberfield development precinct. These Māori-made soils were not identified during the soil bureau survey of Waipa County (Grange et al. 1939) but have been confirmed by field investigations within the Amberfield footprint.
S14/210	Māori horticulture	Located to the north of Weston Lea Drive, including the area around Echobank Place, although some of the site may extend south of Weston Lea Drive. It incorporates both the presence of Māori-made soils (Tamahere series soils) and borrow pits. Extent of made soils was originally mapped by the Soil Bureau of the DSIR in the 1930s (Grange et al, 1939). This area was previously examined by Cable (2013). He described that the site extended from the river edge to the area around Echobank Place and to its immediate south. While many of the borrow pits are no longer clearly visible on the ground surface, historic aerial photographs from 1943 clearly show large visible depressions. Investigations in relation to the PST project, which affects part of this site, indicate that the horticulture is located on the upper terraces and has been affected by ploughing. The site has also been affected by a sand quarry that was located immediately west of Echobank Place. As well as the sand quarry and the developed of the new bridge and approach roads the eastern element of the site will be affected by a proposed aged care facility. A small portion of the site will remain to the west of the old sand quarry and which includes a distinctive and large borrow pit. This lies within private ownership and is likely to be subject to residential development in the future.
S14/224	Māori horticulture	East of Peacockes Rd and immediately north of a stream draining a spring, just north of the stream and the E-W race cross-cutting the Amberfield development area. Located on Pt Lot 6 DP 34164. An area of Māori-made soils (Tamahere loam) defined following soil auger testing and excavation of test trenches including 3 to 4 borrow pits which can be recognized on the ground surface.
S14/243	Māori horticulture	Located in reserve land along south side of Waikato River between a substation on Waiora Terrace and properties along Riley Place. This site was recorded on the basis of land surface formation visible in 1943 aerial photography indicating the presence of borrow pits, and also on the basis of field observation by N Cable. The undeveloped vacant land is generally hummocky with distinct round borrow pit type features. Garden soil found during excavation of geotech test pit (authority 2011/393) in one of the hummocky areas.
S14/318	Māori horticulture	Located immediately east of Stubbs Rd on the "island". Lot 5 DP 17475 and Allotment 87 Te Rapa Parish. An area of Māori-made soils (Tamahere loam) defined following soil auger testing and excavation of test trenches. The site is located on three river terraces: the lower two on Taupo Pumice Alluvium and the upper on the Hinuera Formation. At least six borrow pits are identifiable on the ground surface including some cut into the top of river terrace escarpments. Testing identified at least two filled borrow pits invisible on the ground surface.  Part of this site is proposed to form an historic/cultural reserve within the Amberfield development.
S14/319	Māori horticulture	Immediately north of the end of Stubbs Rd and is adjacent to the current milking shed and on Lot 5 DP 17475. This area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. Approximately ten borrow pits are visible on the ground surface or on lidar-derived hillshade images. The south-eastern corner of the site has been destroyed by sand quarrying.

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Located on a headland between two arms of a gully system emptying into the Bureau Survey (1930s) it was identified from analysis of aerial photography and lidar data. Located beyond the end of Hall Read, across the gully arm to the east of Dixon Road, a tributary to the Mangakotukutuku Stream. Part of a cluster of three Maori horticulture sites probably associated with Whatukorturu Pa (S1447). The site has not been visited by an archaeologist.    S14/321		
horticulture  River. Initially recorded from soil science data generated by the NZ Soil Bureau Survey (1930s) it was identified from analysis of aerial photography and lidar data. Located beyond the end of Hall Road, across the gully arm to the east of Dixon Road; a tributary to the Mangakotukuuku Stream. NZ Soil Bureau Survey data indicates that the garden occupies the same space as pa S1447, Part of cluster of three Māori horticulture sites probably associated with Whatukoruru Pa (S14474).  S14/322  Māori  On a headland between two arms of a gully system emptying into the Waikato River. Initially recorded from soil science data generated by the NZ Soil Bureau Survey (1930s) it was identified from analysis of aerial photography and lidar data. Located beyond the end of Hall Road, across the gully arm to the east of Dixon Road; a tributary to the Mangakotukuuku Stream. Indicated by a deposit of Tamahere sandy gravelly loam identified by NZ. Soil Bureau Survey in their 1935 soil survey map on the Part of Hamilton S.D. Waipa County map.  S14/326  Māori  A single borrow pit located in the palaeochannel 60 m east of Peacockes Road. Limited testing with a soil auger and a single test trench confirmed the presence of Māori-made soil to the west of the borrow pit within the Southern Links Peacocke Strategic Transport designation. The natural soil in this area is the gravelly variant of the Horoiu Soil Series, and so the soils have a slightly elevated level of gravel in them than naturally.  Located along Peacockes Road from Waterford Road, on the right of the road, in a crook formed by the tight then of Peacockes Rd. Lot 1 DP 316288 and Lot 2 DP 316288. the 1943 aerial photographs show it had three borrow pits on the raised river levee. Although identified during the Soil Bureau survey of the 1930s the site has not been field-checked by an archaeologist. The site has been entirely destroyed by a sand quarry.  S14/328  Māori  Located along Peacockes Road from Waterford Road, north of the south arm of the horticulture a	S14/320	Waikato River. Initially recorded from soil science data generated by the NZ Soil Bureau Survey (1930s) it was identified from analysis of aerial photography and lidar data. Located beyond the end of Hall Road, across the gully arm to the east of Dixon Road; a tributary to the Mangakotukutuku Stream. Part of a cluster of three Māori horticulture sites probably associated with Whatukoruru Pa (S14/47). The
Norticulture	S14/321	River. Initially recorded from soil science data generated by the NZ Soil Bureau Survey (1930s) it was identified from analysis of aerial photography and lidar data. Located beyond the end of Hall Road, across the gully arm to the east of Dixon Road; a tributary to the Mangakotukutuku Stream. NZ Soil Bureau Survey data indicates that the garden occupies the same space as pa S14/47. Part of a cluster of
horticulture Limited testing with a soil auger and a single test trench confirmed the presence of Māori-made soil to the west of the borrow pit within the Southern Links Peacocke Strategic Transport designation. The natural soil in this area is the gravelly variant of the Horotiu Soil Series, and so the soils have a slightly elevated level of gravel in them than naturally.  S14/327 Māori horticulture Located along Peacockes Road from Waterford Road, on the right of the road, in a crook formed by the tight right bend of Peacockes Rd. Lot 1 DP 316288 and Lot 2 DP 316288. the 1943 aerial photographs show it had three borrow pits on the raised river levee. Although identified during the Soil Bureau survey of the 1930s the site has not been field-checked by an archaeologist. The site has been affected by an old sand quarry and the current house.  S14/328 Māori horticulture Located on the south side of Peacockes Road, north of the south arm of the Mangakotukutuku gully. The flat area has been quarried away entirely. A cluster of at least 27 borrow pits was recorded from 1943 aerial photography. The site has been entirely destroyed by a sand quarry.  S14/475 Māori horticulture Continue area of Māori-made soils (Tamahere loam) defined following soil auger testing and excavation of test trenches. The site may extend further to the north along the ridge crest towards the house.  S14/476 Māori horticulture Located east of Peacockes Rd immediately south of a stream on Pt Lot 6 DP 34164 and Lot 5 DP17475 including the unformed road reserve separating the two lots. An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. Approximately 25 borrow pits can be identified on the ground surface. This is a large site covering circa 11.5 hectares. Part of the site has been destroyed by a farm quarry active since at least the 1940s. Paddocks have been cultivated.	S14/322	River. Initially recorded from soil science data generated by the NZ Soil Bureau Survey (1930s) it was identified from analysis of aerial photography and lidar data. Located beyond the end of Hall Road, across the gully arm to the east of Dixon Road; a tributary to the Mangakotukutuku Stream. Indicated by a deposit of Tamahere sandy gravelly loam identified by NZ Soil Bureau Survey in their 1935
horticulture crook formed by the tight right bend of Peacockes Rd. Lot 1 DP 316288 and Lot 2 DP 316288. the 1943 aerial photographs show it had three borrow pits on the raised river levee. Although identified during the Soil Bureau survey of the 1930s the site has not been field-checked by an archaeologist. The site has been affected by an old sand quarry and the current house.  S14/328 Māori horticulture  S14/328 Māori horticulture  Māori horticulture  S14/475 Māori horticulture  S14/476 Māori horticulture  S14/476 Māori horticulture  S14/476 Māori horticulture  S14/477 Māori Located as to f Peacockes Rd immediately south of a stream on Pt Lot 6 DP 34164 and Lot 5 DP17475 including the unformed road reserve separating the two lots. An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. The site may extend further to the north along the ridge crest towards the house.  S14/477 Māori Located 400 metres east of Peacockes Rd immediately south of the gully mouth  S14/477 Māori Located 400 metres east of Peacockes Rd immediately south of the gully mouth	S14/326	Limited testing with a soil auger and a single test trench confirmed the presence of Māori-made soil to the west of the borrow pit within the Southern Links Peacocke Strategic Transport designation. The natural soil in this area is the gravelly variant of the Horotiu Soil Series, and so the soils have a slightly elevated level of gravel
horticulture Mangakotukutuku gully. The flat area has been quarried away entirely. A cluster of at least 27 borrow pits was recorded from 1943 aerial photography. The site has been entirely destroyed by a sand quarry.  S14/475 Māori horticulture On the end of a ridge east of Peacockes Rd and 150 metres north of a stream draining a spring. Located on Lot 4 DPS 81210 and Pt Lot 6 DP 34164. A small area of Māori—made soils (Tamahere loam) defined following soil auger testing and excavation of test trenches. The site may extend further to the north along the ridge crest towards the house.  S14/476 Māori horticulture Located east of Peacockes Rd immediately south of a stream on Pt Lot 6 DP 34164 and Lot 5 DP17475 including the unformed road reserve separating the two lots. An area of Māori—made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. Approximately 25 borrow pits can be identified on the ground surface. This is a large site covering circa 11.5 hectares. Part of the site has been destroyed by a farm quarry active since at least the 1940s. Paddocks have been cultivated.  S14/477 Māori Located 400 metres east of Peacockes Rd immediately south of the gully mouth	S14/327	crook formed by the tight right bend of Peacockes Rd. Lot 1 DP 316288 and Lot 2 DP 316288, the 1943 aerial photographs show it had three borrow pits on the raised river levee. Although identified during the Soil Bureau survey of the 1930s the site has not been field-checked by an archaeologist. The site has been affected
horticulture draining a spring. Located on Lot 4 DPS 81210 and Pt Lot 6 DP 34164. A small area of Māori-made soils (Tamahere loam) defined following soil auger testing and excavation of test trenches. The site may extend further to the north along the ridge crest towards the house.  S14/476 Māori  Located east of Peacockes Rd immediately south of a stream on Pt Lot 6 DP 34164 and Lot 5 DP17475 including the unformed road reserve separating the two lots. An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. Approximately 25 borrow pits can be identified on the ground surface. This is a large site covering circa 11.5 hectares. Part of the site has been destroyed by a farm quarry active since at least the 1940s. Paddocks have been cultivated.  S14/477 Māori  Located 400 metres east of Peacockes Rd immediately south of the gully mouth	S14/328	Mangakotukutuku gully. The flat area has been quarried away entirely. A cluster of at least 27 borrow pits was recorded from 1943 aerial photography. The site has
horticulture and Lot 5 DP17475 including the unformed road reserve separating the two lots.  An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. Approximately 25 borrow pits can be identified on the ground surface. This is a large site covering circa 11.5 hectares. Part of the site has been destroyed by a farm quarry active since at least the 1940s. Paddocks have been cultivated.  S14/477 Māori Located 400 metres east of Peacockes Rd immediately south of the gully mouth	S14/475	draining a spring. Located on Lot 4 DPS 81210 and Pt Lot 6 DP 34164. A small area of Māori-made soils (Tamahere loam) defined following soil auger testing and excavation of test trenches. The site may extend further to the north along the ridge
	S14/476	and Lot 5 DP17475 including the unformed road reserve separating the two lots. An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. Approximately 25 borrow pits can be identified on the ground surface. This is a large site covering circa 11.5 hectares. Part of the site has been destroyed by a farm quarry active since at least the 1940s.
	S14/477	

W. Gumbley Ltd 17 February 2021



		loam) defined following soil auger testing and excavation of test trenches. The site is small and constrained to the ridge top.
S14/478	Māori horticulture	Located 500 metres east of Peacockes Rd adjacent (south) to the mouth of a small stream gully on Lot 5 DP17475. An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. The site contains two borrow pits visible on the ground surface.
S14/479	Māori horticulture	Located 420 metres south-east of Peacockes Rd at the eastern toe of a high escarpment west of a drain on Lot 5 DP17475. An area of Māori-made soils (Tamahere loam) was defined following soil auger testing and excavation of test trenches. The site lies on a flat area at the eastern toe of a high escarpment and west of a drain. Site may represent colluvial deposit from the Kirikiriroa soils on the slope above.
S14/480	Māori horticulture	Located 180 metres south of Stubbs Rd terminus, on the lower river terrace north of Nukuhau Stream mouth, Allotment 87 Te Rapa Parish and part unformed road reserve. A small area (420 square metres) of Māori-made soils (Tamahere loam) was identified following soil auger testing and excavation of test trenches.
S14/490	Māori horticulture	Located at 221 Peacockes Road, on the upper terrace west of the raised access track. A series of soil auger tests were made which showed Māori-made horticultural soils were present. Soils to the east of the track were all natural TPA soil. Characteristically the modified soil was unusually deeply worked. Site includes at least one borrow pit. The 1930s Soil Bureau map shows this area to be Māori made soils but the site differs from the soil map by being discrete.

Attachment 9



Peacocke Structure Plan: Archaeology

## 3.3 Burial ground

The information relating to this takes the form of a sketch plan lodged with the NZAA site record form for Kairokiroki Pa (S14/46).

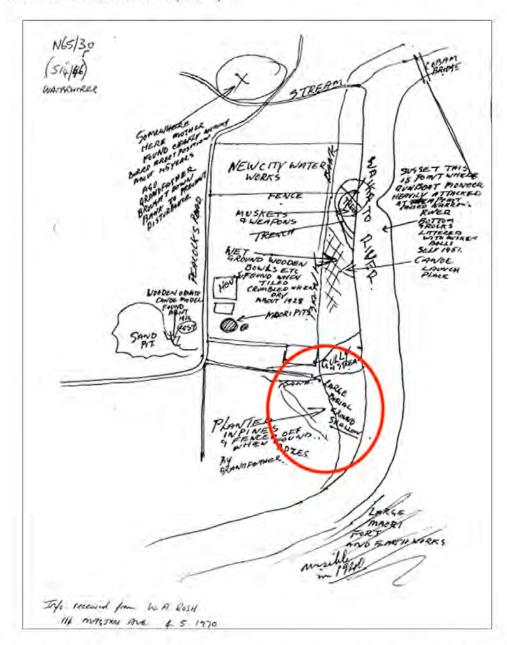


Figure 16: sketch plan attached to the NZAA site record for \$14/46 (Kairokiroki Pā). The approximate location of the urupā (burial ground) is highlighted in red.

W. Gumbley Ltd 19 February 2021

Page 1109 Attachments

12 August 2021



Peacocke Structure Plan: Archaeology

The sketch plan identified the information was supplied by W. A. Rush in 1970 and was apparently based on personal and family recollections. The description is in two parts: "Large burial ground shallow", and "Planted in pines & fences off when found by grandfather" with additional annotation of "adzes", which may be assumed to refer to the finding of adzes associated with the burial ground. The sketch plan is sufficiently detailed to identify the location clearly. It was east of the short gully between the right-angled bend of Peacockes Road and the river and on a lower terrace immediately adjacent to the river. This places the burial ground in the same location of a recorded find-spot S14/161, where an artefact described as a "patu-blank" was found. The term patu-blank implies that it was in the process of manufacture. It is probable that the item was associated with the use of the area as a burial site. The identification on the sketch map of adzes at the same location is also consistent with the deposition of grave goods.

A second burial is also shown on the sketch map. This is located on the western side of the Mangakotutuku Stream and is described thus on the plan: Somewhere here mother found chiefly mummy buried [??] position about 45 years ago. Grandfather brought it down bank to prevent disturbance". The human remains appear to have been reburied and so may still be present.

#### 3.4 Findspots

As well as the adzes and patu-blank described above the sketch plan indicates two other areas where artefacts have been found. One of these in around Kairokiroki Pā and have been described above. The other is the identification of what is described on the sketch plan as a "wooden ornate canoe model found about 1914 (lost)" found in a sand quarry at the bend in Peacockes Road. This sand quarry has also affected the horticulture site S14/327, with which the model waka may have been associated.

#### 3.4.1 S14/193

A Māori waka tiwai was recorded by Andrew Dodd in 2005 on the southern side of the Waikato River near the Hamilton City Council water facility on Waiora Road. Its location was described as being a soft sediment bank where two hull sections of the waka had washed out of their original context. Waka sections measured  $7.4 \times 0.5 \times 0.3$  and  $5.4 \times 0.4 \times 0.2$  metres and exhibited an intact bow. The site lies approximately 1.5 kilometres downstream from the north-western part of the development area.

W. Gumbley Ltd 20 February 2021

<sup>&</sup>lt;sup>3</sup> Record made by NA Ritchie in 1988. A sketch plan in the S14/161 identifies the location as the eastern bank of gully and that the property was owne by Dr R Pirrit.

Attachment 9

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Peacocke Structure Plan: Archaeology

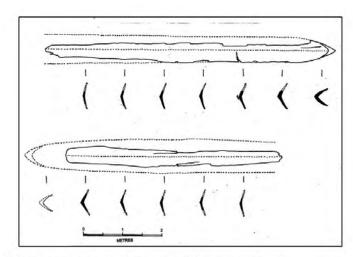


Figure 17: Two hull sections of waka tiwai found at S14/193 (Source: Archsite).

## 3.5 Unrecorded potential site



Figure 18: Location of Site 1. It is located just south of pā S14/47 on the banks of the Maungakotukutuku gully system.

### 3.5.1 Site 1

A pit cluster (Site 1) is consistent with the archaeological focus provided by the Mangakotukutuku gully and reflects a potential for further archaeological sites in the vicinity.

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During a familiarisation walkover for the East-West Link in May 2019 an area of several possible pits at the edge of the gully was identified. They are located on either side of the gully and are distinct and easily recognisable but with varying depths and sizes (Figure 21). The status of these as archaeological features has not been confirmed but their location and morphology indicate they are archaeological. It is also possible that further pits may be present within the adjacent cultivated paddock (Gainsford 2019).

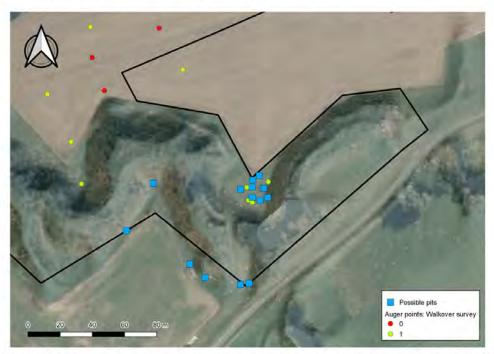


Figure 19: Location of Site 1 within the east-west designation. An area of pits on both sides of the gully. The red and green dots relate to a soil survey for made soils carried out as part of the East-West Link Project.

W. Gumbley Ltd 22 February 2021

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Peacocke Structure Plan: Archaeology

## 4 Nineteenth Century sites/areas

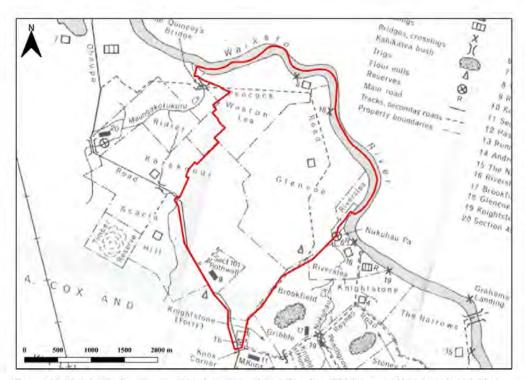


Figure 20: Sketch map from Raynes1981 showing southwest Hamilton. The location of homesteads and other European sites are noted.

The wider Peacocke area was subject to European occupation soon after the conclusion of the 1863–1864 invasion with survey of allotments for the settlement of members of the Waikato Militia. The general desirability of the area is witnessed by the selection of land there by General Galloway and Colonel de Quincy. It was, after the 1863–1864 war, confiscated by the Government and allotted parcels to men of the Fourth Regiment of Waikato Militia.

SO 381-II (1864 or 1865), created as part of the partition of land to the militia, shows that land within the Peacocke Structure Plan area was granted General Galloway, Colonel De Quincey, J. Calderwood, Part of Captain D.M. Browns selection, S. Moody, J. Leonard, Wm Gillie, P. Conroy, W.B. Eager, S. Middleton, J. Scholes, J. Loughlin, N. Partington, T. Rothwell, R. W. Hammond and W. Yeats, T Rothwell.

W. Gumbley Ltd 23 February 2021





Figure 21: Historical map dated  $30^{th}$  June 1865. The plan also shows land ownership. An area of 'ti tree' is identified, as is the larger Mangakotukutuku gully system to the east. No archaeological features of interest are identified on the plan (HNC SO  $381\_1$ ) (Source: Quickmap).

After the initial allotting parcels, it seems that the Peacockes area followed the pattern common elsewhere in the Waikato with land blocks allocated to the militia changing hands rapidly in the 1860s and 1870s. They were eventually purchased by individuals who established larger homesteads, for example, Weston Lea, Korokanui and Glencoe (Raynes 1981).

#### 4.1 Glencoe

Land was granted to General Thomas James Galloway who had come to New Zealand in 1861 with the 70<sup>th</sup> Regiment. In 1865 after retiring from a command of the Waikato Militia and volunteers he was granted 800 acres south of west Hamilton which he named 'Glencoe'. The association of Glencoe with General Galloway raises the potential for the development

W. Gumbley Ltd 24 February 2021



of the homestead, at least as a manager's quarters, soon after the invasion. Raynes identified a location for the homestead on her map (1981), a little to the west of the existing Peacockes Road. The description by Raynes of the homestead is of a place developing over time from a simple cottage to a large house suggests that this is a possible scenario. It is, however, uncertain if Galloway ever resided there.

The property occupied land south of Colonel de Quincey's as far as Nukuhau Pā and the ridge terminating in the west at the Mangakotukutu Stream and gully. On the eastern side of his property the landscape was characterised by a flax field and flax swamps which dominated around 200 acres. In 1898 the property was purchased by Herbet Spong Hawkins. During the following few years Hawkins cleared the land of flax and scrub to enable ploughing and sowing. Before 1900 the original cottage had been transformed during renovations to create a large home with surrounding veranda. The location of the house according to Raynes (1981) map is within or immediately adjacent to the east-west link designation. Up until the 1960s the descendants of Hawkins maintained and continued to farm the land.

#### 4.2 Weston Lea

Colonel Paul de Quincey, who was General Galloway's military secretary was granted 450 acres south of the river. De Quincey lived there until the 1880s when he retired to Auckland and the land was bought by John Peacocke, who had married De Quincey's step-daughter. De Quincy's land extended along the west bank of the Waikato River south from the Mangakotutuku Stream; bounded at its southern extremity by Galloway's estate, 'Glencoe'.

In 1871, De Quincey established himself in the Waikato and developed his estate, including the construction of a two and a half storied house called Weston Lea, which was built from kauri close to the bank of the river (Figure 24).

Access to the estate and homestead was largely by river and a landing was developed as part of this. Raynes proposes that stone steps were constructed at the landing but no evidence of this exists today. This link with Hamilton for goods and produce continued until the early 1900s. However, it appears that De Quincey had a bridge constructed across the Mangakotukutuku Stream, in much the same location as the present bridge, as part of the track to service his property (Raynes 1981). In the early 1890s a road was established from Hamilton through to de Quincy's estate (Raynes 1981).

Despite a sizeable house being built by de Quincey no surface traces of the original homestead remain. Aside from the main house, the homestead would have a range of associated structures; outhouses, stables, barns, sheds, staff-accommodation and washhouses. This complex would probably also have included gardens and amenities.

W. Gumbley Ltd 25 February 2021

The exact location of the homestead and its accompanying structures is not known precisely. However, based upon information from members of the Peacocke family<sup>4</sup>, consideration of landform and historical photos a position for the homestead can be approximated. This is generally to the south of the 1912 Weston Lea house<sup>5</sup> on the crest of the ridge on the eastern side of Weston Lea Lane. Today the area has a handful of specimen trees, with a lone palm marking the location of the now demolished 1912 house. A large reservoir is located immediately south of the 1912 house site, which was built by Frank Peacocke around 1924<sup>6</sup> to supply an irrigation system for his farm. Information from his son, Bob Peacocke, was that the original Weston Lea was not demolished until approximately 1926, which suggests that the location of the house may be undisturbed by the reservoir, although it may have affected outbuildings. (Peacocke & Peacocke 1980, Raynes 1981).



Figure 22: The Old Weston Lea homestead. This image and another in Raynes (1981) shows a two storied house with an asymmetrical roof-line with a large veranda on both the upper and ground floors. (Image: N & R Peacocke 1980.)

W. Gumbley Ltd 26 February 2021

12

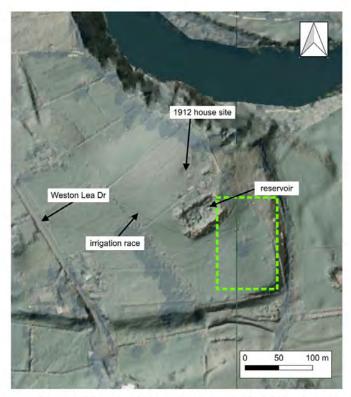
<sup>&</sup>lt;sup>4</sup> Personal communications to Gumbley from Bob Peacocke and Mark Peacocke, 2018.

<sup>&</sup>lt;sup>5</sup> Demolished in the 1980s.

<sup>&</sup>lt;sup>6</sup> Bob Peacocke, personal communication.

Attachment 9

Peacocke Structure Plan: Archaeology



Figure~23: Approximate~location~of~the~original~Weston~Lea~homestead~built~by~De~Quincey~is~identified~by~the~green~dashed~polygon.



Figure 24: The second Weston Lea homestead built circa 1912 (Image: N & R Peacocke 1980).

27 W. Gumbley Ltd February 2021



Figure 25: Excerpt of an historic aerial from 1938 that shows the extent of the 1912 Weston Lea complex. The reservoir built in the early 1920s is visible directly south of the house. The double row of trees extending south from the 1912 house's access-way, past the reservoir is thought to mark the track to the original 1870s homestead site. (Source: Retrolens).

## 4.3 Korokonui/Acacia Hill

Militia lots were bought up by R. W. Hammond whose aggregation enlarged to approximately 1000 acres on both sides of Ohaupo Road. Hammond cleared his land and used it for running stock as well as breeding race horses. Hammond's land on the eastern side of Ohaupo Road became known as Korokonui, however it was known later as Korkonui. James Brown bought Korokonui in 1877. However, he lost the estate, going into liquidation in the early 1880s. The new owners became the NZ Loan and Mercantile Agency Co. (NZLMA). In 1882 it was bought by Charles Hibbs who grew grain and ran sheep but he too had to sell up in 1895. The property was once again owned by the NZLMA. About 200 acres in the southern end were sold to Duncan Macdonald. In 1896 (1898?) Korokonui, now approximately 380 acres, was sold to Thomas Macky Hall. The homestead was established at the site of the existing house about half a mile south of Mill Creek and was the only house on Ohaupo Road between Thomas Rothwell and James Ridler. Hall built a new house shortly after 1900 that stood on one of the highest points in the area; this was incorporated into the DSIR Rukuhia Soil Research Station. (Raynes 1981).

W. Gumbley Ltd 28 February 2021

Attachment 9



Peacocke Structure Plan: Archaeology

#### 4.4 Rukuhia Research Station

During the Second World War the Department of Agriculture acquired the approximately 300 acres under the Public Works Act establishing market gardens to supply the Armed Forces. After 1945 the land was divided into five almost equal allotments. Allotment 406 SO 37212 was transformed into the DSIR Soil Research Station 'The Rukuhia Soil Research Station' (Raynes 1981:89–93; Williams 2012).

#### 4.5 Rothwell

Raynes (1981) informs us that Thomas Rothwell's homestead was located on the hill crest at Rukuhia. After Thomas' death, his son William continued to manage the property. It remained in Rothwell hands until the death of Eleanor in 1900 (Raynes 1981). Like the other homesteads information about the precise location is lacking.

#### 4.6 Smith

Newell's sketch map (1874) of the Waikato shows a house labelled Smith to the east of a track following the Peacockes Rd alignment (Figure 26). Since Newell's map is only a sketch with no accurate scale or orientation the location of the Smith site location cannot be verified to any degree of accuracy.



Figure 26: Part of Newall's Sketch Map (Reproduction), dated 1874, which is understood to have been prepared by Captain Stuart Newall, the part of the map reproduced shows a rectangle (house?) labelled Smith located on the east side of a track through the Peacocke area. (Unpublished, Waikato Museum).

W. Gumbley Ltd 29 February 2021



## 5 Assessment of archaeological values

The following assessments addresses the archaeological values of all sites within the Peacocke Structure Plan area. It assesses sites against the historic and cultural heritage assessment criteria in table 10-1 of the Waikato regional policy statement. In this assessment three of the 19th Century homestead sites, Weston Lea, Rothwell's house and Glencoe, have been assessed. Of these only Weston Lea has robust information about its history and location. Too little is known about the place annotated 'Smith' in the Newall map to be confident of its location much less its heritage values.

The potential archaeological site on the eastern bank of the Mangakotukuku Stream has not been assessed as its archaeological status has not been confirmed. Similar the find locations, including the waka (S14/193) have not been assessed. In the case of the waka because this not strictly within the Peacockes Structure Plan area and in the case of the others because they are no longer in place.

## 5.1 Pā sites

Kairokiroki Pā (S14/46)

Archaeological	
Qualities	
Information	Potential information value for the site is high since the site is readily visible and in good condition.
Research	Can contribute to the growing body of archaeological information surrounding Māori occupation and subsistence within inland Waikato.
Recognition or	Archaeological sites are protected under the Heritage New Zealand/Pouhere
protection	Taonga Act and cannot be destroyed or modified without authority from Heritage New Zealand. The site is currently identified in the Hamilton District Plan
Architectural	
Qualities	
Style or type	N/A
Design	N/A
Construction	N/A
Designer or Builder	N/A
Cultural Qualities	
Sentiment	Māori values may still be relevant to the site.
Identity	Māori values are relevant to the site.
Amenity or Education	High amenity value, based on its location and good condition.
Historic Qualities	
Associative Values	The site is part of a wider complex of Māori sites concentrated along the banks of the Waikato River. It is rare/unique based not only being a pā but also because it is well-preserved.
Potential Scientific	Has the potential to offer substantial information surrounding Māori occupation
Research	of the inner Waikato. Research into Māori oral history regarding the site may be warranted.
Technical Qualities	
Technical	Represents a form of adaptation to conditions in the Waikato.
Achievement	

W. Gumbley Ltd 30 February 2021



## Whatukorero Pā (S14/47)

Archaeological Qualities	
Information	Potential information value for the site is high since the site is readily visible and in good condition. S14/47 is in moderate condition with damage from the planation pines diminishing what would otherwise be high values. Nonetheless the site holds high archaeological potential. It is a prominent feature and easily identifiable by the ditch and bank defences. Aside from visible features within the cleared area it is expected that features also remain in the section covered by pine trees; these pose an imminent risk to the site as they near the end of their lives.
Research	Can contribute to the growing body of information surrounding Māori occupation and subsistence within inland Waikato. Part of a larger complex of sites with interconnected horticulture along the Waikato River. Within close proximity of the site are multiple recorded horticulture sites that are most probably associated.
Recognition or protection	Archaeological sites are protected under the Heritage New Zealand/Pouhere Taonga Act and cannot be destroyed or modified without authority from Heritage New Zealand. This site is not listed in a schedule to the Hamilton District plan.
Architectural	
Qualities	
Style or type	N/A
Design	N/A
Construction	N/A
Designer or Builder	N/A
Cultural Qualities	
Sentiment	Māori values may still be relevant to the site.
Identity	Māori values will be relevant to the site.
Amenity or Education	High amenity value, based on its location and good condition. It will be readily visible from the proposed east-west link.
Historic Qualities	
Associative Values	The site is part of a wider complex of Māori sites concentrated along the banks of the Waikato River. It is unusual for its location up a tributary away from the river. Like other pā, this site is associated with horticultural sites of the Waikato Horticultural Complex.
Potential Scientific	Has the potential to offer substantial information surrounding Māori occupation
Research	of the inner Waikato. However, damage from tree roots and potentially from tree throw have and will continue to affect the potential for scientific research.  Research into Māori oral history regarding the site may be warranted.
Technical Qualities	· ·
Technical	Represents a form of adaptation to conditions in the Waikato.
Achievement	

## 5.2 S14/164, Burial Ground/Urupā

Archaeological	
Qualities	
Information	The archaeological value for the site is high although the state of preservation of
	the site is uncertain.
Research	The site has potential to offer information about burial practices and more
	specifically about the age sex and health of those interred.
Recognition or	Archaeological sites are protected under the Heritage New Zealand/Pouhere
protection	Taonga Act and cannot be destroyed or modified without authority from Heritage
	New Zealand. This site is not listed in a schedule to the Hamilton District plan.
Architectural	
Qualities	
Style or type	N/A
Design	N/A

W. Gumbley Ltd 31 February 2021



- · · · ·	37/4
Construction	N/A
Designer or Builder	N/A
Cultural Qualities	
Sentiment	Māori values will be relevant to the site.
Identity	Māori values will be relevant to the site however, the hapū groups associated with
	the burials are unknown.
Amenity or Education	High amenity value, based on its location and good condition. It will be readily
	visible from the proposed east-west link.
Historic Qualities	
Associative Values	The site is part of a wider complex of Māori sites concentrated along the banks of
	the Waikato River including pā, this site is associated with horticultural sites of
	the Waikato Horticultural Complex. The urupā may be understood to have very
	high associative values for mana whenua.
Potential Scientific	The site has potential to offer information about burial practices and more
Research	specifically about the age sex and health of those interred. Further research into
	Māori oral history is warranted.
Technical Qualities	
Technical	Unknown.
Achievement	

## 5.3 Pre-European horticultural sites

Sites: S14/64, S14/174, S14/210, S14/224, S14/243, S14/318, S14/319, S14/320, S14/321, S14/322, S14/326, S14/327, S14/328, S14/475, S14/476, S14/477, S14/478, S14/479, S14/480 and S14/490.

Archaeological	
Qualities	
Information	Sites of Māori horticultural activity offer valuable information regarding Māori horticulture and associated archaeology including Māori-made garden soils, borrow pits and potential sub-surface Māori domestic settlement features. Information value is affected by the condition of archaeological sites. Some parts of these sites have suffered only minimal modern modification, while others have been affected by modern cultivation or, more adversely, sand quarrying. Archaeological investigation should enable recording and identification of the specific nature of these sites as elements of the Waikato Māori horticultural complex. Data can be compared with other parts of the Waikato.
Research	Site of this class may address broader questions regarding diachronic settlement patterns in the Waikato including intra/inter-site dynamics. The have potential to address archaeological research questions about the adaptation of tropical Polynesian horticulture, including initial forest clearance, to the temperate environment of New Zealand generally and specifically the Waikato. Radiocarbon dating of sites contribute to developing a regional chronology, and palaeo-environmental information recovered from the sites allows reconstruction of the vegetation history of the area before and after human settlement. Sites are important for evaluating current understanding of pre-European horticultural strategies in the Waikato by comparing results with other similar sites.
Recognition or protection	HNZPT archaeological provisions: archaeological sites are protected under the Heritage New Zealand/Pouhere Taonga Act and cannot be destroyed or modified without authority from Heritage New Zealand. Site S14/176, is itemised on Schedule 8C Group 2 (Archaeological and cultural sites), Hamilton City operative district plan as A100.
Architectural Qualities	
Style or type	N/A
, ,,	N/A N/A
Design	IN/A

W. Gumbley Ltd 32 February 2021



- · · · ·	27/4
Construction	N/A
Designer or Builder	N/A
Cultural Qualities	
Sentiment	Māori values may still be relevant to the site.
Identity	Māori values may still be relevant to the site.
Amenity or Education	Opportunities for education or amenity are limited to nil. An area of Māori horticultural land is being proposed for reservation within the Amberfield proposal. Otherwise the results of mitigation investigations will permit information/interpretation of sites to be developed.
Historic Qualities	
Associative Values	These sites are associated with the Māori settlement of the inland Waikato; Southern Hamilton/Tamahere area. Horticultural sites will be associationed with one or more of the pā located on the west and east banks of the Waikato River.
Potential Scientific Research	Pre-European Māori horticultural sites form a major element of the archaeological landscape of the Hamilton Basin with the overall level of preservation within the development area classifiable as moderate to good. Research tin to Maori oral history may further understanding of the realtinships of particular garden sites with specific hapū and pā.
Technical Qualities	
Technical	Māori horticultural sites represent the remains a very sophisticated level of
Achievement	technological achievement regarding the adaptation of agronomic techniques and cultigens developed for tropical environments to temperate New Zealand. Large borrow pits are common in the landscape, and the alluvium quarried from these pits was used to develop growing media understood to be used for cultivating kūmara.

## 5.4 Historical European

## Weston Lea

	De Quincy Homestead
Archaeological Qualities	
Information	The original Weston Lea homestead, along with its successor, has been demolished/deconstructed. Potential information value for possible identified remains and subsurface features is moderate to high. Remains of a range of structures that may be expected to be associated with a mid/late 19 <sup>th</sup> Century homestead.
Research	Weston Lea has the potential to develop knowledge surrounding early settlement of Hamilton and the Waikato. The association of the site with a senior member of the Waikato Militia can provide an important insight into the lifeways of a member of the colonial elite.
Recognition or	HNZPT archaeological provisions: archaeological sites are protected under the
protection	Heritage New Zealand/Pouhere Taonga Act and cannot be destroyed or modified
	without authority from Heritage New Zealand.
Architectural	
Qualities	
Style or type	No standing remains.
Design	No standing remains.
Construction	No standing remains.
Designer or Builder	No standing remains.
Cultural Qualities	
Sentiment	The site forms part of the Peacocke family history but also represents a remnant
	of the turbulent mid-19th Century history of the Waikato.
Identity	Values associated with the Peacocke family may still be relevant.
Amenity or	Education surrounding the colonial settlement of the Waikato.
Education	
Historic Qualities	

W. Gumbley Ltd 33 February 2021



Associative Values	Associations with the De Quincy/Peacocke estate and family that followed the de
	Quincy ownership. The site also represents the tangible remains of the colonial
	elite with specific associations to the senior ranks of the Waikato Militia.
Potential Scientific	see Archaeological Qualities.
Research	
Technical Qualities	
Technical	Unknown.
Achievement	

#### Glencoe and Rothwell Homesteads

Archaeological	
Qualities	
Information	The homesteads have been demolished/deconstructed. There is potential for
	information to be recovered through archaeological investigation of subsurface
	features. However, without identification of the locations of the homesteads it is
	not possible to understand the level of potential. Remains of a range of structures
	that may be expected to be associated with a mid/late 19 <sup>th</sup> Century Homestead.
Research	Has the potential to develop knowledge surrounding early colonial settlement of
	Hamilton and the Waikato. The association of Glencoe with General Galloway
	can provide an important insight into the lifeways of a member of the colonial
D '''	elite.
Recognition or	HNZPT archaeological provisions: archaeological sites are protected under the Heritage New Zealand/Pouhere Taonga Act and cannot be destroyed or modified
protection	without authority from Heritage New Zealand.
Architectural	without authority from Heritage New Zealand.
Oualities	
Style or type	No standing remains.
Design	No standing remains.
Construction	No standing remains.
Designer or Builder	No standing remains.
Cultural Qualities	
Sentiment	Descendants of Galloway may still be relevant to the site.
Identity	Values associated with descendants may still be relevant.
Amenity or Education	Education surrounding the settlement of the Waikato.
Historic Qualities	
Associative Values	Part of the original colonial settlement of southwest Hamilton through the
	distribution of land to the colonial military.
Potential Scientific	see Archaeological Qualities.
Research	
Technical Qualities	
Technical	Unknown.
Achievement	

## 6 Summary and recommendations

Altogether, as noted in the introduction, there are two pā in the Peacocke area along with 20 horticultural sites of varying sizes, an urupā, and a number of artefact associated 'findspots' within the Peacocke Structure Plan zone. Three 19th Century homestead sites have been identified with a possible reference to a fourth (Smith), however only, Weston Lea, one has sufficiently information have some confidence of its location. All of the sites, particularly those relating Māori occupation, have wider associative values in relation to sites outside the

W. Gumbley Ltd 34 February 2021

Attachment 9



Peacocke Structure Plan: Archaeology

Peacocke Structure Plan area as well as broader themes relating to the settlement of New Zealand and more specifically the Waikato. The most common site class are horticultural sites, which form part of the nationally distinct Waikato Horticultural Complex. This complex represents a form of agronomic adaptation of Polynesian agricultural practice to temperate New Zealand and as such this this form of intensified agricultural practice is of significance both within the New Zealand context and also within the context of the study of these practices across Oceania.

None of these site currently lie within a reserve although part of the horticultural site \$14/318 is proposed to be placed within a reserve in relation to the Amberfield development with the intention for it to classified as an Historic Reserve and managed accordingly. This reserve will be 1.25 ha and, as well as containing representative examples of surface features typical of sites of the Waikato Horticultural Complex, it also has good sight lines of the river and upstream to nearby Nukuhau Pā. The proposed reserve is embedded in the resource consent for Amberfield and Heritage New Zealand Pouhere Taonga has also excluded the area of the reserve from Authority 2019/69 (see attachment 1), which permits the destruction of archaeological sites within the remainder of the subdivision. Otherwise almost all of the other horticultural sites within the Peacocke zone are located within areas slated for development.

Preservation of horticultural sites should be sufficiently extensive to preserve representative areas of Māori-made soils and borrow pits to facilitate an understanding of their place within the landscape and also the layout and scale of the enterprise.

Both Kairokiroki Pā (S14/46) and Whatukorero Pā (S14/47) will have filled the role of central places for communities living within the broad landscape encompassing the Peacocke zone and merit high levels of protection. Both pā require management plans and this should be given priority as should the removal of pine trees from Whatukorero Pā. In the context of both of these pā and the other sites associated with Māori occupation research into Māori oral histories would provide important contextual and associative information which appear to be lacking, at least in a collated form.

The absence of recorded pā at the mouth of the Mangakotukutuku Stream, as noted above, represents an unusual exception to an otherwise very predictable pattern in the distribution of pā along the Waikato River. Given this, the area merits further research to investigate the possibility of a pā in this location. We also have some concerns about the reliability of the recording horticultural site S14/243 in the same area and recommend that this site is further examined to assess the veracity of the sites status.

W. Gumbley Ltd 35 February 2021 Peacocke Structure Plan: Archaeology

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W. Gumbley Ltd 36 February 2021

Hamilton City Council

Peacocke Structure Plan: Archaeology

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### **Databases:**

- New Zealand Archaeological Associations site recording database—Archsite. <a href="http://www.archsite.org.nz/">http://www.archsite.org.nz/</a>>.
- Retrolens
- Waikato Regional Council aerial photography. WRAPS 2012 & 2016, LIDAR 2007.
- Quickmap

W. Gumbley Ltd 37 February 2021



Peacocke Structure Plan: Archaeology

8 Attachment 1: Heritage New Zealand Pouhere Taonga Authority 2019/69 for Amberfield subdivision.

W. Gumbley Ltd 38 February 2021

Hamilton City Council
Te kaunihera o Kirikiriroa

Peacocke Structure Plan: Archaeology



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29 August 2018

File ref: 2019/069 11013-21

Mark Peacocke Weston Lea Limited 24 Duncan Parade HAMILTON 3216

Tena koe Mark

APPLICATION FOR ARCHAEOLOGICAL AUTHORITY UNDER HERITAGE NEW ZEALAND POUHERE TAONGA ACT 2014: Authority no. 2019/69, 514/64, 514/176, 514/224, 514/318, 514/319, 514/475, 514/476, 514/477, 514/478, 514/479 and 514/480, Maori Horticultural Sites, 337 and 461 Peacockes Road, Hamilton (Map 1)

Thank you for your application for an archaeological authority which has been granted and is attached.

In considering this application, Heritage New Zealand Pouhere Taonga notes that you wish to undertake the Amberfield development at 337 and 461 Peacockes Road, Hamilton (Map 1). Amberfield is a large subdivision (105ha) that will be developed in stages over the next decade. This will cause the destruction of 11 recorded archaeological sites (S14/64, S14/176, S14/224, S14/319, S14/319, S14/475, S14/476, S14/477, S14/478, S14/479 and S14/480) relating to pre-European Maori horticulture. This is an extensive and important archaeological landscape and there is reasonable cause to suspect that unrecorded subsurface sites shall be encountered. Visible surface features are usually part of larger archaeological gardening systems that are unable to be identified prior to development. We note that two authorities have already been granted for this development (2018/266 and 2018/466) for the purposes of gaining a greater understanding of the archaeology prior to the current application being made. This work identified 33.4ha of gardening soils in 11 tracts spread the length of the project area.

The authority has been granted for a 10 year period to cover the timeframe of the development. The conditions of the authority are based around the "Archaeological Site Management Plan" and the "Mitigation and Research Strategy" prepared by Warren Gumbley and submitted with the application. These documents will guide the recovery of archaeological information and it is our expectation that they will be reviewed prior to each major stage of development to ensure they reflect the current state of knowledge. The conditions of the authority provide for this.

It is also noted that you have proposed to reserve 12.5ha to protect part of \$14/318. The area of the proposed reserve has been excluded from this application (as shown on Map 1). It is intended that this area will preserve a representative element of the archaeological landscape and provide an opportunity for it to be interpreted for the public. The area is of significance to Nga Mana Toopu o Kirikiriroa, Te Ha o Te Whenus o Kirikiriroa and Waikato Tainui and we appreciate the consultation you have undertaken.



W. Gumbley Ltd 39 February 2021

Peacocke Structure Plan: Archaeology

Please inform Nga Mana Toopu o Kirikiriroa, Te Ha o Te Whenua o Kirikiriroa and Walkato Tainui, the approved archaeologist and the Heritage New Zealand Pouhere Taonga Archaeologist of start and finish dates for the work.

An appeal period from receipt of decision by all parties applies. Therefore this authority may not be exercised during the appeal period of 15 working days or until any appeal that has been lodged is resolved.

The granting of this authority by Heritage New Zealand Pouhere Taonga does not constitute affected party approval under the Resource Management Act or in any way prejudice its response to any other consent processes in respect of the proposed works.

40

If you have any queries please direct your response in the first instance to:

Dr Rachel Darmody Archaeologist Heritage New Zealand Pouhere Taonga, Tauranga Office PO Box 13339, Tauranga 3141

Phone (07) 577 4535 Email ArchaeologistLN@heritage.org.nz

Yours sincerely

Vanessa Tanner Manager Archaeology

W Gumbley Ltd

February 2021

**Hamilton City Council** 

Peacocke Structure Plan: Archaeology

- cc: Weston Lea Limited Mark Peacocke via email at <a href="mark@whitehorse.nz">mark@whitehorse.nz</a>
- cc: Strategic Property Solutions Ltd, Andrew Duncan via email at <a href="mailto:andrew.duncan@spsl.net.nz">andrew.duncan@spsl.net.nz</a>
- cc: Warren Gumbley
  via email at warren@archaeologist.co.nz
- cc: Nga Mana Toopu o Kirikiriroa, Wiremu Puke and Boris Samujh
  via email at <u>wiremupuke123@xtra.co.nz</u> and <u>boris.samujh@gmail.com</u>
- cc: Te Ha o Te Whenua o Kirikiriroa, Rawiri Bidois via email at <u>rawiribidois@gmail.com</u>
- cc: Waikato Tainui, Lee Tane via email at <u>Lee.Tane@tainui.co.nz</u>
- cc: Land Owner, The Adare Company Limited, Mark Peacocke via email at <a href="mark@whitehorse.nz">mark@whitehorse.nz</a>
- cc: Planning Manager Hamilton City Council via email at <u>info@hcc.govt.nz</u>

Pursuant to Section 51 Heritage New Zealand Pouhere Taonga Act 2014 Heritage New Zealand Pouhere Taonga must notify TLAs of any decision made on an application to modify or destroy an archaeological site. We recommend that this advice is placed on the appropriate property file for future reference.

cc: Ministry for Culture and Heritage via email at <a href="mailto:protected-objects@mch.govt.nz">protected-objects@mch.govt.nz</a>

Pursuant to Section 51 Heritage New Zealand Pouhere Taonga Act 2014

cc: NZAA Central Filekeeper c/o DOC, WELLINGTON Attn: Nicola Molloy via email at <u>nmolloy@doc.govt.nz</u>

- cc: Heritage New Zealand Pouhere Taonga, Archaeologist, Dr Rachel Darmody
- cc: Heritage New Zealand Pouhere Taonga, Director Northern Region, Sherry Reynolds
- cc: Heritage New Zealand Pouhere Taonga Pouarahi, Dave Robson and Makere Rika-Heke

W. Gumbley Ltd 41 February 2021



Peacocke Structure Plan: Archaeology



# AUTHORITY

# Heritage New Zealand Pouhere Taonga Act 2014

**AUTHORITY NO: 2019/069** 

FILE REF: 11013-21

**DETERMINATION DATE: 29 August 2018** 

EXPIRY DATE: 29 August 2028

**AUTHORITY HOLDER: Weston Lea Limited** 

POSTAL ADDRESS: 24 Duncan Parade, HAMILTON 3216

LOCATION: 337 and 461 Peacockes Road, Hamilton (Map 1)

ARCHAEOLOGICAL SITES: \$14/64, \$14/176, \$14/224, \$14/318, \$14/319, \$14/475, \$14/476, 514/477, 514/478, 514/479 and 514/480

APPROVED ARCHAEOLOGIST: Warren Gumbley

LANDOWNER CONSENT: Completed

This authority may not be exercised during the appeal period of 15 working days or until any appeal that has been lodged is resolved.

### DETERMINATION

Heritage New Zealand Pouhere Taonga grants a general authority pursuant to section 48 of the Heritage New Zealand Pouhere Taonga Act 2014 in respect of the archaeological sites described above, within the area specified as Lot 1 DPS 81210 - SA66A/99, Lot 2 DPS 81210 -SA56A/99, Lot 3 DPS 81210 - SA66A/100, Lot 4 DPS 81210 - SA66A/100, Lot 1 DP 36935 -SA5D/1211, Pt Lot 6 DP 34164 - SA4B/788, Lot 5 DP 17475 - SA718/181, Allotment 87 Te Rapa Parish - SA528/20, Lot 1 DPS 78023 - SA60A/826, Pt Allotment 94 Te Rapa Parish - SA528/20, Pt Allotment 93 Te Rapa Parish - SA528/20 (Map 1) to Weston Lea Limited for earthworks for the proposal to undertake the Amberfield development at 337 and 461 Peacockes Road, Hamilton (Map 1), subject to the following conditions:

# CONDITIONS OF AUTHORITY

The authority holder must ensure that all contractors working on the project are briefed by the approved archaeologist on the possibility of encountering archaeological evidence, how to identify possible archaeological sites during works, the archaeological work required by the conditions of this authority, and contractors' responsibilities with

W. Gumbley Ltd February 2021

**Hamilton City Council** 

Peacocke Structure Plan: Archaeology

- regard to notification of the discovery of archaeological evidence to ensure that the conditions of the authority are complied with.
- The authority must be exercised in accordance with the "Amberfield Archaeological Site Management Plan" (2 July 2018) and the "Amberfield Mitigation and Research Strategy" (July 2018) attached to the authority application and any changes to the plan require the prior written agreement of Heritage New Zealand Pouhere Taonga.
- 3. Annually from the date of issue of this authority, the authority holder and the archaeologist approved by Heritage New Zealand Pouhere Taonga must review the "Amberfield Archaeological Site Management Plan" (2 July 2018) and the "Amberfield Mitigation and Research Strategy" (July 2018) to ensure the documents are up-to-date and reflect the current state of knowledge. The results of the review must be submitted to Heritage New Zealand Pouhere. Any changes to the plan require the prior written agreement of Heritage New Zealand Pouhere Taonga.
- 4. All earthworks that may affect any archaeological sites must be monitored at the discretion of an archaeologist approved by Heritage New Zealand Pouhere Taonga and in accordance with the Site Management Plan and Mitigation and Research Strategy referred to in Conditions 2 and 3. A representative sample of archaeological evidence encountered during the exercise of this authority must be investigated, recorded and analysed in accordance with current archaeological practice.
- 5. If any koiwi tangata (human remains) are encountered, all work should cease within 5 metres of the discovery. The Heritage New Zealand Pouhere Taonga Archaeologist, New Zealand Police and Nga Mana Toopu o Kirikiriroa, Te Ha o Te Whenua o Kirikiriroa and Waikato Tainui must be advised immediately in accordance with Guidelines for Koiwi Tangata/Human Remains (Archaeological Guideline Series No.8) and no further work in the area may take place until future actions have been agreed by all parties. This condition is not a statement of mana whenua status.
- 6. Any archaeological work must be undertaken in conformity with any tikanga Maori protocols agreed to by the authority holder and Nga Mana Toopu o Kirikiriroa, Te Ha o Te Whenua o Kirikiriroa and Waikato Tainui, so long as the legal requirements of the authority are met. This condition is not a statement of mana whenua status.
- 7. That annually from the date of issue of this authority, the authority holder must submit to the Heritage New Zealand Pouhere Taonga Archaeologist and Nga Mana Toopu o Kirikiriroa, Te Ha o Te Whenua o Kirikiriroa and Waikato Tainui a written report containing a summary of the progress of the project.
- The NZAA Site Recording Scheme must be updated annually from the date of issue of this authority with new or updated site record forms by the approved archaeologist.
- 9. That within 12 months of the completion of the on-site archaeological work, the authority holder shall ensure that a final report, completed to the satisfaction of Heritage New Zealand Pouhere Taonga, is emailed to the Heritage New Zealand Pouhere Taonga Archaeologist. Digital copies of the final report must also be sent to the NZAA Central Filekeeper and Nga Mana Toopu o Kirikiriroa, Te Ha o Te Whenua o Kirikiriroa and Waikato Tainui.

W. Gumbley Ltd 43 February 2021



Peacocke Structure Plan: Archaeology

Signed for and on behalf of Heritage New Zealand.

That having given due consideration to Section 21(c) of the Act, the Board <a href="mailto:approve">approve</a> the granting of authority 2019/069 to Weston Lea Limited, for the proposal to undertake the Amberfield development subject to the conditions of this authority.

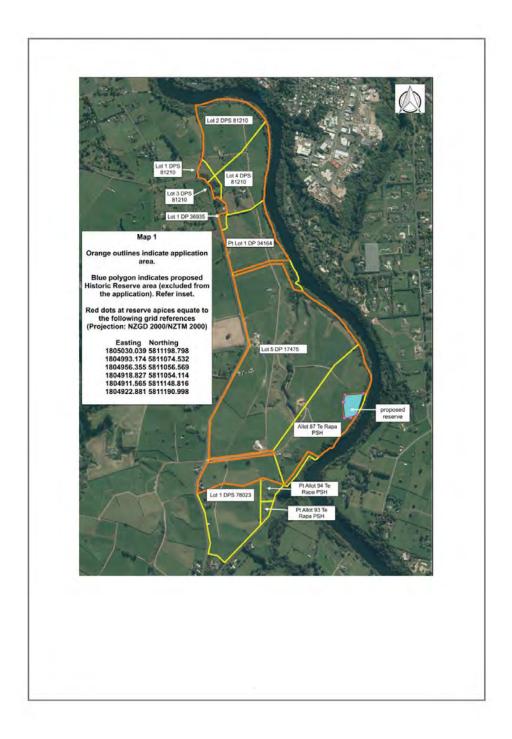
Heritage New Zealand Pouhere Taonga Board PO Box 2629 WELLINGTON 6140

Date 23 August 2018

W. Gumbley Ltd 44 February 2021

Hamilton City Council
Te kaunihera o Kirikiriroa

Peacocke Structure Plan: Archaeology



W. Gumbley Ltd 45 February 2021







# Peacocke Structure Area Plan Change

Long-tailed bat report

For Hamilton City Council

June 2021

Hamilton City Council
Te kaunihera o Kirikiriroa

# REPORT INFORMATION AND QUALITY CONTROL Prepared for: Jamie Sirl City Planning Hamilton City Council Dr Hannah Mueller (4Sight) Author! Dr Ian Davidson-Watts (Davidson-Watts Ecology) Gerry Kessels (Bluewattle Ecology) Reviewer: Dr Matt Baber (Tonkin + Taylor) Approved for Dr Pete Wilson Release: Principal Ecologist **Document Name** 4sight\_Psp\_Bat\_Report\_Final\_June 2021 **Version History:** Final 4 June 2021





CONTENTS	
	Pag

FX	CUTIVE	SUMMARY	10
1		DDUCTION	
	1.1	Report scope and purpose	
	1.2	Background	
2		ING UNDERSTANDING OF HABITAT USE BY LONG-TAILED BATS	4
	2.1	Summary of bat research relating to the PSPA	
	2.2	Distribution and habitat use by long-tailed bats in southern Hamilton as it relates to the PSPA.	5
	2.3	Specific habitat requirements by long-tailed bats in southern Hamilton	
	2.3.1	그런데요 그리고 있었으면 하는 어디를 가는 것으로 되었다. 그는 이번 하나가 그런 그런 그런데요? 그런데요? 그는 이번 아니는 이번 사람이 되었다. 그런데요? 그런데요? 그런데요? 그런데요? 그런데요?	
	2.3.2	Roosting habitat preference of long-tailed bats in southern Hamilton	
3	Section 1	TS OF URBANISATION ON BATS.	
	3.1	Habitat loss and severance of connectivity	
	3.2	Disturbance effects	
	3.2.1	Lighting	
	3.2.2	- No. 2017 - Albert Personal and Comment	
	3.3	Mammalian predators	
	3.4	Knowledge gaps on the effects of urbanisation	
4		TS MANAGEMENT STRATEGIES, MECHANISMS & ECOLOGICAL PERFORMANCE STANDARDS	
	4.1	Effects assessment and offsetting guidelines	
	4.2	Specific design and ecological performance standards	
	4.2.1	Corridor and buffer design and operational maintenance requirements	
	4.2.2	Lighting standards and design	
	4.2.3	Vegetation removal protocols.	
	4.2.4	Artificial bat roosts and roost tree enhancement	
	4.2.5	Controlling domestic and feral animal pests	26
	4.3	Monitoring	
	100	Future research	
5		LUSION AND RECOMMENDATIONS	
6		RENCES	
Tal		bles  nge of views on key lighting matters  nmary of adverse effects of urbanisation within the PSPA and measures to address each effect	
	t of Fig		
	ure 2 P Red/ histo	acocke Structure Plan Area (map supplied by Hamilton City Council)	017). d on v line
Fig		portant habitat features for long-tailed bats found by radio tracking (Davidson-Watts, 2019)	
	ure 4 Kn	own roost sites and home range of long-tailed bat population in relation to the PSPA -2018-2019 as for map supplied by Ian Davidson-Watts)	(data

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Attachment 10





Figure 5 Qualitative assessment of the value of existing natural and landscape features within the Pstailed bats.	SPA for long-
Figure 6 Location of Stanford Park long-tailed bat habitat - Top: historic aerial imagery 1979 (source:	Retro Lens);
Bottom Google Earth Image 2020	19
Figure 7 Examples of corridor bat habitat landscape features in urban development areas	23
Figure 8 Examples of buffer bat habitat landscape features in urban development areas	24

# List of Appendices

Appendix A: Peacockes Structure Plan Area: Pre-Development Bat Monitoring Guidelines

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### **EXECUTIVE SUMMARY**

This document presents an ecological review and assessment of the effects of land-use change on the long-tailed bat (Chalinolobus tuberculatus) to inform the urbanisation of the Peacocke Structure Plan Area (PSPA) in Hamilton. To this end, it provides:

- A summary review and analysis of current scientific understanding of long-tailed bat distribution and habitat requirements and habitat use within, and adjacent to, the PSPA;
- A synopsis on the likely direct and indirect adverse effects of urbanisation on long-tailed bats and their habitats within the PSPA;
- Recommendations for effects management, including measures to avoid, remedy, mitigate and monitor effects, as well as measures to offset or compensate for effects that cannot be avoided, remedied or mitigated; and
- Recommendations for ecological performance standards and habitat protection/enhancement measures to avoid, remedy, mitigate and monitor adverse effects on bats and their habitats.

A population of long-tailed bats regularly use the PSPA for foraging, commuting and roosting. Within the PSPA, the riparian margins of the Waikato River, the Mangakotukutuku Gully and treeland areas containing known roosts trees for bats, are considered to be key habitats for foraging, commuting and roosting. However, to varying degrees, bats are also using a variety of other exotic and indigenous habitats for foraging and/or commuting.

This habitat usage is consolidated by a network of exotic and indigenous stands of trees and mature shelterbelts scattered through this largely pastoral environment. These lines of shelterbelts and patchily distributed stands of mature trees enable bats to move around this landscape as they use these features as navigational features to guide them to and from key habitats.

This population of bats is also utilising the wider urban and peri-urban areas of southern Hamilton, including the riparian margins of the Waikato River, other gully systems, and planted parkland including the Hamilton Gardens, Sandford Park and Hammond Park as foraging, commuting and roosting habitat. Evidence suggests that in certain instances, long-tailed bats are able to discover and utilise these habitats within existing urban and peri-urban environments.

The potential impacts on long-tailed bats and their habitats associated with urbanisation of the PSPA area include:

- Loss and modification of habitat;
- Severance or partial severance of connectivity;
- Disturbance effects such as an increase in artificial lighting; and
- Increases in predation by introduced mammalian animals.

Recommendations for protecting bat populations and enhancing their habitats as the PSPA becomes urbanised as discussed in this report. Avoidance and protection measures include:

- Identification of the key bat habitats within and adjacent to the proposed urban areas, and an understanding of how the bats utilise those habitats:
- Adopting cross-discipline mechanisms and performance standards in urban design and construction to address direct and indirect effects on bat habitats; and
- Implementation of vegetation removal protocols across the entire PSPA applied to identified potential roost trees, and strategies to avoid or mitigate adverse effects of the loss of these trees for bats, including installation of artificial roost boxes or cavity bearing trees, which are protected and maintained as such.

Mitigation measures and measures relating to offsetting and compensation opportunities recommended include:

- Mechanisms to protect and enhance the structural and functional attributes of existing, restored and re-created 'greenspace' areas within the PSPA which have, either wholly, or partly, been identified as bat habitats;
- Protection and enhancement measures for areas identified as 'key bat habitats' in this report;
- Creation of 'bat buffer zones' adjacent to key bat habitats, at least 20 m in width, with a 5 m setback to buildings, to provide foraging and commuting habitats;

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- Creation of linking 'bat corridors', at least 50 m wide (with a 5 m setback on each side) to create connections to high value habitats within and adjacent to the PSPA, wherever possible following existing tree lines and/or gullies;
- Buffering from new development of communal roosts by at least 50 m and of non-communal roosts by 25 m;
- Early planting of new bat foraging and commuting vegetation, well ahead of development phases affecting bat habitat:
- Ecological performance standards relating to artificial lighting and the design, composition, density and height of
  vegetation needed to create bat habitats, buffers and corridors, including a multi-disciplinary review of current
  infrastructure design and lighting standards adjacent or dissecting these key habitats; and
- Adherence to best practice effects management and offsetting methodologies for evaluating, protecting and recreating bat habitats during the design and impact assessment stages of urban development;

Measures allowing for adaptive management, including monitoring, include:

- Developing guidelines to assist in the assessment and quantification of moderate and low value bat habitats within the PSPA, in order to allow for consistent approaches to determining ecological values and offset mitigation associated with loss, modification or fragmentation of those habitats associated with urbanisation;
- Investigation of a PSPA wide animal pest control programme, in collaboration with other key stakeholders, particularly those with statutory obligations to protect bats, such as the Department of Conservation and Waikato Regional Council, targeting the key animal pests of long-tailed bats in urban areas, and including measures to control the widespread introduction of domestic cats as urbanisation occurs; and
- Fostering and contributing towards further research on the effects of urbanisation on long-bat populations and their habitats, including monitoring the effectiveness of avoidance and mitigation measures.

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### 1 INTRODUCTION

# 1.1 Report scope and purpose

The authors of this document have been engaged by Hamilton City Council (HCC) to collate a high-level ecological review on the effects of land-use change on long-tailed bats (*Chalinolobus tuberculatus*) to inform the urbanisation of the Peacocke Structure Plan Area (PSPA).

To this end, the document presents:

- A summary review and analysis of current scientific understanding of long-tailed bat distribution and habitat requirements and habitat use within, and adjacent to, the PSPA (section 2);
- A brief synopsis on the likely direct and indirect adverse effects of urbanisation on long-tailed bats and their habitats within the PSPA based on a review of international and local research and findings (section 3); and
- Recommendations for effects management, including measures to avoid, remedy, mitigate and monitor effects, as well as measures to offset or compensate for effects that cannot be avoided, remedied or mitigated. Performance standards and habitat protection/enhancement measures to avoid, remedy, mitigate and monitor adverse effects on bats and their habitats, based on current local and international best practice (section 4).

This report should be considered in conjunction with two other technical ecology reports prepared for HCC;

- PSPA Assessment of Ecological Significance report (Kessels & Baber 2021)
- PSPA Biodiversity Effects Management Framework report (Baber & Kessels 2021)

While this report pertains to the PSPA, bats are a highly mobile species and the successful conservation of bat populations needs to consider a wider landscape context and the resource needs of the home range of the population, which covers a larger area than the PSPA. Thus, where necessary, the requirement to consider effects, monitoring and management measures beyond the boundaries of the PSPA are referred to in this report.

# 1.2 Background

The PSPA comprises approximately 720 ha of rural land on the southern fringe of Hamilton (Figure 1) and was initially zoned in 2007 to provide a framework for guiding urban development within the PSPA. The PSPA is the city's primary growth area and when fully developed, is likely to accommodate around 8,000 homes (Hamilton City Council 2019).

Hamilton City Council (HCC) is currently reviewing the Peacocke Structure Plan (PSP) to address changes in the infrastructure needs of the city in this locality and update and improve the provisions relating to the PSP to reflect changes in the legal and planning framework in recent years. The PSP review will consider policy and rules to protect, recreate and restore biodiversity values of habitats of indigenous fauna and the Waikato Regional Policy Statement.

Because of a recorded decline in distribution of known bat populations and susceptibility to predation, long-tailed bats - one of New Zealand's only two extant terrestrial indigenous mammals - are afforded the highest threat status by the Department of Conservation (DOC) of Threatened - Nationally Critical (O'Donnell et al. 2018). Species that are threatened with extinction are indigenous species that have been evaluated and placed within any of the 'Threatened' or 'At Risk' categories within the New Zealand Threat Classification System (Townsend et al. 2008) and are relevant to determining significant biodiversity habitat in the Waikato region. In this case, vegetation or features (exotic as well as indigenous) that provide habitat for long-tailed bats will trigger criterion 3 of table 11-1 of the Waikato Regional Policy Statement (WRC 2018) and in addition, requires recognition and protection of habitat under section 6(c) of the Resource Management Act 1991 as a matter of national importance.

Long-tailed bats have complex lifecycles and wide-ranging habitat usage requirements (O'Donnell 2000). Long-tailed bats appear to be adaptable enough to utilise intensively farmed rural and semi-rural land, as well as habitats within and along the margins of some of New Zealand's urbanised areas (Dekrout et al. 2014).

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https://ourhamilton.co.nz/growing-hamilton/whats-the-plan-for-peacocke/ accessed 19 April 2021





Research shows that a population of long-tailed bats is regularly using parts of the PSPA throughout the year for foraging, commuting and roosting habitat (e.g., Davidson-Watts 2018). This population is also using the wider landscape outside of the PSPA as part of its home range. They utilise a wide range of habitats in this rural landscape, comprising both exotic and indigenous vegetation which varies on a seasonal basis. Research shows habitats used includes treeland, shelterbelts, vegetated riparian margins, well-vegetated gully systems and wetlands, open water, such as the Waikato River, pasture areas and mature trees, for roosting and foraging as well as visual cues in the landscape for commuting pathways.

There are several main factors causing the decline of long-tailed bats in New Zealand. Habitat modification and fragmentation due to urban and infrastructure development in rural landscapes is likely a factor (Jones et al. 2019). Predation and competition from introduced mammals such as cats and possums, is also likely to be a significant factor threatening the sustainability of bat populations throughout New Zealand (O'Donnell 2017).

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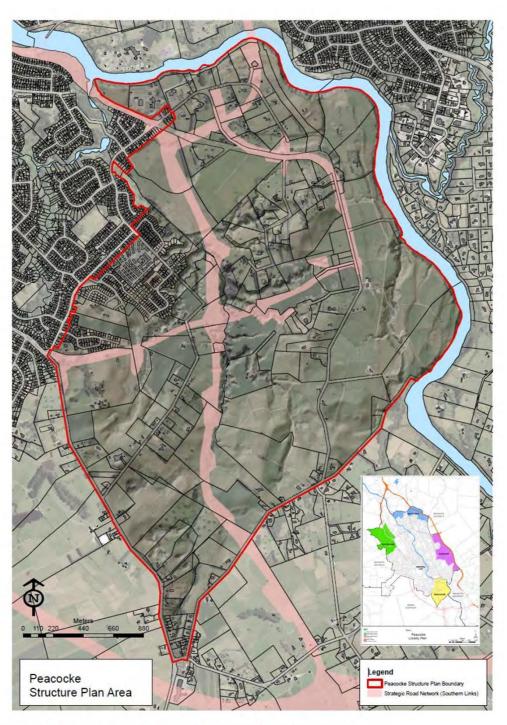


Figure 1 Peacocke Structure Plan Area (map supplied by Hamilton City Council)

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### 2 EXISTING UNDERSTANDING OF HABITAT USE BY LONG-TAILED BATS

### 2.1 Summary of bat research relating to the PSPA

A number of international, national and Hamilton-focussed bat research studies shape our understanding of bat populations and habitat use as it pertains to how long-tailed bats utilise potential habitat within the PSPA. Internationally, small insectivorous bat species (such as long-tailed bats), are considered one of the more challenging terrestrial mammal groups to study due to their small size, nocturnal behaviour, complex behavioural traits and high mobility (Collins 2016). There have been several studies undertaken on bat species which are useful to draw comparisons with long-tailed bats, such as Jung & Threlfall (2016).

Long-tailed bats use of habitats needs to be considered at the landscape scale, in that they rely on and use a range of habitats within a relatively large area, often over 100km², and throughout the year, as seasonal use of these habitat changes from spring to summer to winter (O'Donnell, 2001b). Thus, the need for properly controlled experiments, providing an evidence-based platform to determine behaviour and habitat usage through the seasons and over at least three to five years, remains critical to support our understanding of current habitat use and in developing measures to protect and enhance habitat for bats in these landscapes. This is particularly the case in landscapes where land use changes are prosed to modify the features shown to be key habitats.

The majority of New Zealand-based research of how long-tailed bat use habitat and roosts within a landscape is derived from several studies which have predominantly focused on their use of South Island native beech forests (e.g., O'Donnell et al. 2007, O'Donnell 2006). In recent years, observations and studies of long-tailed bats using marginal and/or modified or exotic habitats in rural and urban North Island landscapes are becoming increasingly frequent in other areas of New Zealand (e.g., Griffiths 2007, Borkin and Parsons 2010, Davidson-Watts, 2019).

Inferences on habitat use and behaviour can also be drawn to some extent from observations of bats using habitats associated with ecological effects assessments (e.g., Mueller & Kessels 2014). However, this approach does not necessarily provide a high level of scientific confidence of the factors influencing long-tailed bats habitat selection (or avoidance) preferences. These assessments are targeted to specific development proposals and often do not have the opportunity to collect sufficient data to provide statistically robust data. Nonetheless, 'grey literature' from consultancy assessments can be useful in validating or directing where knowledge gaps are, and where future research is required, which over time is leading to a deeper understanding of long-tailed bats' habitat requirements and the factors which influence their use of that habitat.

In addition, there are several academic studies underway at present studying long-tailed bats. For example, a doctoral research study is underway investigating the use of artificial lights on urban long-tailed bat behaviour, using Hamilton as the study site. This emerging research will likely provide invaluable knowledge to help inform bat habitat requirements, which could be incorporated into urban infrastructure design in the PSPA.

Three studies of long-tailed bats in Hamilton have used radio tracking or modelling to study bats use of habitat within Hamilton, and in particular southern Hamilton, including the PSPA. These studies provide the basis of the current understanding of the distribution; habitat use and status of long-tailed bats in the PSPA. The studies assessed habitat use to consider foraging/flying activity/presence, as well as roosting locations. In addition, long term bio-acoustic studies of long-tailed bats have been undertaken in city-wide bats surveys (e.g., Mueller and van der Zwan 2020). While the bio-acoustic city-wide surveys are arguably less scientifically robust than radio tracking, they have provided valuable insights into distribution and habitat use by bats of peri-urban and urban areas of Hamilton City.

A summary of the findings and limitations of the principal research underpinning this report are as follows:

Dekrout (2009) and Dekrout et al. (2014) used acoustic and radio telemetry (radio tracking) surveys to provide a
city-wide approach and the first baseline data on activity and habitat usage. However, the radio tracking was
limited to bats captured at Hammond Park, and this may have resulted a high male bias (most of the tracked bats
were male) and an element of pseudo replication due the same site being used for the samples (i.e., the captured
bats).

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- Le Roux and Le Roux (2012) undertook a city-wide bioacoustics survey which found that 87.5% of the confirmed bat habitats were classified as 'riparian margins' (43.75%) or 'major gullies' (i.e., situated 0-100 m from the Waikato River or a major gully which feeds into the Waikato River. The study was a one-off study, where site selection and the short duration of the survey may have skewed the findings to favour these sites. Surveys conducted using bioacoustics bat monitors only show activity of bats, but do not offer insight into detailed behaviour such as direction of travel, features used or numbers of bats present. However, subsequent city-wide surveys, such as Mueller et al. (2017), continue to validate the findings of this original city-wide bioacoustics survey.
- Crewther and Parsons (2017) provide a modelling approach to determine bat habitat use based on presence data of bats in various habitats from the city-wide bat surveys. This approach makes predictions on localities bats are likely to use as habitats. However, confidence of the predictions is only as good as the data entered into the model and the accuracy of the data for the model variables, and the city-wide surveys were limited in terms of site location and duration of survey episodes.
- Davidson-Watts Ecology (Pacific) 2018 & 2019 (DWEP) provides data with high confidence levels in the determination of habitat use and roost locations in southern Hamilton. While this study primarily focused on areas potentially impacted by the Southern Links development, these data also correspond well to the spatial extent of the PSPA. Many of the bats radio tracked during these surveys roosted and flew within the PSPA. However, radio tracking can only provide a relatively small sample of the population from which other inferences can be made. For instance, only one trapping survey (which was unsuccessful) was carried out in the PSPA, thus limiting the sample size of bats specifically using the PSPA.

# 2.2 Distribution and habitat use by long-tailed bats in southern Hamilton as it relates to the PSPA

A multi-species study, exploring a hypothesis of a global test of the 'urban tolerance' for bats shows that insectivorous microbat species, with open and edge space foraging and trawling behaviours, as well as exhibiting flexible roosting strategies, seem to be better able to adjust to urban landscapes than others (Jung & Threlfall, 2016). Long-tailed bats exhibit similar behavioural traits and ability to adapt to modified habitats to some of the species studied in international research (Jones et al 2019).

The primary habitat features that allow this animal to persist within Hamilton, and particularly in the southern periurban/rural residential landscape of Hamilton, are the relatively deep and connected swaths of well-vegetated riparian margins of the Waikato River and gullies feeding into the river, which bats use as roosting and foraging habitat. This habitat usage is consolidated by a network of exotic and indigenous stands of trees and mature shelterbelts scattered through this largely pastoral environment. These lines of shelterbelts and patchily distributed stands of mature trees likely enable bats to move around this landscape, as they use these features as navigational cues to guide them on their travels to and from the key habitats.

Dense urban areas are less utilised by bats, even when suitable habitat is present within these areas. For example, while Dekrout (2009) found that bat activity was strongly correlated with the reaches Waikato River in southern Hamilton (south of the Cobham Bridge) and topographical complexity (3 m contour line density), habitat usage was negatively correlated with housing and streetlight density.

Research to date shows that southern Hamilton provides home to at least one population of long-tailed bat and that the PSPA is likely a critical part of that home range (Refer to Figures 3, 4 and 5). The population size is not known, however DWEP (2019) found the largest single count of emerging bats (39) near Narrows Park, and 34 bats were discovered roosting in a kahikatea tree south of the PSPA boundary. The majority of these bats were ringed at the latter roost site in 2018. A high proportion of these bats were recaptured at another roost 1.5 km to the north-east, indicating that the size of the maternity population is relatively small (perhaps less than 50 females).

Individual long-tailed bat homes ranges are an average of circa 700–1600 ha, with a range span averaging 5–10 km (O'Donnell 2001b; O'Donnell et al. 2006). Generally, male's ranges are smaller than for breeding females. The Hamilton long-tailed bat population makes use of exotic and indigenous vegetation across a large home range, perhaps extending over an extent of 5-10 km. Based on the existing evidence, the home range of the long-tailed bat population, which the PSPA forms part of, is likely is distributed from Glenview/Rest Hills Park in the west, the southern

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fringes of Hamilton Airport and Mystery Creek to the south, Matangi to the east, and at least The Hamilton Gardens, Hammond and Sandford Park to the north/north east (see Figures 2-4 below). This population appears to have roosting foci in mature stands of exotic trees (including artificial roosts) in Sandford Park, Mangakotukutuku Gully, stands of trees in the Raynes Road area including nearby gullies, stand of trees the Narrows Park area which regularly supports multiple maternity roosts, and remnant native forest stands, such as a number of small kahikatea stands to the south of the PSPA. Adult male bats appear to be more sporadically distributed within the overall ranges of these populations. However, Hammond Park is regularly used by adult males and is possibly an important mating area.

This population is likely part of a wider metapopulation<sup>2</sup> of long-tailed bats in this locality. Bats have been detected throughout the rural landscape south, east and west of Southern Hamilton (G. Kessels, *pers. obs.*) and are very likely more widespread in the Waikato region than records in the current Department of Conservation national bat database suggests. The movement and visitation of individual bats from one population to another likely occurs regularly and thus the metapopulation as a whole is often stable because immigrants from one population (which may, for example, be experiencing a population boom) are likely to re-colonise habitat, and/or mate with, other adjacent populations. They may also emigrate to a small population and 'rescue' that population from extinction (called the rescue effect). These interactions between individual bat populations allow the species to become more resilient to habitat changes and predation threats at a wider meta-population scale.

The PSPA therefore likely provides an important role in providing habitat for this population, such as the riparian margins of the Waikato River and the Mangakotukutuku Gully. The PSPA also likely provides commuting corridors through the presence of mature tree shelterbelts and mature stands of trees in open pastureland largely devoid of artificial lighting, which provide commuting corridors to nearby roosting and foraging habitats within and outside of the PSPA.

# 2.3 Specific habitat requirements by long-tailed bats in southern Hamilton

### 2.3.1 Preferred habitat characteristics of long-tailed bats

Long-tailed bats require large home ranges so that bats can find enough resources in the environment for feeding, roosting and socialising. Individual bats tend to spread out in the landscape to reduce competition (Dekorut 2009). Davidson-Watts (2019) found the long-tailed bat population south of Hamilton used a broad area of at least 52 km² spanning 9.5 km (see Figure 4). As a consequence, habitat connectivity or distance to the Waikato River/major gullies emerged as the single most significant explanatory variable found in statistical modelling from the city-wide bioacoustic surveys, highlighting the importance between habitat type and distance to the river/gullies for bats. Overall, it was found that bat activity significantly increased with:

- Decreasing distances from well-connected habitats and linear landscape features (gullies and river); and
- Increasing distances from the city centre and levels of human activity. Pass rates were consistently highest at habitats where houses, roads and streetlights were lowest. Even slight increases in the number of roads and streetlights resulted in decreases in pass rates indicating bats generally do not persist urban habitats at the population level. This could suggest that urbanisation related developments may adversely affect bats.

Riparian margins, with dense indigenous and exotic trees and shrubs associated with riverine and gully landscapes, appeared to be critical habitat, as bats depend on access to key resources associated with these environments. These habitats provide:

- Mature exotic and indigenous vegetation for roosting purposes;
- Emergent aquatic insect prey (e.g., mosquitoes) for foraging (which can include foraging over areas of open pasture);
- Freshwater for drinking; and
- Linear landscape corridors for movement and navigation.

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A metapopulation is a population of number of sub-populations that is made up of the same species. Each subpopulation is spatially separated from the other subpopulations, but movement of individuals from one population to another occurs regularly.





Predictions of habitat use by Crewther and Parsons (2017) also found that gullies and vegetation were the key predictor of bat presence. They also found that adjacent land cover increased or decreased the likelihood of bat presence, and the presence of adjacent urban areas decreased the likelihood of bat presence. Crewther and Parsons go on to state, in line with Dekrout, that the recorded presence of long-tailed bats is concentrated in the peripheral urban areas of south and southwest Hamilton, even though suitable habitat occurs in the northern areas of Hamilton.

Dekrout (2009) concluded that but presence was positively correlated with the topographical complexity associated with gullies and negatively correlated with housing and streetlight density. Crewther and Parsons (2017), in their modelling study of but habitat distribution in Hamilton City, concluded that:

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

DWEP (2019) provides a ranking of habitat use by long-tailed bats based on where the entire known area of each tracked individual (known as their home range) and comparing this to where they spent the majority of their flying time (known as core areas). Using this approach, it was possible to determine what habitats radio tagged bats were selecting, as they often flew through large areas within their home range to get to specific sites for flying activities such as foraging, social behaviour and investigating or visiting roost sites. Top ranked habitats found from this study were those dominated by native or exotic forest, open water and water ways and parkland habitats. Parkland was described as more open than forest and usually a mosaic of treelines, hedges or scattered trees and grasslands including the city's parks and golf courses. The least selected habitats were agricultural, urban and industrial which includes residential and the majority of pasture habitats (refer to Figures 3 and 4).

While this research demonstrated that bats will disperse across open grassland, this is not preferred habitat as even when flying over pasture bats appear to require structural cues, such as vegetation edges, to bounce their echolocation calls off to navigate and to forage efficiently. As an edge-adapted species, it is likely that long-tailed bats use open pasture spaces predominantly only for commuting, as shown in a habitat preference modelling exercise undertaken by Parsons et al. (1997, Figure 2). Research indicates that foraging mostly occurs in pasture adjacent to shrubland, trees and open water adjacent to linear features, edges and gaps (O'Donnell 2001).

Shelterbelts are likely an important part of bat habitat in this landscape. They can just be a single line of trees but they still provide shelter from the wind and darkness so bats can move along the edge without being detected by predators. The connectivity of the tree networks has been found to be important to allow bats to commute safely across the landscape. Figure 5 displays the current network of existing natural features (such as gully and river margin vegetation as well as shelterbelts and stands of trees) within the PSPA which likely provide habitat for bats. High value habitats are supported by data of bat presence, and moderate value habitats indicate 'likely' presence and regular use of a landscape feature by bats. The values of these features as bat habitat have been qualitatively assessed in this figure based on known and likely use of the features by bats as habitat, from 'high value' habitats (the margins of the Waikato River, Mangakotukutuku Gully and known roost sites), 'moderate value' habitats (areas containing vegetation, edge pasture habitat in topographical gradients near high value habitat which may be utilised by bats as commuting corridors, foraging habitats or contain potential bat roost trees), and 'low value' habitats (such as areas of open pasture which likely provide occasional foraging or commuting habitat for bats)<sup>3</sup>. Man-made structures, such as buildings and roads, are unlikely to provide habitat for bats.

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<sup>&</sup>lt;sup>3</sup> 'High' value bat habitats were determined by available presence data and known roost locations, and professional judgement of bat habitat usage. Professional judgement of bat behaviour and Southern Links radio tracking estimators were used to assign 'Moderate' and 'Low' value habitats where habitat was determined by spatial analysis using 2019 four band Aerial Photography and ArcGIS. Normalised Difference Vegetation Index raster generation was used to obtain vegetation mapping.





### 2.3.2 Roosting habitat preference of long-tailed bats in southern Hamilton

Long-tailed bats differ from many other bat species by frequently changing roosts and having low rates of roost reuse (O'Donnell & Sedgeley 1999; Sedgeley 2003). Long-tailed bats preferably roost in the oldest, and largest trees in the landscape and switch roosts often and they use roosts with different characteristics during different stages of their life cycle. Communal roosts are known to be frequented by reproductive females and their young, whilst solitary roosting bats are mainly males and post-lactating females (Rockell et al 2017).

The preference of a tree species in which bats roost is thought to be linked to the varying thermal properties of different roosts (Sedgeley & ODonnell 1999). Maternity roosts are generally occupied by groups of breeding females and their young pups. Bats seek to maintain higher temperatures in maternity roosts by grouping together and selecting the oldest, largest trees available which contain cavities with preferential thermal characteristics. This is because the females have higher energetic demands during pregnancy and lactation, and they need the roost to maintain an increased temperature through the night when they leave their pups alone to forage. Outside of the breeding season, long-tailed bats of both sexes generally roost solitarily in a broader range of trees and other structures. Solitary roosts do not require the same thermal properties as maternity roosts, and trees with appropriate characteristics are less limited in the landscape compared to maternity roosts.

In the two radio-tracking studies undertaken in this locality, of the 64 roost trees located, at least 78% were in exotic trees (Dekrout 2009; Davidson-Watts 2018; AECOM 2019). Roosts were recorded in exotic and native trees and artificial bat boxes (located on pine trees), although the predominant use of exotic trees may reflect the preponderance of exotic trees in the modified rural and semi-urban landscape associated with the area. Only one native tree species (kahikatea) was confirmed as being used as a day roost site. Exotic species, such as English oak, willow species, eucalyptus, acacia, and pine trees were all recorded as roost sites (DWEP, 2019, Dekrout 2009). Long-tailed bats were found roosting in a wide range of features associated with tree damage and decay, highlighting the importance of the feature rather than the tree species itself when considering the potential presence of bat roosts. Similar conclusions were found by Sedgeley and O'Donnell (2004), when investigating long-tailed bat roost site selection in a rural fragmented landscape South Canterbury.

Roosts were generally within or on the edges of small forest areas or in gullies and were patchily clustered and distributed throughout the population's known home range. These results were also supported by Dekrout (2009) who found day roosts in small forest groves within pasture and gully habitats. The studies indicate the roost trees in this southern Hamilton area are usually associated with patches of trees along the river or gully margins, within glades in a park scape or part of a stand of trees or around a home garden. There is currently no indication that isolated trees within open pasture (including single line shelterbelts) had been utilised as bat roost trees.

Long-tailed bats at Hamilton appear to regularly use artificial made and installed bat roost boxes. These roost features were used by long-tailed bats during all survey sessions of the DWEP 2019 study, with peak numbers of 34 bats being present at one time in two adjacent bat boxes and confirming the use by a maternity population.

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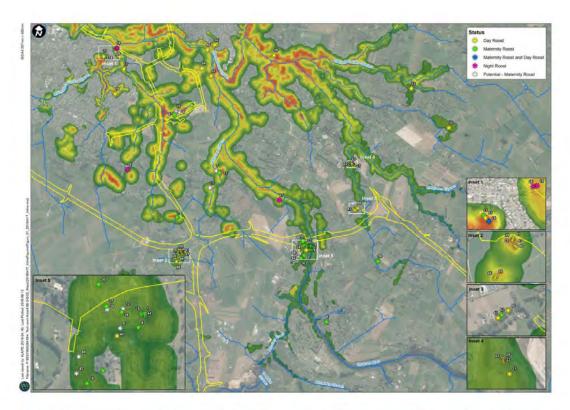


Figure 2 Predictive habitat model for long-tailed bats in southern Hamilton (Crewther & Parsons 2017). Red/orange indicates habitats of high potential while greens indicate habitats of low potential based on historical bat records. Distribution on known bat roosts also shown (Davidson-Watts, 2019). Yellow line shows Southern Links designation

Attachment 10





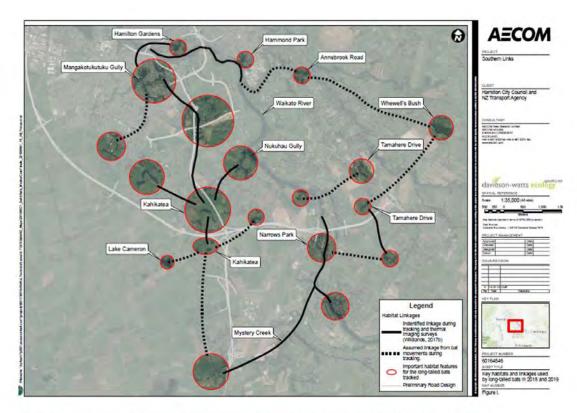


Figure 3 Important habitat features for long-tailed bats found by radio tracking (Davidson-Watts, 2019)

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10





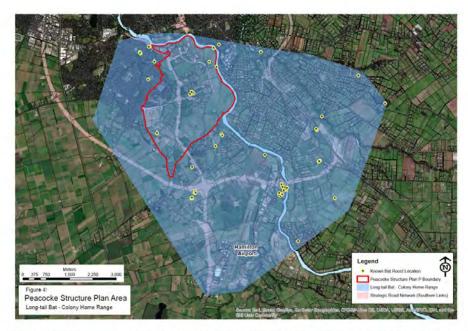


Figure 4 Known roost sites and home range of long-tailed bat population in relation to the PSPA -2018-2019 (data points for map supplied by lan Davidson-Watts).





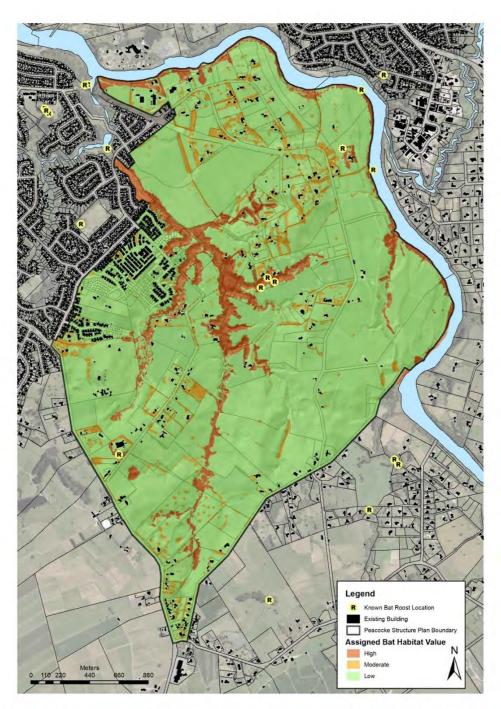


Figure 5 Qualitative assessment of the value of existing natural and landscape features within the PSPA for long-tailed bats.

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12





### 3 EFFECTS OF URBANISATION ON BATS

This section provides a summary review of available literature and technical evidence on the impacts of urbanisation including traffic, noise, and lighting on habitat and habitat utilisation. The review draws on a combination of relevant international and national literature, with a focus on research conducted in Hamilton where available.

The potential impacts on long-tailed bats and their habitats associated with development of the PSPA area include:

- Loss and modification of habitat: The direct loss or degradation of foraging, commuting and roosting habitat of bats as urbanisation and its associated infrastructure infills the rural landscape and intrudes on vegetated riparian margins of the Walkato River and the Mangakotukutuku Gully. This includes removal of mature trees for roosting and infilling the pastureland along the edges of tree lines, which removes or degrades foraging and commuting habitats. Injury and death of bats has been observed in the PSPA when occupied bat roost trees have been felled (G. Kessels, pers. obs.);
- <u>Severance or partial severance of connectivity</u>: This includes severance or partial severance of ecological
  connectivity through the landscape, and the potential exclusion from otherwise significant habitat types within
  their home range, by removal or cutting through shelterbelts and stands of trees currently used by bats as
  navigational ques through this landscape;
- <u>Disturbance effects</u>: Artificial lighting and noise disturbance during the construction and operation of urban areas
  can cause avoidance, or less usage, of bat habitats within or adjacent to the PSPA. Artificial lighting also has the
  potential to alter roost emergence timing and behaviour, as well as disrupt social interactions; and
- Increase in predation: The rural aeras of southern Hamilton host a multitude of introduced animals including cats, stoats, rats, possums and some wasp species, all of which prey on or compete with bats. A higher density of houses results in an increase in pets, including cats. Cats (domestic and feral) predate on bats while they are roosting, which are particularly vulnerable to predation whilst in their maternity roosts.

### 3.1 Habitat loss and severance of connectivity

International research suggests that urbanisation can lead to a decrease in bat activity (Jung & Threlfall 2016). Urban development, such as roads, housing, and other infrastructure, may thus cause a number of adverse effects on long-tailed bat habitat, including habitat loss, habitat fragmentation, changes in microclimates, and increases in noise, and lighting (Smith et al. 2017). In Hamilton itself, Le Roux and Le Roux (2012) found that road and streetlight density and housing density (i.e., typical characteristics of urbanisation) were associated with a decline in recorded bat activity. Overnight traffic and road density associated with urbanisation also is likely linked to a decrease in bat activity (Borkin 2009), with research so far suggesting a negative effect of the presence of roads on bat activity (Wildland Consultants 2018). Roads can affect bat movements and activity patterns as a result of habitat loss, permanent lighting and noise.

Bat movement through the landscape may be compromised by traffic, leading to injury and direct mortality by collisions with vehicles (Kerth and Melber, 2009). Smith et al. (2017) found bat activity on New Zealand's highways to be negatively correlated with increasing night-time traffic intensity. However, they also noted that: "in general, roads may be more of a barrier to bats which forage close to taller vegetation, such as the short-tailed bat, than those species which forage in open areas such as long-tailed bats" and that "roads with low traffic density can act as positive filters to bat movement while high traffic roads are barriers to their movement". Smith et al (2017), citing overseas studies, also suggested that there is evidence that bats may perceive vehicles as a threat and thus may exhibit predator avoidance behaviour in response to the presence of traffic, changing direction quickly in response to a vehicle's approach. Nonetheless, urbanisation will create additional roads and streets. Where new streets and roads are in close proximity to high value habitats, or dissect buffer or corridor habitat for bats, utilisation of habitat by bats may be adversely affected, and increasing risks of traffic strike may occur.

Urbanisation is connected to habitat loss and fragmentation. Habitat loss is a critical factor for the survival of wildlife (Huxel & Hastings 1999), with research indicating a great risk to species survival when less than 60% of the original habitat remains, and unlikely survival of species in a locality if less than 30% of habitat is preserved (Fariq 2001). In addition, maintaining habitat features and connectivity between them is critical to preserve usable bat habitat during urban development (Hale et al. 2012). The loss of connectivity and key roosting, foraging and socialising habitat areas, habitat fragmentation caused by increasing urbanisation can have a negative effect on bats at a landscape scale. For

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example, the ability of juvenile long-tailed bats to disperse from maternal roost sites to preferred habitats and interact with the metapopulation of bats within the wider locality.

Through the removal of trees and vegetation, replacing forest remnants, vegetation cover and open pasture areas with built-up environments, urbanisation contributes to the fragmentation and 'cluttering' of bat habitat. This can lead to the loss of available roost trees, loss or partial loss of connectivity between roosting and foraging areas, and the loss of areas used for foraging and socialising. Houses and roads replace and intersect this mosaic of tree-filled pastureland which is a direct loss of habitat for bats. In addition, remaining mature trees which may be used by long-tailed bats for roosting are often removed over time because of safety concerns when near residential or transport infrastructure and consequently lead to their removal, reducing existing or potential roosts.

Mature trees, within suitably dark and well-connected habitat around them, may be a limited roosting habitat resource within southern Hamilton (Davidson-Watts, 2019). Communal roosts have specific thermal requirements and are considered a limiting resource for long-tailed bat populations. Consequently, increased roost availability will have population level effects, but these are difficult to detect. Roosts that are occupied, known roost trees and associated habitats (both maternity and temporary day/night roosts) are considered to be core or key habitat, wherever situated within the PSPA, and removal of these occupied bat roost trees should be avoided. The removal of potential roost trees and associated habitat can be mitigated for, but only if it is certain the habitat does not include occupied roost trees, or evidence the habitat contains previously recorded roost occupancy.

Despite this, long-tailed bats behavioural characteristics appear to exhibit some tolerance and plasticity to urbanisation if the right habitat features remain within and adjacent to the urban area (e.g., Dekrout et al 2014, Le Roux & Le Roux 2012). Long-tailed bats are edge adapted. Their wing morphology and the structure of their echolocation calls are adapted for foraging along edges and gaps (O'Donnell 2001).

In Hamilton, research indicates that bats can remain in the southern, urbanised areas of the city. The topography of this area offers several incised gully systems (tributaries to the Waikato River) that provide micro-habitats with linear features and edges between open pasture and trees/shrubs. The gullies provide a buffer from urbanisation by providing a network of vegetated, dark corridors with internal and external edge micro-habitats, functioning as core habitat as well as linkages between other habitat features, such as roost trees. As an edge-adapted species, it is likely that long-tailed bats use open pasture spaces predominantly only for commuting (Parsons et al. 1997), while foraging mostly occurs in pasture adjacent to shrubland, trees and open water adjacent to linear features, edges and gaps (O'Donnell 2001).

More recent studies have found low levels of bat activity in places such as Lake Rotoroa and Jubilee Park (Mueller & van der Zwan 2020), which suggests that bats occasionally fly across residential areas (built up environments) to access these locations. Bats have also found to be roosting adjacent to residential areas such as Sandford Park and Hammond Park (Davidson-Watts 2018), sometimes less than 25 m from residential houses.

#### 3.2 Disturbance effects

# 3.2.1 Lighting

Several international studies have shown that bats alter their behaviour in the presence of artificial light sources (Downs et al. 2003, Longcore & Rich 2004, Stone et al. 2009, Stone et al. 2015, Bat Conservation Trust 2018), which is summarised in Table 1. Overseas research also stresses the importance of preserving dark corridors for bats to minimise the effects of artificial light on bat activity (Zeale et al. 2018). Another international study suggests a buffer of 50 m between street lighting and bat habitat areas and the avoidance of vertical light above 0.1 lux impacting the habitat area in order to provide for bat species that are sensitive to light (Azam et al. 2018). Experimental studies on other bat species internationally suggest that an increase in ambient light may deter bats from utilising existing suitable habitat or discourage bats from commuting through well-lit areas. The reproductive cycles of bats are affected by light levels and illumination periods (Stone 2015). Artificial lighting can affect bat feeding behaviour and bats may be deterred from normal commuting behaviours by increased artificial light levels (Longcore and Rich 2004).

In European guidelines for artificial lighting that minimises the effects on bats, warmer colour lighting (with a temperature of 2700 Kelvin (K) or less) is recommended for any areas that might be regarded as sensitive to bats (Voigt et al. 2018). Australian research suggests that light levels around 0.3 lux can be considered 'dark spaces' for bats, with levels of 0.29 to 0.47 lux measured in bushland used as a control site in one study (Haddock et al. 2019a).

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Studies into the change in bat activity in the presence of different light sources have also shown that the colour or spectrum of light is a factor. Light in the range between 620 and 750 nm (red spectrum) appeared to have the least effect on bats (Haddock et al. 2019b). The type of lighting was also found important, with LED lights shown to decrease bat activity when replacing older mercury vapour lights in street lighting (Haddock 2018). For long-tailed bats, limited research is available on the effect of artificial lighting, although as long-tailed bats are similar to many of the temperate bats subject to lighting related studies highlighted above it is reasonable to assume potential effects could be similar. Bats may be sensitive to light, with some studies showing a decrease of bat activity with an increase in light (Wildland Consultants 2018). Crewther and Parsons (2017) modelling suggested that bat presence in Hamilton increased with distance from streetlights; but only up to 100 m; with the model showing a decrease of presence over 100 m from light sources.

Without appropriate buffering, the increased artificial light spill from urbanisation within the PSPA will likely impact feeding, commuting and roosting habitat of bats in the high-value long-tailed bat commuting corridors and habitats adjacent to the site, including the known important roosting site at Hammond Park, Mangakotukutuku Gully and Sandford Park.

Table I Range of views on key lighting matters

Key matter	Range of views	Sources	
Lux levels in 'bat habitat'	0.1 lux 0.3 lux	Carrie Court and American	
Colour temperature	2700 K Voigt et al. 2018 (Europe 620 – 750 nm Haddock et al. 2019b (Au		
Width of buffer zone from light source	50 m	Azam et al. 2018 (Europe)	

### 3.2.2 Noise

No clear research is available on the potential of noise from traffic and other activities associated with urbanisation to disturb present long-tailed bats. While internationally there are some research findings suggesting that traffic noise can impede bat feeding behaviour (Siemers and Schaub 2011; Schaub et al. 2008), no clear indication has so far been discovered that long-tailed bats are similarly impacted by noise. Limited research into noise and long-tailed bat behaviour so far has not established a relationship (Wildland Consultants 2018; Le Roux and Waas 2012). Further research is required to investigate the potential effects related to artificial noise.

### 3.3 Mammalian predators

Populations of long-tailed bat are declining at rates of up to 9% per annum in areas with high predator numbers in some parts of New Zealand (Pryde et al., 2006). Ship rats, brushtail possums, cats and mustelids (such as stoats), will all likely predate on bats, especially while they are roosting (O'Donnell et al 2017). While cats will likely increase in density in an urbanised landscape as opposed to a rural landscape, research of pests in urban Hamilton suggest that mustelids are largely absent (Morgan et al 2008). However, the research indicates that rats are still found in gully habitats and would therefore likely predate on long-tailed bats in urban areas.

# 3.4 Knowledge gaps on the effects of urbanisation

Research to date gives a broad understanding of the impact of urbanisation on long-tailed bats. But there is insufficient evidence to be able to quantify the adverse effect of urbanisation, such as lighting, traffic, and housing density on a particular population of bats. While the factors that affect bats and their habitat usage are understood, and it is clear these factors are all interlinked, the research has not yet clearly shown indications whether one or the other is a larger contributing factor, or if it is a combination of these factors.

At this stage, it is unknown whether bats use habitats within urban areas because of limited roost availability within their home range, or if bats are opportunistic and have adapted to finding and utilising habitats within urban areas. It

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is also yet unknown exactly why bats are present widely throughout the gully systems and Waikato River in the south of the city but found to be present much less in gully systems in the northern part of the city. While these northern gully systems also provide complex, vegetated habitat, bat activity recorded in these areas has so far been much lower than in the southern parts of the city (Mueller & van der Zwan 2020).

Food availability is potentially a critical factor that has not yet been accounted for in research of bats in urban areas. It is unknown whether food resources are a limiting factor to habitat utilisation by bats in urban areas, and what role further urbanisation might play on the extent of foraging habitat and food availability for bats. The impact of artificial lighting on insects may also be an important consideration.

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13





# 4 EFFECTS MANAGEMENT STRATEGIES, MECHANISMS & ECOLOGICAL PERFORMANCE STANDARDS

As a species with complex habitat requirements in space and over time, the scale and approach to assessing potential impacts at the plan change level requires a good understanding of the habitat resources available to long-tailed bats at a population level. Addressing adverse effects on bats associated with urbanisation in the PSPA will therefore require co-ordinated, landscape-wide management strategies, development of quantitative compliance performance standards, consistent approaches to baseline information gathering and ongoing monitoring methods, and consistent approaches to specific methods to achieve avoidance, mitigation and offsets ('delivery strategies'). There are a number of strategies and measures that can be implemented before and during urbanisation to protect habitats for bats including:

- Identification of the key bat habitats within and adjacent to the proposed urban area, and an understanding of
  how the population of bats utilises those habitats, spatially and temporally, as well the structural elements within
  the landscape which are allowing the bats to travel between the key habitats;
- Adherence to best practice effects management and offsetting methodologies for evaluating, protecting and recreating bat habitats during the design and impact assessment stages of urban development;
- Adopting cross-discipline mechanisms in urban design and construction to address direct and indirect effects on bat habitats; and
- Mechanisms to enhance and protect the structural elements and functional attributes of existing and restored
  'greenspace' areas within the PSPA which have, either wholly, or partly, been identified as key bat habitats.

# 4.1 Effects assessment and offsetting guidelines

Given the high likelihood that bats are using a wide range of habitats within the PSPA, including high, moderate and low value habitats as shown in Figure 5 above, it is recommended that any new development within the PSPA undertakes an assessment of effects on long-tailed bats and their habitats in accordance with current best practice. Current best practice for ecological assessment in New Zealand should be undertaken in accordance with 'The assessment of ecological effects used the Ecological Impact Assessment (EcIA)' guidelines produced by the Environment Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al. 2018).

The EclA guidelines require adherence to one of the key principles of biodiversity offsetting: the mitigation hierarchy. When addressing impacts on habitats of threatened fauna species, avoiding direct adverse effects on high value habitat is likely to be the most effective means of minimising adverse effects on the population.

Adverse effects of development on high value habitats for long-tailed bats within the PSPA have been identified in section 2 above, namely the riparian margins of the Waikato River and the Mangakotukutuku Gully, as well as known roost sites, should be avoided.

The ideal scenario from an ecological perspective would mean development is designed in a such way that incorporates buffers adjacent to these existing key habitat features for bats. The requirements of buffer design are discussed in section 4.2.1 below.

Maintaining the function and the structural connection of commuting flyways, or corridors, is important for mitigation techniques as pasture and isolated trees that bats were using will no longer be available once the PSPA is urbanised.

From an ecological perspective, it is import that the PSP incorporates corridors between, and maintains buffers adjacent to, key bat habitats given the behavioural traits of bats using mature linear vegetation in a rural landscape for commuting, as well as open pasture areas adjacent to key habitats for foraging and commuting (refer to section 2.3 above).

Strategically, bat-friendly habitat and linking corridors should be either maintained and restored, or created, to provide a net-increase of high-quality habitat across the PSPA. In particular, the enhancement of known bat corridors and linear features needs to be considered to increase their functional values for bats and to prevent barrier effects for bats moving within their established home ranges and to other populations within the wider landscape.

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Known bat roosts should be retained, protected and buffers created around them. Protection will also require inclusion of connectivity corridors in order for these roosts to be retained as functional habitat.

Even if key habitats of bats are protected, corridors and buffers created, and the majority of adverse effects of urbanisation avoided, there can be residual adverse effects which will require some form of biodiversity offset or compensation package additional to the avoidance, remediation and mitigation measures proposed by an applicant to ensure there is no net loss of bat habitats associated with development.

There has been a trend in recent assessments of infrastructure and development impacts on long-tailed bats to offer pest control and installation of artificial bat roosts as a form of mitigation to address loss or disruption of habitats. Pest control and installation of artificial bat roosts alone will be unlikely to address all adverse effects, such as the loss of food producing and commuting habitat as urbanisation changes the landscape of the PSPA. Loss of foraging habitat, and loss invertebrates as part of that habitat loss, is unique to the modified landscape and effects of urbanisation. One way to address habitat loss, such as potential roost sites and food supply, is to recreate habitat as far in advance as possible before it is lost, as well as ensuring that space is provided adjacent to key habitats. This averted loss approach could be achieved through implementation of incentive strategies, such as 'biodiversity biobanking' (e.g., New South Wales Biodiversity Banking and Offsets Scheme 2017).

Ideally, recreation and restoration of habitat for bats should happen well in advance of urbanisation progressing into currently rural landscapes. If this approach is not possible, enhancement of existing habitats within the home range of the affected bat population will be required to address the temporal effects of subdivision, as bat habitats to replace those lost through urbanisation are recreated or restored.

Creating new habitat for bats appears to be an effective solution to mitigating for loss of habitat. Evidence shows that bats will 'discover' and occupy new habitats within a rural and urban landscape as that habitat matures. Internationally, a multi-species study, exploring a hypothesis of a global test of the 'urban tolerance' for bats shows that insectivorous microbat species, with open and edge space foraging and trawling behaviours, as well exhibiting flexible roosting strategies, seem to be better able to adjust to urban landscapes than others (Jung & Threlfall, 2013). Long-tailed bats exhibit similar behavioural traits to some of the species studied in this research. For example, long-tailed bats are commonly found within pine plantations throughout the upper North Island, even when the forest is only 15 years old (Borkin & Parsons 2009).

The ability of long-tailed bats to utilise habitat adjacent to houses, and to adapt to changes in the urban landscape within several decades, is evident in recent observations of bats regularly occupying at Sandford Park. Sandford Park comprises parkland dominated by a mosaic of tall exotic trees (mostly pine trees), and mowed grass amenity spaces in urban areas next to houses. The site where the bats were observed by others (e.g., Davidson-Watts 2019) appears to be exposed earth in a review of a historical photo from 1979 (Figure 6 below). The movement of bats through the Mangakotukutuku Gully demonstrates that long-tailed bats appear to be able to commute through urbanised areas to access core areas if there are relatively dark vegetated dispersal routes that buffer the bats from adjacent residential development while also providing navigation cues.

Long-tailed bats are long-lived (>20 years) and are slow to reproduce, with only one pup a year. As bats tend to roost in mature trees and use mature trees for commuting cues, effects of loss of habitat can take a long time to become apparent and bats will take a long time to recover from adverse effects. Rapid change in the home range of a bat population could mean individuals may not have sufficient time to adapt to those changes. Therefore, there is a temporal aspect in addition to spatial requirements with regards to addressing the loss of habitat for bats in the PSPA as urbanisation becomes the predominant land use. Moreover, there will be a time lag effect where the full effectiveness of offset mitigation will take a number of years to provide the structural features required for bats functional behavioural requirements. This will be around 15 years for foraging and feeding habitats and likely over 25 years for roosting trees to become functional, although artificial roost boxes or created roosts within existing or transplanted trees could speed up this habitat creation. Anticipating this temporal aspect is important to ensure bats have sufficient foraging and roosting resources throughout phases of development and landscape change.

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11

<sup>&</sup>lt;sup>1</sup> Biodiversity Biobanking establishes an 'improve or maintain' test for biodiversity values. Improving or maintaining biodiversity values means avoiding important areas for conservation of biodiversity values, and offsetting impacts on other areas.





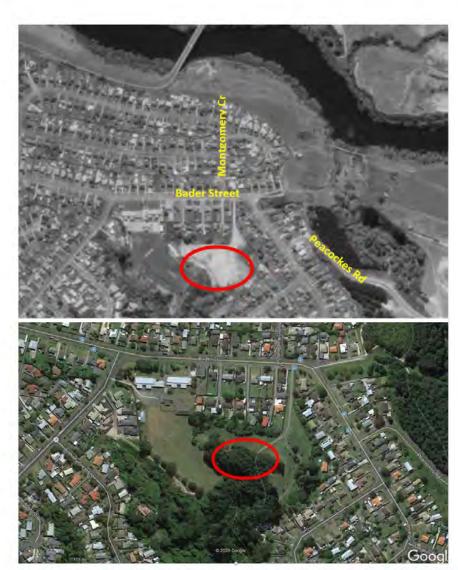


Figure 6 Location of Stanford Park long-tailed bat habitat – Top: historic aerial imagery 1979 (source: Retro Lens);

Bottom Google Earth Image 2020

There are best practice approaches to addressing residual adverse effects to creating additional habitats or improving existing habitat quality. This can be achieved by negotiation, applying multipliers, or applying Biodiversity Offset Accounting Models (BOAMs) and Qualitative Biodiversity Models (QBMs) to determine the quantum of offset required. A PSPA wide effects management methodology approach for assessing and addressing effects on habitat of long-tailed bats is detailed by Baber & Kessels (2021). The PSPA effects management technical report outlines a framework HCC could adopt for addressing effects management on long-tailed bats in the PSPA. Applying a scientifically based approach to compensate for residual impacts, such as the primary principles of biodiversity offsetting and QBMs, where a biologically based 'currency' for estimating sufficiency of the compensation is calculated and/or based on expert opinion, using a transparent, accepted methodology, is required (Baber et al 2021). Over time, as further research and monitoring increase our knowledge of bats habitat use and the effects of urbanisation on bats, these models can be refined to become BOAMs, which will increase the certainty around the specific measures required to address these residual adverse effects.

4sight\_Psp\_Bat\_Report\_Final\_June 2021

19

Attachment 10





The timing of the establishment of mitigation bat habitat will be essential to minimise the temporary loss of available bat foraging habitat, Ideally the creation of such habitats should commence 15 years prior to the removal of key habitats to allows replanted areas to develop into bat foraging areas. Given that bats currently utilise foraging habitats dominated by faster growing exotic tree species, the use of exotic tree species as a first tranche should be considered with native plants following on. Pest and predator control will be required to ensure any displaced predators will not increase predation impacts on areas retained and managed for bats.

In addition to protecting, restoring and recreating bat habitat, ongoing operational management of development will be required including artificial lighting controls, vegetation management and predator control.

# 4.2 Specific design and ecological performance standards

Table 2 outlines the potential adverse effects on habitat of long-tailed bats and summarises the mitigation and offset/compensation strategies and mechanisms which may be considered in the context of future urbanisation of the PSPA. Table 2 also summarises the key mechanisms which could be adopted for addressing these effects on longtailed bats within the PSPA, acknowledging that the development of plan provisions/performance standards is a matter for planners. The following sections discuss and present specific delivery mechanisms, design measures and performance standards to consider in the urban design of the PSPA as it relates to the protection of long-tailed bat habitats.

Table 2 Summary of adverse effects of urbanisation within the PSPA and measures to address each effect

Effect	Avoidance measures	Remediation/ mitigation measures	Resilience measures	Performance standards, delivery mechanisms, operational requirements and monitoring
Loss or modification of high value bat habitat — includes communal roosting habitat, the Waikato River and its riparian margins, and the Mangakotukutuku Stream gully.	Protect all high value bat habitats.  Avoid any significant adverse effects of urbanisation on high value habitats.	Create buffer habitats along the margins of high value habitat.	Increase the functional value of bat habitat over time by weed control, infill planting of cavity bearing trees and creation of microhabitats which encourage commuting and foraging as well as production of winged insects.  Install and create artificial bat roosts, Undertake targeted animal pest control within and adjacent to high value habitat.	Identify and protect specific high value habitats for bats in the PSPA.  Specify restoration criteria in terms of weed control, plant species selection, animal pest control and ongoing maintenance.  Undertake monitoring of high value bat habitats in the PSPA in accordance with best practice, in a co-ordinated manner with other wider bat research studies.
Loss or fragmentation of moderate and low value habitat — includes shelterbelts, stands of trees or day/night roosts.	Monitor moderate and low value bat habitats to determine use of specific use of these habitats by bats.  Protect existing mature shelterbelts and stands of trees wherever possible.	Create bat corridors through the PSPA to maintain connectivity and replace lost foraging habitat.	Enhancement of existing wetlands or creation of new wetlands within the PSPA to increase winged invertebrate food resources for bats.  Install and create artificial bats roosts.	Identify specific areas for corridors and buffers in the PSPA.  Specify restoration criteria and performance standards to be achieved in corridor and buffer design in terms of vegetation width, height, spatial location, density, species selection and ongoing maintenance.

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	Minimise clearance or partial clearance of existing habitats, such as shelterbelts and clusters of trees known to be used by bats.		Undertake targeted animal pest control.	Set design standards to maximise bat 'hop over' habitats for any streets intruding or intersecting with bat buffer or corridor habitats.  Require bat assessments for significant land use change applications in the PSPA.  Apply best practice biodiversity offset/compensation approaches to address residual adverse effects on bat habitats.  Undertake monitoring of bat habitats throughout the PSPA in accordance with best practice, and which is applied across the PSPA in a co-ordinated manner.
Effects of lighting of urbanisation — within or adjacent to the PSPA	Protect high value and retained/created bat habitats from artificial light intrusion to avoid any significant adverse effects from lighting on bat utilisation.	Minimise artificial light intrusion in buffer and corridors being retained or created as bat habitat.		Set performance standards for lux and light warmth/glare.  Apply set back distances for buildings from buffers and corridors.  Set lighting standards where, property, amenity or street lighting is within or adjacent to retained bat habitats.  Set standards for vegetation design and maintenance where it is required to attenuate light intrusion into bat habitats.
Effects of increased presence of animal pests (domestic and feral) on bats and their habitats	Instigate domestic cat bans or controls throughout the PSPA.	Undertake targeted animal pest control with the PSPA in and adjacent to high value bat habitats, especially roost habitat.		Enact suitable rules to restrict cat ownership.  Use nationally accepted best practice performance standards to ensure pest control is effective in reducing target animal pests.  Undertake population wide monitoring of bats to understand population trajectory pre- and postanimal pest control along with general monitoring.

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#### 4.2.1 Corridor and buffer design and operational maintenance requirements

Internationally, several guidelines have been developed to assist in creating habitat for bats in urban areas. In the absence of specific research to guide protection and enhancement of habitat of long-tailed bats in urban areas, these have been drawn upon to provide recommendations to assess and management bat habits within the PSPA. Figures 7 & 8 below provides a schematic cross section of:

- how buffering of High value habitat features (such as the Waikato River and Mangakotukutuku Gully) can be designed to protect these key habitats as well as create foraging and commuting habitats (top diagram); and
- the design of a corridor to link key bat habitats through urban areas, as well as create additional habitat (lower diagram).

It is recommended that High value bat habitat will be retained and enhanced as dark zones to retain connectivity and core habitat for bats in the PSPA. In terms of buffer and corridor habitat, for both enhancement of existing or recreation of new habitat areas, the most important general principle is that wide swathes of land are required to be set aside as bat habitat in order to retain a permeable and functioning landscape for long-tailed bats. Dark buffer zones may be used for hard and soft amenity landscaping, provided that this use does not compromise the functioning and maintenance of the High value bat habitat it protects.

Public use of buffer or corridor bat habitats need not be restricted as long as the structural and functional elements of these areas for bats are maintained, and could include amenity, community and green infrastructure activities, or constructed stormwater treatment wetlands. Larger private sections could also make up part of the buffer zones and corridors, provided the buffer principles can be achieved and long-term protection and maintenance of the bat habitat assured. Public uses within High value bat habitats may require further restrictions than for buffer zones and corridors to ensure functional habitat is protected, but could also include low-impact, unlit footpaths and cycle ways, which avoid any vegetation clearance that is important for bat habitat.

There is no research showing what the optimum width for these buffer and corridor areas should be. However, Le Roux and Le Roux (2012) show that without any bespoke design measures a minimum width of 100 m is likely to be optimum to retain use of gully systems in Hamilton by long-tailed bats. Nonetheless, in Hamilton, such as Sandford Park and Hammond Park, bats continue to use the vegetation in these areas for roosting and foraging, even when only 20-50 m from the nearest houses.

The structural characteristics of these areas are important for the bat's ability to use them. Ideally, the vegetation within these areas is mature and dense, and there is an inter-laced network of mature corridors of trees, with open grass parkland, wetlands or low shrubland 'glades' interspersed between. With bespoke planting design and artificial lighting control measures (as discussed in section 4.2.2 below), corridor width could be reduced from 100 m (shown to be 50 m with 5 m building setback on either side, in Figures 7 and 8 below). Meeting lighting standards is the primary purpose of the proposed 5m setback recommendations from buildings. For roads, the setback to achieve the 0.3 lux and the buffer or corridor edge may have to be wider than 5m to achieve the 0.3 lux boundary performance standard (refer to section 4.2.4 below). As well as planting design, topography and adjacent land use are *critical* factors to consider when determining a suitable corridor width.

Buffer widths are also difficult to quantify and are dependent on the adjacent land use, including lighting controls and topography. A *minimum* width of 20 m from the edge of high value habitats, including buffer planting devoid of large infrastructure, such as buildings and roads would be likely be effective at maturity. A further set back of 5 m from the edge of this buffer to buildings is also recommended, giving a total effective buffer width of 25 m. For communal bat roosts a minimum buffer of 50 m is appropriate and reflects the current situation at Sandford Park. A buffer of 25 m is likely to be appropriate for non-communal bat roosts.

Existing bat habitat could be enhanced by increasing the density and diversity of invertebrate attracting native plant species and filling in gaps in the vegetation (taking care not to plant out flyways and established vegetation edges – consider using a mixture of low stature and tall stature plants to maintain or create vertical variation). Buffer planting added between potential sources of disturbance (lighting, and roads) and existing habitat to reduce existing disturbance impacts on known habitats.

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If roads, footpaths and other infrastructure are to intersect corridors, measures will be required to minimise the habitat severance and associated ongoing effects, such as street lighting and traffic lights. Additionally, currently used corridors that have potential barriers such as roads, could be improved in similar ways.

The improvement or creation of corridors should include addition of carefully designed and maintained swaths of vegetation too ensure establishment of a dark corridor for commuting and additional habitat for foraging. As bats will fly over open ground and artificial structures when lighting is low and structural elements are in place, establishing dark areas for crossing roads or modifying public space lighting nearby to prevent flooding of light into potential bat commuting paths by careful tree planting is recommended. This should result in bats either beginning to use the created, or improved potential commuting corridors, or increase their use of them. Ultimately the effect should be bats expending less energy commuting or dispersing between roosting and foraging habitat patches when compared to previously used, less direct, commuting corridors, and in turn increasing overall population survival and fecundity.

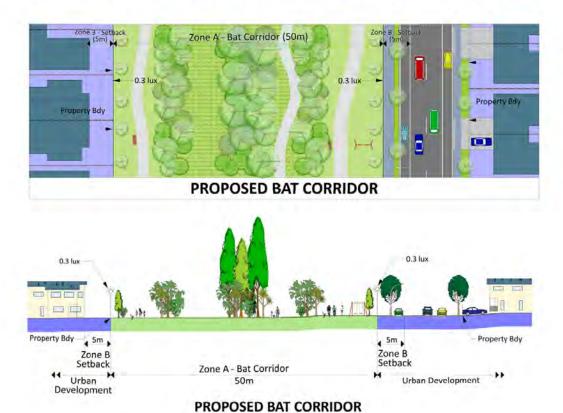


Figure 7 Examples of corridor bat habitat landscape features in urban development areas

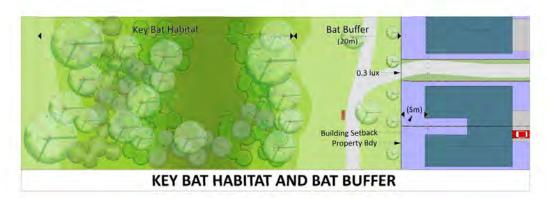
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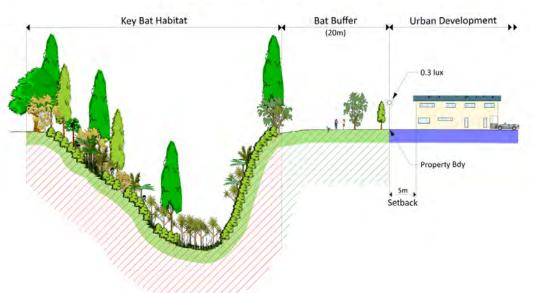
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Attachment 10



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## **KEY BAT HABITAT AND BAT BUFFER**

Figure 8 Examples of buffer bat habitat landscape features in urban development areas

The creation of habitat with connectivity to existing bat habitats could increase foraging, commuting, and, in the longterm, roosting habitats available to the southern Hamilton bat population. This could include planting of farmland with insect-attracting native plant species and the establishment of vertically varied vegetation communities to create flyways to provide increased foraging and commuting opportunities. Areas that would provide best benefit for planting would be those that have natural edges such as ponds, wetlands, gullies, and riparian areas. A component of the plantings should include native and/or non-native tree species that are known to provide roosting features such as cavities when older (and preferably known to provide these features at a relatively young age). Success for these areas of created habitat would be that bats either start using these new areas for commuting and/or foraging or (if already using the area) increase their usage of these areas overtime.

In developing buffer and corridor design, the following key factors also require consideration:

4sight\_Psp\_Bat\_Report\_Final\_June 2021

24





- Fast growing, densely foliated vegetation planted in front of retained habitat to reduce light from the adjacent development;
- Bat sensitive lighting installed along roads and on the outside of dwellings adjacent to retained and enhanced habitat:
- Measures during the construction phase of urban development measures, such as lot deferrals, to ensure artificial
  light is not introduced adjacent to retained or re-created bat habitat until the vegetative buffers have grown
  sufficiently to meet the specified performance criteria; and
- Measures to maintain and replace the vegetated habitat features over time (effectively in perpetuity) in order to retain the structural features of the bat corridor and buffers.

## 4.2.2 Lighting standards and design

Based on the discussion of lighting effects discussed in section 3.2.1 above, if lighting at the property boundaries and road edges is kept below 0.3 lux (at any height), effects of artificial light spill on bat habitat will likely be minimal. Best international practice in terms of lighting controls is best summarised by the UK guidelines (Bat Conservation Trust and Institution of Lighting Professionals 2018), and is a useful benchmark for consideration when applying lighting standards for long-tailed bats in the PSPA. The 0.3 lux limit, at any height, at the development or road boundary with buffer or corridor bat habitat will in effect mean that no measurable artificial light will be observed within the existing core bat habitats or re-created bat habitats. In addition, the 'warmth' of emitted light is also an important factor to consider when considering artificial light next to bat habitats. In this regard, a temperature of 2700 K or less is considered optimal, although security or road lighting with timers set to short durations (no greater than a few minutes at a time), and with a temperature no greater than 3000 K may be acceptable in some situations. Architectural design should be considered for built structures adjacent to bat buffers. to avoid lighting impacts.

#### 4.2.3 Vegetation removal protocols

Vegetation removal protocols are designed to avoid any direct harm (injury or mortality) to bats during clearance of vegetation. They are therefore a final backstop to avoid these direct impacts if vegetation (and therefore habitat) removal could not be avoided.

Best practice guidelines for the monitoring and removal of any potential or occupied bat roosts in the PSPA is an important method to identify and protect existing roosts and provide a benchmark for the quantum required to replace lost habitat containing potential roost trees.

Vegetation removal protocols were first designed and implemented in New Zealand in 2009 for a sand quarry consent application at Tamahere (G. Kessels, pers. comm.). The protocols were designed to minimise the risk of injury or mortality of long-tailed bats associated with the removal of potential bat roost trees. The loss of that habitat was mitigated by replanting cavity bearing trees and installing artificial bat roosts along the stream adjacent to the site.

The protocols have now been widely adopted throughout New Zealand and refined as the science and knowledge on the efficacy of the protocols has improved. It is understood that DOC is conducting a review of vegetation removal protocols and will provide guidelines on best practice. Adaptation of best practice guidelines for the felling of any potential bat roost trees in all of the PSPA is recommended as a precautionary measure. Should the tree be occupied, felling of the roost should be avoided. If the tree is not occupied, it can be felled, but suitable replacement roosting habitat should be provided as mitigation of the loss of that future habitat opportunity and as a precautionary measure because roost use and occupancy within and adjacent to the PSPA is not well understood.

There has been a tendency for ecological effects assessment reports on the effects of development on bats to term the vegetation removal protocols as a form of 'mitigation' for removal of known or potential bat roost trees. The implementation of vegetation removal protocols is an appropriate mechanism to reduce the risk of injuring or killing bats when felling potential bat roost trees. However, it is not mitigation for the loss of potential or actual roosting habitat. Moreover, it is important to differentiate between potential and occupied roost trees and habitat within the PSPA.

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#### 4.2.4 Artificial bat roosts and roost tree enhancement

The addition of artificial bat roosts in known bat habitat areas could be used to supplement available roost trees and recreate roosting habitat with buffer and corridors, as well as within high value and recreated habitats. The current artificial bat roost boxes used in Hamilton are based on overseas roost design that are used by more opportunistic bats which regularly roost in artificial structures such as dwellings and bridges. Nonetheless, recently detected use of artificial bat roosts in the area means this approach deserves some additional effort, such as researching the efficacy of the various artificial roost designs and placement of roosts.

The bat roosts currently utilised are those which have banding above and below which exclude mammalian predators. Increased roost availability will have benefits at a population level, but the benefits will be difficult to detect, as there may be a significant lag time between roost installation and bats using them. The thermal quality of artificial roosts may not be as good as that presented by a natural roost tree. However, the ability to create pest proof roosts by banding above and below the roost boxes, and the relative ease of monitoring the occupancy of artificial roosts, means that artificial roosts are considered to form an important means towards enhancing habitats for long-tailed bats in the PSPA, but only if installed in protected bat habitats, either existing or re-created, and only if maintained over time.

In addition to installation of bat roosts, planting trees which, over time, will present cavity bearing properties suitable for roosting habitat, is considered an effective form of mitigation for loss of potential roost trees. There are a number of native and exotic species which are suitable. Exotic trees are commonly used as roosts by bats, but their thermal qualities and roost utilisation is not known. Native trees may provide better thermal qualities as bat roosts, but they can take a longer time to grow and to present cavities suitable for roosting than exotic trees.

A possibly effective and relatively instantaneous strategy for mitigation of the loss potential bat roost trees, which has not been trialled in New Zealand as yet, is the modification or transplanting of existing mature trees (alive or dead), to create suitable cavities and crevices for bats to roost in. This is a possible alternative method for creating additional roosting habitat which warrants further investigation.

#### 4.2.5 Controlling domestic and feral animal pests

As Morgan et al (2009) have shown, key potential introduced predator guilds are likely absent (mustelids) or comparatively rare (rats) in urban Hamilton and largely confined to gully habitats. In contrast, free-ranging cats (both domestic and feral), are widespread and likely to be a significant threat to bats, especially when they are roosting in trees within and adjacent to the PSPA.

Therefore, priority should be given to protecting known and potential roost trees and artificial roosts from access by predators, especially from cats and rats. This can be done by placing metal bands around the trunks of trees (above and below the roosts), and by ensuring that neighbours trees are also suitable pruned or banded to prevent animals jumping across the canopy. This treatment could also be applied to potential roost cavities (but not confirmed to be utilised) in habitats connected to known bat habitats as predator pressure may influence roost site selection and utilisation. Traps set in high densities in proximity to the roosts, creating a 'ring of steel' around roosts is also effective, but only if undertaken, maintained and monitoring regularly through the year.

Gullies and corridors are likely to become conduits for pests entering the PSPA from the surrounding landscape. Regular control of animal pest in the gullies will reduce pest numbers entering the PSPA and hence pressure on bat roost habitats from predation. Any widespread introduced animal pest control within the PSPA should therefore focus on gullies, by using best practice mechanisms, such as trapping, poisons in bait stations, or a combination of methods. Self-setting trap technology is quickly improving, and may, over time, be the safest, effective and most cost-effective option for pest control in urban areas.

Given the longevity of bats, pest control is likely to be most effective if undertaken for many decades and ideally in perpetuity.

As discussed in section 3.3, cats are known predators of native wildlife in New Zealand including bats. Trapping of feral cats is possible but differentiating between domestic and feral cats is problematic while there is no Hamilton City, yet alone New Zealand, statutes requiring cat owners to keep their cats on their property, or to licence or microchip their cats, as is required for dog owners. However, an increase of free-ranging domestic cats within the PSPA will very likely occur without controls, and in turn lead to an increase in predation of bats in un-protected roosts. Currently, there is one known maternity roost within the Mangakotukutuku Gully in the PSPA (Figure 2 – Roost 8) and other maternity

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roosts in this area are likely. This is wherebats are most vulnerable to predation. Further studies could detect additional maternity roosts. In addition, potential roost trees in the PSPA could eventually become occupied bat roost over time, either temporary day/night roosts (which do currently exist in the PSPA), or maternity roosts. Given that cats are likely to be a significant, if not the most significant, predators of bats, unless every roost is protected by banding or targeted cat trapping, bats roosting in these habitats will be vulnerable to cat predation. It may be impractical to sustain long-term targeted cat control of every known or potential roost tree in the PSPA. Therefore, some form of control over domestic cats within the PSPA is considered to be the most effective method to protect these habitats.

In terms of measuring success of pest control, it is expected to result in increased utilisation of protected roosts, greater survival of roosting bats, and in the circumstance of maternity roosts, an increase of fecundity and survival of juveniles to adulthood.

## 4.3 Monitoring

Monitoring of bat populations will be critical to determine any chances in habitat use and bat behaviour as residential development and mitigation measures interact with bats present in the area.

In Hamilton and surrounding landscapes, roosting habitat is likely to be a limiting resource for long-tailed bats. Consequently, identifying and protecting existing bat roosts is key to the continued survival of the Hamilton bat population particularly considering the proposed development across large areas of southern Hamilton. The most effective technique of identifying long-tailed bat roosts is radio telemetry. Such studies have been undertaken in Hamilton. Collaborating and extending these studies with other organisations would be highly beneficial, particularly if identified roosting areas can be enhanced and protected from future development. This activity alone would not immediately enhance the bat population, but instead aims to halt future impacts on bat habitat by finding further roost areas for protection measures as well as understand how roosting behaviour responds to development related activities.

Long-term population studies (mark and recapture) are the most recognised method of measuring population increase or decrease overtime. It is hypothesised that the long-tailed bats in Hamilton are part of a single population and therefore undertaking a long-term mark recapture study to detect trends in the population would provide information on the general efficacy of all of the management options discussed above.

Any monitoring conducted should be standardised across survey efforts and repeatable. A best-practice monitoring framework should be developed that can be adopted for the wider Hamilton area. Pre-development surveys should cover aspects such as light levels, habitat availability, bat activity levels, habitat use and behaviour, and occupied and potential roost identification, using methods that can be replicated in future years. Post-development monitoring should focus on studying the effectiveness of habitat enhancement measures, and include monitoring of light levels, available and newly created habitat, habitat usage, bat activity levels, and roost occupancy.

The following measures should be included in the monitoring framework, as a minimum:

- Habitat (amount), including areas lost versus areas created;
- Artificial light sources and levels (pre- and post-development);
- Roost sites, including potential and occupied roost sites;
- Bat activity levels;
- Habitat use and behaviour, including usage of landscape features and foraging activity;
- Monitoring of mitigation including created habitat and use of artificial roost boxes;
- Noise levels (pre- and post-development); and
- Efficiency of pest control measures.

Guidelines for pre-development bat monitoring were developed by Hamilton City Council in 2020 and are attached in Appendix A. These guidelines were designed to standardise monitoring prior to residential development in the PSPA. These can form a starting point for a wider monitoring framework; however, monitoring for the area should also involve baseline studies at a landscape scale, and more detailed monitoring such as radio telemetry to ensure bat habitat enhancement and mitigation measures are effective in the long-term, and at a wider landscape scale.

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Monitoring should also be coordinated with ongoing existing infrastructure projects, such as monitoring for Southern Links, subdivisions such as Amberfield, and the Hamilton city-wide annual monitoring programme.

#### 4.3.1 Future research

Research, collaboration and sharing of knowledge is a critical part of finding and implementing strategies that can protect bats and their habitat in this area. All research into bats in the PSPA as well as the wider Hamilton and Waikato areas should link within the Regional Bat Strategy (currently being developed). Research programmes currently underway through the University of Waikato and DOC should be closely linked to any future research conducted in the PSPA. A key aim for this will be to ensure that the effectiveness of mitigation measures can be better understood, adapted where necessary, and implemented in other areas where effective.

Some examples of research topics based on above activities include:

- Will bats use and forage in newly created habitats and how long between planting and bats starting to use the area?
- Will bats use newly established vegetated corridors between current habitats?
- What effect does reducing lighting and noise effects on an existing roost site have?
- Will bats utilising commuting corridors more if they are improved through lighting modification and/or plantings?
- What environmental or roost design factors can explain the utilisation of artificial bat roosts in Hamilton South?
- What effect does wasp control have on bat populations?
- What invertebrates are available (including seasonal changes) and what species are bats foraging?

Future research needs to be aimed at better understanding habitat use, size and characteristics of the Hamilton bat population(s), with the aim to improve the ability to preserve the population and their habitat requirements. Many of the habitat enhancement and mitigation activities prosed for bats in urban New Zealand contain unknowns on their efficacy and how best to go about implementing them. More focussed research could be undertaken to measure the response of the Hamilton bat population to various management techniques. This will allow for an accurate assessment of their relative efficacy and enable adaptation to techniques overtime to better the outcome for bats.

An important factor requiring further investigation is the role of invertebrates as a food source for bats. Studies on the nightly activity of long-tailed bats have indicated that insect activity, rather than habitat, could be a predictor of bat activity (O'Donnell 2000). In the Hamilton context, one research imperative is to establish what role the availability of food (invertebrates) has on bat populations. This includes aspects such as:

- What species are they eating?
- What invertebrate species are present or available, and could this be a limiting factor or threat to bats across the landscape?
- Where are they foraging, and does this change throughout the seasons?

These questions could be addressed through studies such as eDNA analysis of bat droppings from captured bats.

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#### 5 CONCLUSION AND RECOMMENDATIONS

Long-tailed bats are afforded the highest threat status by DOC of Threatened – Nationally Critical. Species that are threatened with extinction are relevant to determining significant biodiversity habitat in the Waikato region. In this case, vegetation or features (exotic as well as indigenous) that provide habitat for long-tailed bats will trigger criterion 3 of table 11-1 of the Waikato Regional Policy Statement (2018) and hence requires HCC to recognise and provide for the protection of these habitats as a matter of national importance (section 6(c), Resource Management Act 1991).

A population of long-tailed bats are regularly using parts of the PSPA for foraging, commuting and roosting habitat. This population is also using the wider landscape outside of the PSPA as part of its home range. They utilise a wide range of habitats in this mostly rural landscape, comprising of both exotic and indigenous vegetation, with use varying on a seasonal basis. Habitats used includes treeland, shelterbelts, vegetated riparian margins, well-vegetated gully systems wetlands, open water, such as the Waikato River, pasture areas and mature trees, for roosting and foraging, as well as visual cues in the landscape for commuting pathways. In the case of the PSPA, the riparian margins of the Waikato River, the Mangakotukutuku Gully and treeland areas containing known roosts trees for bats, and are considered to be high value habitats for bats.

This key habitat usage is consolidated by a network of exotic and indigenous stands of trees and mature shelterbelts scattered through this largely pastoral environment. These lines of shelterbelts and patchily distributed stands of mature trees, all appear to be important in ensuring that bats can move around this landscape, as they use these features as navigational ques to guide them on their nightly travels to and from the key habitats.

Bats are utilising relatively recently planted parkland as foraging, commuting and roosting habitat within urban areas of Hamilton, such as Sandford Park and Hammond Park. Evidence shows that long-tailed bats are able to discover and utilise these habitats within existing urban and peri-urban environments.

The potential impacts on long-tailed bats and their habitats associated with urbanisation of the PSPA area include:

- Loss and modification of habitat;
- Severance or partial severance of connectivity;
- · Disturbance effects such as an increase in artificial lighting; and
- Increases in predation by introduced mammalian animals.

Recommendations for protecting bat populations and enhancing their habitats as the PSPA becomes urbanised as discussed in this report. Avoidance and protection measures include:

- Identification of the key bat habitats within and adjacent to the proposed urban areas, and an understanding of how the bats utilise those habitats;
- Adopting cross-discipline mechanisms and performance standards in urban design and construction to address
  direct and indirect effects on bat habitats; and
- Implementation of vegetation removal protocols across the entire PSPA applied to identified potential roost trees, and strategies to avoid or mitigate adverse effects of the loss of these trees for bats, including installation of artificial roost boxes or cavity bearing trees, which are protected and maintained as such.

Mitigation measures and measures relating to offsetting and compensation opportunities recommended include:

- Mechanisms to protect and enhance the structural and functional attributes of existing, restored and re-created
  'greenspace' areas within the PSPA which have, either wholly, or partly, been identified as bat habitats;
- Protection and enhancement measures for areas identified as 'key bat habitats' in this report;
- Creation of 'bat buffer zones' adjacent to key bat habitats, at least 20 m in width, with a 5 m setback to buildings, to provide foraging and commuting habitats;
- Creation of linking 'bat corridors', at least 50 m wide (with a 5 m setback on each side) to create connections to high value habitats within and adjacent to the PSPA, wherever possible following existing tree lines and/or guillies;
- Buffering from new development of communal roosts by at least 50 m and of non-communal roosts by 25 m;
- Early planting of new bat foraging and commuting vegetation, well ahead of development phases affecting bat habitat;

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Attachment 10

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- Ecological performance standards relating to artificial lighting and the design, composition, density and height of vegetation needed to create bat habitats, buffers and corridors, including a multi-disciplinary review of current infrastructure design and lighting standards adjacent or dissecting these key habitats; and
- Adherence to best practice effects management and offsetting methodologies for evaluating, protecting and recreating bat habitats during the design and impact assessment stages of urban development;

Measures allowing for adaptive management, including monitoring, include:

- Developing guidelines to assist in the assessment and quantification of moderate and low value bat habitats within the PSPA, in order to allow for consistent approaches to determining ecological values and offset mitigation associated with loss, modification or fragmentation of those habitats associated with urbanisation;
- Investigation of a PSPA wide animal pest control programme, in collaboration with other key stakeholders, particularly those with statutory obligations to protect bats, such as the Department of Conservation and Waikato Regional Council, targeting the key animal pests of long-tailed bats in urban areas, and including measures to control the widespread introduction of domestic cats as urbanisation occurs; and
- Fostering and contributing towards further research on the effects of urbanisation on long-bat populations and their habitats, including monitoring the effectiveness of avoidance and mitigation measures.

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Appendix A:

Peacockes Structure Plan Area: Pre-Development Bat Monitoring Guidelines

Attachments Page 1175





## Peacockes Structure Plan Area - Guidelines for Pre-Development Bat Surveys

#### Purpose

All developers applying for a landuse/subdivision consent within the Peacocke Structure Plan area (PSPA) shall engage a suitably qualified bat ecologist to prepare and implement pre-development bat surveys, for the purposes of assessing bat activity and habitat use before construction, including data collection to provide information on how bats utilise and move across the site prior to development occurring. The survey is intended to inform the ecological impact assessment.

The survey information shall be used by the bat ecologist to determine the following assessment matters relating to long-tailed bats, which shall be supplied to Hamilton City Council (HCC) with each development resource consent application:

- A review of the ecological significance of site for bats in accordance with section 6(c) of the RMA and section 11a of the Waikato Regional Policy Statement;
- An assessment of ecological effects of all aspects of the proposed development on longtailed bats and their habitats in accordance with the most current version of the Ecological Impact Assessment Guidelines (EcIAG) developed by the Environment Institute of Australia and New Zealand (EIANZ)<sup>1</sup>;
- Development of suitable avoidance, remediation, mitigation, offset, and compensation
  measures specially for long-tailed bats in accordance with HCC Biodiversity Management
  Technical Guideline for the Peacocke Structure Plan<sup>2</sup>
- 4. Development of ongoing monitoring of bats during construction and post-construction.

The following framework provides a brief, generalised guidance on suitable pre-development surveying for long-tailed bats within the PSPA, particularly bioacoustics monitoring. However, there are a number of methods to monitor for bats. The bat ecologist will be required to ascertain and implement the most suitable monitoring measures, including a combination of methods, sufficient to provide robust evidence to support a resource consent application for land use change within the PSPA, in accordance with best available practice and scientific literature.

#### Monitoring Objectives

Pre-development bat surveys in the PSPA shall be conducted to determine:

- Variation in presence of bats using a spatially balanced design<sup>3</sup>;
- Habitat use across the site: if bats are present, what levels of activity are recorded at what types of habitat across the development site?;
- · Roosting, commuting and foraging behaviour; and
- Flights paths/patterns for key features such as shelterbelts or gullies using an ABM array, thermal imaging/infrared or handheld detector observation at dusk/dawn.

Peacocke Structure Plan Area Bat Monitoring Guidelines for Pre-Development Surveys\_November 2020

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<sup>&</sup>lt;sup>1</sup> Roper-Lindsay, J., Fuller, S.A., Hooson, S., Sanders, M.D. and Ussher, G.T., 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.

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#### Habitat types to be surveyed

All potential bat habitat types present at a particular site shall be monitored equally (in terms of sample size and survey effort); these could include, but not be limited to:

- Shelterbelts
- Stands of trees
- · Streams, river margins, ponds
- Gully systems
- Open pasture areas

Any monitoring equipment used (e.g. ABMs) is to remain the same type and versions of monitors throughout the entire monitoring period.

#### Survey methodology

- 1. Bioacoustics monitoring
- Observations at dusk (and dawn) using observers and thermal imaging/infrared cameras to determine behaviour and flight patterns
- 3. Climbing and checking of potential roost trees

#### Potential roost assessment

Ground level bat roost tree assessments shall be done on all suitable trees to assess the site's potential to support tree roosting bats. Where the assessment is considered high risk of roosting bats being present due to the number and nature of potential roost features (PRFs), further climbing inspections and/or emergence surveys and/or dawn re-entry surveys shall be undertaken to investigate whether trees support roosting bats.

Climbing and/or emergence/dawn re-entry surveys shall be undertaken at least three times across the bat activity season. Ideally one in the periods Nov/Dec, Jan/Feb and March/April. Surveys shall be undertaken in temperatures at dusk above 10°C, no more than light rain/drizzle and avoiding strong wind conditions (Beaufort Scale 6 or greater) at dusk.

It is strongly recommended that emergence and dawn/re-entry surveys are supported with the use of infrared cameras and/or thermal imaging devices.

Where bats are confirmed using a roost feature, the assessment shall characterise the roost or undertake further investigations to determine the roost status i.e., day roost, mating roost, maternity roost etc.

## Bioacoustics monitoring

All bioacoustics monitoring shall be undertaken using DOC 'AR4' acoustic bat monitors 'ABMs', or if using other bioacoustics detectors, the data from alternative units shall be calibrated in terms of detection parameters, to that obtained from AR4 units.

ABMs sample size shall ideally be determined using a spatially balanced design. The key focus shall be on covering all habitat types present with sufficient numbers of ABMs. The spatially balanced approach allows for flexibility of where ABMs are placed in the field relative (i.e., a 50m radius from) the original computer-generated point.

Peacocke Structure Plan Area Bat Monitoring Guidelines for Pre-Development Surveys\_November 2020

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Monitoring shall be conducted during weather suitable for bat emergence (outlined above) and be repeated if there is equipment failure or loss of data.

#### Timing of surveys

Monitoring to ideally commence at least two seasons prior to lodgement of consent application to establish baseline information and allow for suitable bat management measures to be developed. Surveys shall take place during peak LTB activity periods, November to April.

ABMs shall be deployed for three survey events/periods throughout the year, repeated at the same time of year. Each survey event shall be for a minimum of two consecutive weeks, simultaneously at all monitored sites. One survey event shall be conducted in the period Nov-Dec (pre-parturition), one in January/February (post-parturition) and one in March/April (mating season).

Surveying shall be repeated on the same dates, and at the same sites, using the same devices and/or methods.

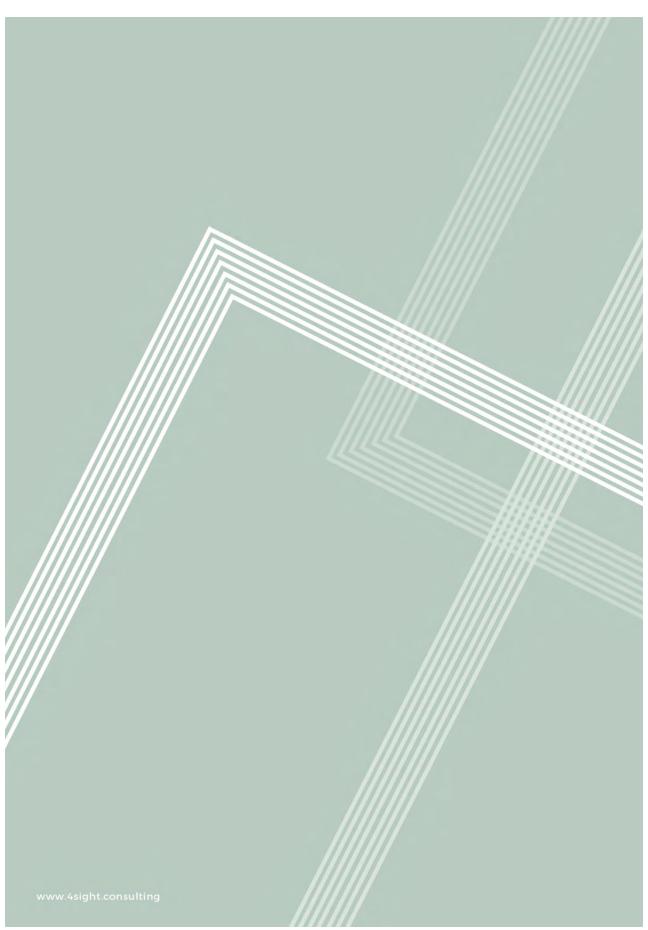
#### Data management and distribution

Council shall be supplied with all the raw ABM data (bmp or sound files with processed csv files) for all ABM surveys and keep it for 10 years to be made available on request. The summary data shall be sent to the DOC Bat Recovery Group and added to the National Bat Database within 6 months of report publication (i.e., within the public domain).

Ongoing monitoring and coordination with other PSPA bat surveys & research

Where practicable, pre-development bat surveys are to be coordinated and cross-referenced with Southern Links monitoring and construction works, and other long-tailed bat surveys that may be undertaken in the Peacocke Structure Plan Area to provide a landscape-wide context for interpretation of data.

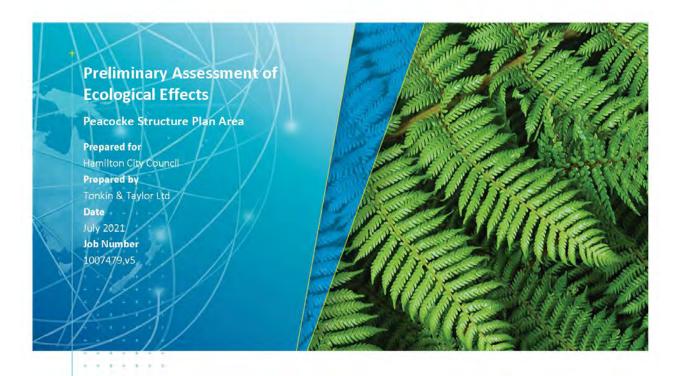
Bat monitoring during the construction period and post-construction monitoring shall be determined as a consequence of the overall ecological effect assessment for each specific consent application, utilising the outcomes of the pre-development survey results. A biostatistician shall be consulted to develop this monitoring programme.





# REPORT APPENDIX K

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Hamilton City Council
Te kaunihera o Kirikiriroa

# **Document Control**

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29/07/2021	5	Preliminary Assessment of Ecological Effects	M Baber and G Kessels	J Markham	P Cochrane

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# **Table of contents**

1	Introduction				
	1.1	Backgro	ound	3	
	1.2	Report	purpose and scope	3	
2	Meth	odology	!	5	
	2.1		p review	5	
	2.2	Assessr	ment of effects on biodiversity	5	
		2.2.1	Step one: Biodiversity values assessment	6	
		2.2.2	Step two: Magnitude of effects assessment	6	
		2.2.3	Step three: Assessment of the level of effects	6	
		2.2.4	Assessment limitations and constraints	6	
	2.3	Residua	al Effects Management	7	
		2.3.1	Residual effects management overview	7	
3	Biodi	versity c	haracteristics and values	8	
	3.1	Context		8	
	3.2	Site des	scription	8	
	3.3	Habitat	: types	9	
	3.4	Long ta	iled bats	12	
	3.5	Birds		13	
	3.6	Lizards		13	
	3.7	Inverte	brates	13	
	3.8	Freshw	ater fauna	13	
	3.9	Vegeta	tion	13	
4	Asses	ssment o	of effects on biodiversity	14	
	4.1	Biodive	rsity value assessment (Step 1)	14	
	4.2	Magnit	ude of effects assessment (Step 2)	17	
		4.2.1	Overview of potential adverse effects associated with the proposed l	anduse	
			change	17	
		4.2.2	Overview of likely measures to avoid, remedy or mitigate for potential	al adverse	
			effects	18	
		4.2.3	Expected magnitude of effects after measures to avoid, remedy or m	_	
			adverse effects	19	
	4.3	Levels o	of effect (Step 3)	21	
5	Resid	lual effe	cts management	24	
	5.1	Residua	al effects	24	
	5.2	Residua	al effects management approach	25	
	5.3	Determ	ining the quantum of residual effects management	25	
	5.4		tive Biodiversity Model results	26	
		5.4.1	Compensation options outside the PSPA	31	
6	Appli	icability		33	
7	Refe	rences		34	
Арре	ndix A	۸:	Waikato Regional Policy Statement –policies regarding biodiversity	offset	
Appe	ndix B	3:	Offsetting overview		
Арре	ndix C	:	Figure		
Арре	ndix D	) :	Ecological Impact Assessment Guidelines Tables		



**Executive summary** 

The need to protect, enhance and restore Hamilton City's biodiversity values is reflected in a range of provisions in policies, plans and non-statutory documents. This includes the consideration and application of biodiversity offsets to address <u>residual</u> adverse effects that cannot be avoided, remedied or mitigated<sup>1</sup>.

The Peacocke Structure Plan Area (PSPA), comprises approximately 750 ha of rural land on the southern fringe of Hamilton. This area is the city's primary growth area and when fully developed, is likely to accommodate around 7,500 homes. The PSPA includes a proposed development footprint of around 500 ha. The remainder includes the Southern Links road footprint, and the balance including conservation areas that are to be protected.

The Peacocke Structure Plan (PSP) was developed in 2007 to provide a framework for guiding development within the PSPA, while recognising the importance of the natural environment and the presence of significant biodiversity values (e.g. the gully network and the presence of Nationally 'Threatened' long-tailed bat). The PSP is currently being reviewed to address changes in the legal and policy framework that have occurred since 2007, along with changes in infrastructure.

To assist the plan change process, this report provides a preliminary assessment of ecological effects associated with the proposed land use change from rural and semirural to intensive residential and commercial uses in the PSPA. In this regard, this assessment:

- Describes the known or likely biodiversity values within the PSPA and immediate surrounds;
- Provides a preliminary assessment of effects associated with the proposed land use change;
   and
- Assesses the type and quantum of habitat restoration and enhancement measures that would likely be required to address residual adverse effects to a No Net Loss (NNL) or Net Gain (NG) standard <u>after</u> consideration of measures to avoid, remedy or mitigate for adverse effects.

The overarching purpose of this preliminary assessment is to inform future plan change or consenting processes, and ultimately improve ecological outcomes across the PSPA.

The assessment was desktop-based and was undertaken following the Ecological Impact Assessment Guidelines (EcIAG) produced by the Environment Institute of Australia and New Zealand (Roper-Lindsay et al, 2018). This was followed by the application of a Qualitative Biodiversity Model (QBM) to better understand the type and quantum of habitat restoration and enhancement that may be required to address residual adverse effects.

The PSPA supports a number of significant biodiversity values, including the ecologically significant Waikato River margin, the Mangakōtukutuku gully network, indigenous forest remnants and includes habitats of the nationally 'Threatened' (nationally critical) long-tailed bat as well as nationally 'Threatened' or 'At Risk' birds, lizards, fish and plants.

Of key importance, the change from rural to residential landuse within the PSPA will likely result in a 'Very High' level of residual effects on bats after measures to avoid, remedy or mitigate for adverse effects are implemented. This is attributed primarily to the large-scale loss (ca 500 ha) of low- and moderate-value bat habitats in the form of pasture, and exotic vegetation of higher stature as well as the loss of 3.09 ha of habitat assessed as having high value for bats.

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5

 $<sup>^1</sup>$  Biodiversity offsetting is based on widely accepted principles. The commonly applied definition of biodiversity offsets  $^1$  is: A measurable conservation outcome resulting from actions designed to compensate for residual, adverse biodiversity effects arising from activities after appropriate avoidance, remediation, and mitigation measures have been applied. The goal of a biodiversity offset is to achieve no-net-loss, and preferably a net-gain, of indigenous biodiversity values.

We consider this loss of 3.09 ha of high value bat habitat to constitute a 'Very High' level of effects that cannot be adequately or appropriately addressed, and we recommend efforts to protect these areas.

However, while the level of residual effects on low- and moderate-value bat habitat within the PSPA is also 'Very High', it is our view that these effects can be appropriately addressed through habitat restoration and enhancement, with a focus on native revegetation and the control of introduced predatory mammals within suitable protected areas.

Application of the QBM indicates that habitat restoration or enhancement activities within all the available 185 ha in the PSPA, but outside of the development footprint, will go a considerable way towards addressing residual effects on long-tailed bats (and it is assumed all other indigenous biodiversity values). This includes approximately 65 ha of revegetation and 120 ha of pest control within existing high value bat habitat. However, the quantum of effort is unlikely to achieve NNL/NG outcomes for long-tailed bats. To achieve NNL/NG outcomes for long-tailed bats would likely require:

- A reduction in the development footprint coupled with an increase in the quantum of habitat restoration and enhancement measures; and/or
- Additional habitat restoration and enhancement measures in areas outside of the PSPA.

On the latter point, the QBM indicates that in addition to restoration and habitat enhancement efforts within available areas within the PSPA (and outside the development footprint), to achieve NNL/NG outcomes with a reasonable degree of confidence would likely require the following restoration and habitat enhancement measures outside the PSPA:

- A further 140 ha of native revegetation; OR
- A further 800 ha of intensive mammalian pest control (in perpetuity); OR
- A lesser quantum of both within habitat outside the PSPA that has high existing or potential bat habitat values.

We have further assessed the relative proportion of revegetation and pest control and assessed that this would require in the order of 60 hectares of native revegetation and 180 hectares of pest control within river or gully margins in the surrounding landscape.

The limitations and constraints associated with the high-level nature of this report and the lack of quantitative data are acknowledged. We expect that further information provided during future policy development or by resource consent applicants will influence — to varying degrees — the location, scale and type of measures considered necessary to demonstrably achieve No Net Loss or preferably Net Gain outcomes for indigenous biodiversity values within the PSPA.



1 Introduction

#### 1.1 Background

The Peacocke Structure Plan Area (PSPA), comprises approximately 750 ha of rural land on the southern fringe of Hamilton City (Appendix C, Figure 1) with a proposed development footprint of around 500 ha. The remainder includes the Southern Links road footprint and mitigation areas (ca 132 ha) and the balance of 119 ha includes conservation areas that are to be protected.

The PSPA is the city's primary growth area and when fully developed, is likely to accommodate around 7,500 homes.

The Peacocke Structure Plan (PSP) was developed in 2007 to provide a framework for guiding development within the PSPA. The PSP recognises the importance of the natural environment and the presence of significant biodiversity values within the PSPA, which include the ecologically significant Waikato River margin, Mangakōtukutuku gully network, indigenous forest remnants and the nationally 'Threatened' (nationally critical) long-tailed bat.

The PSP is currently being reviewed to address changes in the legal and policy framework that have occurred since 2007, along with changes in infrastructure. These changes include the Southern Links, a future state highway and local arterial road network for which designation was approved in 2016.

Within the wider Hamilton Ecological District, less than two percent of indigenous habitat cover remains. The need to protect and enhance remaining biodiversity values in the area is expressly recognised in statutory documents including:

- A 10% indigenous habitat target2, identified in the Operative Hamilton City District Plan as a key policy direction;
- Working towards no net loss (NNL) or preferably a net gain (NG) in biodiversity as directed by Policy 11.1 of the Waikato Regional Policy Statement (WRPS); and
- Consideration and application of biodiversity offsets to address <u>residual</u> adverse effects that cannot be avoided, remedied or mitigated as directed by Policy 11.1 of the WRPS.

## 1.2 Report purpose and scope

To assist the plan change process, this report provides a preliminary assessment of ecological effects associated with the proposed land use change from rural and semirural to intensive residential and commercial uses in the PSPA. To this end, this assessment:

- Describes the known or likely biodiversity values within the PSPA and immediate surrounds;
- Provides a preliminary assessment of effects associated with the proposed land use change; following the Ecological Impact Assessment Guidelines (EcIAG) produced by the Environment Institute of Australia and New Zealand (Roper-Lindsay et al, 2018)<sup>1</sup>. This will largely be based on:
  - the potential level of effects of land use change within the PSPA development area on biodiversity values after measures to avoid, remedy or mitigate for effects are implemented, and
  - potential benefits within areas that are protected for biodiversity management.
- Assesses the type and quantum of habitat restoration and enhancement measures that would likely be required to address residual effects to a No Net loss or Net Gain standard using a Qualitative Biodiversity Model (QBM) as a decision support tool. In this regard, we have focused exclusively on offsetting or compensating for long-tailed bat habitat because:
  - Long-tailed bat is a nationally 'Threatened' species (Nationally Critical);

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5

Page 1185

12 August 2021



4

- There is a reasonable amount of available information on bats within the PSPA and immediate surrounds; and
- Achieving an NNL/NG objective for bat values is expected to result in an NNL or NG outcome for most biodiversity values affected by the development since bats are known to use most, if not all, habitat types within the PSPA.

The overarching purpose of this preliminary assessment is to inform future plan change or consenting processes and ultimately improve outcomes for indigenous biodiversity across the PSPA.

This assessment is informed by a desktop review and in particular by the PSPA Ecological Significance Assessment Report (Kessels and Baber, 2021) and the PSPA Bat Report (Mueller et al. 2021)<sup>2</sup>. The limitations and constraints associated with the high-level nature of this report and the lack of quantitative data are acknowledged. We expect that further information provided during future policy development or by resource consent applicants will influence — to varying degrees — the location, scale and type of measures considered necessary to demonstrably achieve No Net Loss or preferably Net Gain outcomes for indigenous biodiversity values within the PSPA.

July 2021 Job No: 1007479.v5

<sup>&</sup>lt;sup>2</sup> This document is referred to as the PSPA Biodiversity Management Framework in Baber and Kessels (2021) and Mueller et al. (2021) however the title has subsequently changed to the PSPA Preliminary Assessment of Ecological Effects Report.



2 Methodology

#### 2.1 Desktop review

The reports and information referenced in Section 7 was used to inform the methodology and approach to assessing effects. In summary, this included a review of relevant databases and literature including the following:

- New Zealand Herpetological Database (Department of Conservation Bioweb Database);
- New Zealand Plant Conservation Network plant distribution database information (New Zealand Plant Conservation Network, 2017) drawn from the National Vegetation Survey Database (NVS);
- Summaries of Hamilton City biennial bird counts (Fitzgerald and Innes, 2013) and Ornithological Society of New Zealand census summaries (Cornes et al., 2012a);
- Ecological expert evidence statements related to the NZTA Waikato Expressway and Southern Links roading projects;
- The ecologically based objectives and policies in the PSP (2007);
- Hamilton City Council District Plan Section 20.2 Objectives and Policies: Natural Environments;
- Waikato Regional Policy Statement (WRPS) policy directions set out in Part B 11;
- The local Indigenous Biodiversity Strategy Hamilton City Pilot Project September 2018;
- HCC Biodiversity Strategy (2019);
- WRC's RPS criteria (Section 11A Table 11-1) for assessing sites of significant indigenous biodiversity (Waikato Regional Council, 2016);
- Boffa Miskell vegetation mapping and associated reporting for the Amberfield subdivision;
- Significant Natural Areas layer for HCC;
- Standard NZ aerial imagery (2012); and
- Knowledge of experienced local experts (Gerry Kessels).

#### 2.2 Assessment of effects on biodiversity

We undertook a high-level assessment of effects on biodiversity values within the PSPA broadly following the Ecological Impact Assessment Guidelines (EcIAG) produced by the Environment Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al. 2018). The purpose of the assessment of effects was to:

- Broadly characterise the biodiversity values present within the PSPA based on a desktop review of available information and data;
- Assess the likely level of residual effects associated with urbanisation on those values after
  efforts to avoid, remedy or mitigate for effects. We have assumed that standard effects
  management practices are adopted; and
- Determine the type and quantum of habitat restoration and enhancement activities that are likely required to achieve Net Gain outcomes for biodiversity.

Using a standard framework and matrix approach, such as the EcIAG guidelines, provides a consistent and transparent assessment of effects and is considered good practice. The use of these guidelines (or an updated edition) is recommended for all assessment of ecological effects that are required within the PSPA. The EcIAG approach is described the following sections.

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5



#### 2.2.1 Step one: Biodiversity values assessment

Biodiversity values known or likely to be present within the PSPA are assigned on a scale of 'Low' to 'Very High' based on species, communities, and habitats, using criteria in the EcIAG (see Appendix D Table 1-3).

#### 2.2.2 Step two: Magnitude of effects assessment

Magnitude of effect is assessed after efforts to avoid, remedy or mitigate for effects have been considered. The magnitude of effect is a measure of the extent or scale of the effect of the landuse change within the PSPA on the biodiversity values, and the degree of change that it will cause. This is scored on a scale of 'Negligible' to 'Very High' (Appendix D Table 4-5) and is assessed in terms of:

- Level of confidence in understanding the expected effect;
- Spatial scale of the effect;
- Duration and timescale of the effect;
- The relative permanence of the effect; and
- Timing of the effect in respect of key ecological factors.

#### 2.2.3 Step three: Assessment of the level of effects

An overall level of effect associated with the landuse change in the PSPA is identified for each biodiversity value (habitat/species type) using a matrix approach. Each biodiversity value (described in Section 2.2.1) is combined with the magnitude of residual effects on that value (Section 2.2.2) resulting from the activity after efforts to avoid, remedy or mitigate for effects have been considered (Appendix D Table 6).

The matrix describes an expected overall level of effect associated with landuse change in the PSPA for each biodiversity value on a scale of 'Very Low' to 'Very High'. The level of effect is then used to guide the need for residual effects management in the form of habitat restoration or enhancement.

#### 2.2.4 Assessment limitations and constraints

The key limitations and constraints associated with this high-level assessment of ecological effects are as follows:

- The assessment was based on a desktop review of available information, and subjective knowledge of the site. No specific site-based fieldwork was conducted to inform the assessment;
- Any changes to the PSPA layout may change the scenario as presented;
- Habitat condition assessment was based on the standard NZ aerial imagery as part of an ArcGIS licence dated 2012; and
- The assessment assumes the accuracy of assumptions in the PSP regarding the security, management and funding of the potential conservation area into perpetuity.

The following assumptions underpin the assessment:

- The PSPA, as provided as an ArcMap shapefile by HCC, is divided between potential development areas and conservation areas, and is accurate in extent;
- The potential conservation area is currently all private land not under existing private management for biodiversity gain, and therefore can be considered a potential gain to future conservation estate;
- The entire conservation area (excluding the 16 ha lost to Southern Links) is available to compensate for potential impacts on biodiversity within the development area; and

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5

Hamilton City Council
Te kaunihera o Kirikiriroa

7

The entirety of the potential impact is confined to the development area as provided by HCC in the PSPA, i.e., any potential edge effects or indirect impacts are contained within the development area and accounted as full loss, though in reality these would only be partial loss.

## 2.3 Residual Effects Management

Where the level of residual effects on biodiversity values within the PSPA is assessed as 'moderate' or higher, measures to address residual effects to an expected NNL/NG standard are considered warranted.

## 2.3.1 Residual effects management overview

Qualitative Biodiversity Models (QBMs) have been used in this assessment as a decision support tool to provide guidance on the type and amount of compensation required to achieve <u>expected NNL/NG</u> outcomes for biodiversity in the PSPA (Baber et al 2021; Tonkin & Taylor 2021). The models:

- Provide guidance on addressing residual adverse effects within the PSPA for which impacts or gains cannot feasibly be measured or quantified with adequate precision, i.e. cannot be demonstrably offset;
- Serve as a decision support tool that provides additional transparency, process and rigour to
  the process of addressing residual adverse effects through compensation measures at
  proposed habitat restoration/enhancement site(s);
- Provide guidance on whether NNL/NG outcomes are <u>expected</u> to be achieved. <u>Expected</u> Net Gain outcomes are sought, rather than No Net Loss (NNL) outcomes, to provide more confidence that NNL is actually achieved;
- Operate at the 'as close to offset as possible' end of the compensation continuum. This is termed 'biodiversity compensation' in the Proposed National Policy Statement for Indigenous Biodiversity (NPSIB); and
- Are intended for use under the auspices of biodiversity offsetting or compensation principles<sup>3</sup> and importantly, only once adherence to the effects management hierarchy and limits to offsetting principles have been demonstrated (Baber et al 2021).

In broad terms, the QBMs are based on:

- Available information and expert assessment of the amount and quality of habitat that will be adversely affected at the impact sites;
- Available information and expert assessment of the amount and quality of habitat that will be subject to compensation actions (i.e. habitat restoration and enhancement) at the compensation sites; and
- Assessment of the potential biodiversity benefits associated with potential habitat restoration and enhancement measures.

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5

<sup>&</sup>lt;sup>3</sup> We prefer the biodiversity offsetting and compensation principles as set out in the Draft National Policy Statement for Indigenous Biodiversity (NPSIB)



# 3 Biodiversity characteristics and values

#### 3.1 Context

The site is within the Hamilton Ecological District. Indigenous vegetation in the Hamilton Ecological District (ED) has been severely depleted with less than 2% of all indigenous ecosystems remaining (Leathwick et al, 1995). Since human settlement, the original, indigenous-dominated forest ecosystem cover has been largely replaced by ecosystems dominated by exotic species and/or urban development, particularly in the flatter to rolling country of the Hamilton basin floor.

# 3.2 Site description

The 750 ha site is situated in southern Hamilton on a low terrace adjacent to the Waikato River. Within this flat to gentle rolling hill landscape, low mounds or ridges of alluvial plains emerge by moderately to well-drained alluvium from the Hinuera formation which predominantly supported mixed conifer-broadleaf forest. In shallow depressions or swales, the alluvium has more silt and clay and the poorer drainage in these soils created boggy areas that were dominated by kahikatea semi-swamp forests. In lower terraces beside the Waikato River, the alluvium has more sand and gravel and is better drained. These well drained areas suited totara-matai-kowhai forest types (Clarkson *et al.*, 2007). Very few peat areas are situated in the PSPA, but areas of poorly drained gley-soils, as well as the small areas of peat historically hosted a range of vegetation types including submerged vegetation, swamp forest, sedgelands, shrublands and restiad bogs (Clarkson *et al.*, 2007).

As Cornes et al (2012) states:

"Hamilton City, at 11,080 ha, makes up 7.0% of the 159,375 ha of Hamilton Ecological District (ED). Hamilton ED is confined to the Hamilton Basin with some of the surrounding hills and foothills included (McEwen, 1987). Leathwick et al. (1995) found less than 2% of natural vegetation that once existed in the ecological district pre 1840s still remains. Wetlands and conifer forests were the dominant ecosystems of Hamilton ED before human settlement (Harding, 1997). These two ecosystems also suffered the highest percentage reduction through anthropogenic activities. All past vegetation types are less than 2% cover within the district."

The PSPA is dominated by two large physical features: the Waikato River and the Mangakōtukutuku Gully. The Waikato River runs along the eastern side of the PSPA with stepped terraces giving way to steep banks to the river. On the opposite side of the site is the Mangaonua Gully and Hammond Park (Appendix C, Figure 1, 2 and 3). In the south, a minor gully separates an island of river terrace. The surface geology consists of alluvial loose sedimentary and weak igneous rocks. The landscape is undulating with the southern portion substantially elevated, being about 65 metres above the level of the Waikato River.

The PSPA is currently a mixture of large farms with some 'lifestyle block' development, and remains predominantly in rural land use. The farming activities in the area have been in place for over a hundred years and the dominant vegetation includes exotic trees and shelterbelts. Historic clearance has removed almost all of the original indigenous vegetation. Prior to human settlement low terraces adjacent to the Waikato River, and river terrace and gully scarps were once characterised by totara-matai-kowhai forest. Gully floors were likely to have been dominated by kahikatea pukateaswamp maire forest (Clarkson, Clarkson et al. 2007). Very little remnant or regenerating indigenous vegetation now exists and is primarily located as small, fragmented patches within the Waikato River corridor and the Mangakōtukutuku Gully.

Attachment 11



9

# 3.3 Habitat types

A wide range of vegetation or habitats for indigenous fauna have been identified as being ecologically significant within the PSPA based on WRPS significance criteria (Section 11A WRPS) (Kessels and Baber, 2021). These significant ecological areas have been assigned into ecological significance categories based on the ecological values they provide.

July 2021 Job No: 1007479.v5



Table 3.1: Key ecological features within the PSPA, their ecological significance, location relative to the development footprint and areal extent<sup>4</sup> ( refer to section 2.6 for definitions of significance categories).

Key Ecological Features and their aerial extent	General location	Description	Ecological characteristics and values	Key WRPS Ecological Significance Criteria Triggered
Ecologically signific	ant areas of ind	igenous biodiversity		
Significant indigenous terrestrial and freshwater fauna habitat: Riparian margins and associated waterways (58.74 ha)	Mostly outside the current development footprint	This includes mostly exotic forest and shrubland vegetation present along the Waikato River, Mangakōtukutuku Gully and associated tributaries in the PSPA. There are areas of wetland and stream habitats interspersed throughout. Most of this vegetation is exotic though small areas of habitat is dominated by indigenous vegetation in places and exotic dominated vegetation typically also includes native species.	These habitat types provide significant habitat for indigenous vegetation and fauna present on site, and are particularly important as roost, foraging and flyway habitat for the 'Threatened' (nationally critical) long-tailed bat, and important for At Risk bird species including kākā, pied shag, little shag, little black shag, black shag and New Zealand dabchick. The waterways in this habitat complex also provide habitat for several 'At Risk' fish species, while the riparian margins enhance or protect the waterway habitat. It may also provide habitat for indigenous lizard species.	Criterion 3: Long-tailed bats and 'Ar Risk' fish species have been confirmed to use these habitats. Criterion 4, criterion 6, criterion 8: Under-represented stream and riparian margin habitat is utilised by a range of aquatic species. Criterion 11: Parts of this habitat provide an ecological buffer, linkage and corridors which are necessary to protect significant habitat from external adverse effects.
Significant indigenous terrestrial fauna habitat: non- riparian linear features (ecological corridors) (20.49 ha)	Mostly Inside the current development footprint	This includes shelterbelts that provide connectivity across the landscape. The vegetation is largely exotic.	This is important foraging and flyway habitat for long-tailed bats and indigenous bird species.	<u>Criterion 3</u> : Long-tailed bats have been confirmed to use, or likely to use, these habitats. <u>Criterion 11</u> : This habitat provides an ecological buffer, linkage and corridors necessary to protect significant habitat from external adverse effects.

A considerable amount of this habitat will be permanently lost due to Southern Links

Tonkin & Taylor Ltd

Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area Hamilton City Council

July 2021 Job No: 1007479.v5



7	7	
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Key Ecological Features and their aerial extent	General location	Description	Ecological characteristics and values	Key WRPS Ecological Significance Criteria Triggered
Significant indigenous bat habitat: non- riparian habitat ecological buffers (56.59 ha)	Mostly Inside the current development footprint	This includes any vegetation, including pasture, within 20 m of significant riparian margins and associated waterways, and significant non-riparian linear features	This is foraging and flyway habitat for long- tailed bat.	Criterion 3: Long-tailed bats have been confirmed to use, or likely to use, these habitats for foraging and as flyways.  Criterion 11: This habitat provides an ecological buffer, linkage and corridors necessary to protect significant habitat from external adverse effects.
Significant Indigenous vegetation remnants ( <b>4.5</b> <b>ha*</b> )	Mostly outside development footprint	This includes small fragments, groups or individual mature indigenous trees along the margins of the Waikato River and associated tributaries in the PSPA.	This vegetation is important due to its rarity in the landscape. It provides important habitat for native flora and fauna as well as native vegetation, and fauna present on site. This is potentially important as roosting, foraging and flyway habitat for the 'Threatened' (nationally critical) long-tailed bat.	Criterion 4: These small indigenous remnants are under-represented within the Hamilton Ecological District.  Criterion 3: Long-tailed bats have been confirmed to use, or likely to use, these habitats
<b>Ecologically Signific</b>	cant wetlands ar	nd wetlands where significance is Like	ly or Indeterminate	
Wetlands (7.3 ha) including Riverine & Palustrine wetlands (5.6 ha*) and Ephemeral Seep or Spring wetlands (1.7 ha).	Mostly outside the development footprint, but some wetlands are within pasture areas within the development footprint	The wetland areas comprise a mixture of exotic and native rushes and sedges, sometimes with a canopy of exotic deciduous trees, and native tree ferns.	Wetlands are threatened ecosystem types and may include wetland associated 'Threatened' or 'At Risk' species. They are potentially important as roosting, foraging and flyway habitat for 'Threatened' (nationally critical) long tailed bat.	Significant. Some wetland areas are Likely or Indeterminate until further site-specific surveys are undertaken. Criterion 4, criterion 6, criterion 8: Under-represented wetlands and wetland habitat which is utilised by a range of aquatic and terrestrial indigenous species.

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5



## 3.4 Long tailed bats

The New Zealand long-tailed bat (*Chalinolobus tuberculatus*) is considered vulnerable to extinction and is ranked as nationally 'Threatened' (Nationally Critical), which is the highest threat ranking in the Department of Conservation's threat classification system. It meets this threat ranking because it is undergoing a "very high ongoing or predicted decline (> 70%)." (O'Donnell et al 2018).

There have been numerous intensive surveys and monitoring studies of long-tailed bats in and around the PSPA (see Mueller et al. 2021). These surveys include acoustic monitoring, thermal imaging, and capture and radio-tracking of individual bats.

Long-tailed bats use a variety of habitats within the PSPA for roosting, commuting, and foraging. These habitats are all likely to be important for long-tailed bats in this locality. The variety of interconnected habitats in this southern part of Hamilton means this is the most valuable and significant locality for long-tailed bats within Hamilton City.

Previous bat monitoring undertaken across Hamilton City clearly demonstrates that the rural urban fringe to the south of city, within which the PSPA is located, is core habitat for the Hamilton long-tailed bat population (Mueller et al. 2021). The studies reviewed produced similar results, confirming that the large, vegetated gullies containing tributaries of the Waikato River are key landscape features, providing connectivity for bats to move through a comparatively modified landscape.

Habitat connectivity, or distance to the Waikato River/major gullies, emerged as the single most significant explanatory variable the statistical model employed in these city-wide surveys, highlighting the importance between habitat type and distance to the river/gullies for bats. Overall, bat activity significantly increased with:

- Decreasing distances from well-connected habitats and linear landscape features (gullies and river); and
- Increasing distances from the city centre and levels of human activity. Pass rates were
  consistently highest at habitats where houses, roads and street lights were lowest. Even slight
  increases in the number of roads and street lights resulted in decreases in pass rates.

Riparian margins, with dense indigenous and exotic trees and shrubs associated with riverine and gully landscapes, appeared to be critical habitat, as bats depend on access to key resources associated with these environments. In particular, these habitats provide:

- Mature exotic and indigenous vegetation for roosting purposes;
- Emergent aquatic insect prey (e.g. mosquitoes) for foraging (which can include foraging over areas of open pasture);
- Freshwater for drinking; and
- Linear landscape corridors for movement and navigation.

Surveys undertaken in the Mangaonua and Mangakōtukutuku gullies, located to the east and west of the PSPA respectively, also recorded regular bat activity. Recent radio tracking surveys have also demonstrated that long-tailed bats are not limited to the gully network in Hamilton South, but are also commuting overland in areas where anthropogenic disturbance is limited. A number of bat roosts have been found within and adjacent to the PSPA (Mueller et al. 2021). In addition, home ranges and indicative commuting routes have also been determined by recent studies showing that many of these bats reside within, or are directly adjacent to, the PSPA (Davidson-Watts I, 2019; Mueller et al. 2021).



3.5 Birds

The PSPA has a diverse bird assemblage, which includes both terrestrial species, and species associated with wetland/water habitats (Tonkin & Taylor, 2021). This reflects its location directly adjacent to the Waikato River. In terms of abundance, the avifauna assemblage is dominated by naturalised introduced species, which are common in the agricultural landscape surrounding Hamilton (Cornes et al., 2012a; Fitzgerald and Innes, 2013). Nationally 'Threatened' or 'At Risk' species that have been detected, or potentially present in the wider Hamilton City area, include the North Island kākā, kārearea (*Falco novaeseelandiae ferox*), and the pied shag, all classified as 'At Risk – recovering'; and the New Zealand dabchick, little black shag and black shag, all 'At Risk – Naturally Uncommon'). The riparian margin vegetation along the river may be utilised by the shag species for roosting and/or nesting, but there is no suitable habitat for New Zealand dabchick onsite. Like other rural and urban parts of the Hamilton area, kākā may visit the site when dispersing during winter, or as a short visit, but are unlikely to inhabit the area for long periods (Fitzgerald and Innes, 2013).

## 3.6 Lizards

Three lizard species have been recorded in the locality (DOC BioWeb database). The most common of these species is the copper skink, (*Cyclodina aenea*), which is widespread in the Waikato and not threatened, and is known to be present within the PSPA. Faecal material attributed to forest gecko (*Hoplodactylus granulatus*) has been reported in the Hakarimata Ranges, some 30 km to the north. DOC also has a record of the threatened Auckland green gecko (*Naultinus elegans elegans*) from Hakarimata (BioWeb database).

Other species which could be present include ornate skink (*C. ornata*), Pacific gecko (*H. pacificus*) and the introduced plague skink which is known to be present within the PSPA (Tonkin & Taylor, 2021).

## 3.7 Invertebrates

Nationally 'Threatened' or 'At Risk' terrestrial invertebrates are unlikely to be present but as no focussed surveys are known to have been undertaken in the PSPA, the presence of threatened terrestrial invertebrate species cannot be ruled out.

# 3.8 Freshwater fauna

There are numerous records for fish within the PSPA, including in the Waikato River and Mangakōtukutuku Gully, as well as in smaller gullies near the PSPA. Longfin eel (Anguilla diefenbachii) have been recorded in this locality, as havelamprey (Geotria australis), inanga (Galaxias maculatus), giant kōkopu (Galaxias argenteus), shortjaw kōkopu (Galaxias postvectis), torrentfish (Cheimarrichthys fosteri), redfin bully (Gobiomorphus huttoni), koaro (Galaxias brevipinnis) and black mudfish (Neochanna diverus). All of these species are classified as 'At Risk' or 'Threatened'. Freshwater invertebrates recorded near the PSPA include the 'At Risk – Declining' freshwater mussel, kākahi (Echyridella menziesii), and the freshwater snail (Austropeplea tomentosa).

## 3.9 Vegetation

Several plant species are now classified as 'Threatened' due to the threat posed by Myrtle rust. Of these kanuka and manuka are present and naturally occurring within the PSPA.

The only other threatened plant species is poroporo (*Solanum aviculare var. aviculare*) which is 'Threatened – Nationally Vulnerable' (de Lange et al., 2018). It is unclear if this species is found within the PSPA.

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5



# 4 Assessment of effects on biodiversity

The previous section described the biodiversity values present within the PSPA to provide context. This section focuses on assessing the potential biodiversity impacts of urbanisation associated with structure plan. The assessment is based on the EcIAG produced by EIANZ (Roper-Lindsay et al. 2018) and adapted to determine the overall 'level of effect' of the development on biodiversity values. It is an indicative assessment only, and each specific development proposal would need to be evaluated in detail at the time of lodging a consent application to Council.

## 4.1 Biodiversity value assessment (Step 1)

It is important to note that undertaking an assessment of biodiversity values for the PSPA does not preclude the statutory requirement to undertake an assessment of ecological significance applying the criteria in Section11A of the WRPS, and hence section 6(c) of the RMA. There are scheduled significant natural areas (SNAs) in the District Plan which are located within PSPA (refer to section 3.3). However, these SNAs relate to an assessment of indigenous vegetation values only. Hamilton City Council has not undertaken an assessment of significant habitats for indigenous fauna as part of the Hamilton District Plan but see Baber and Kessels (2021).

The biodiversity values associated with each habitat type and for nationally 'Threatened' or 'At Risk species are assessed in Table 4.1 below.

Table 4.1: Biodiversity values within the PSPA5 based on tables in Appendix D, Tables 1-3)

Key biodiversity features	Biodiversity characteristics and values	Biodiversity Value
Habitats		
Significant indigenous terrestrial and freshwater fauna habitat: Riparian margins and associated waterways (58.74 ha)	<ul> <li>High value for rarity and distinctiveness. Indigenous vegetation</li> <li>2% in Ecological District. Important roosting, foraging and flyway habitats for the Nationally 'Threatened' long tailed bat.</li> <li>Likely presence of nationally 'Threatened' kanuka and manuka</li> </ul>	
Significant indigenous terrestrial and freshwater fauna habitat: non-riparian linear features (ecological corridors) (20.49 ha)	Low value for representativeness. High value for rarity and distinctiveness (important foraging and flyway habitats for the Nationally 'Threatened' long tailed bat).  Low value for diversity and pattern. High value for ecological context, particularly ecological connectivity in the landscape and ecological buffering of waterways). Two high and two Low values equates to an overall value assessment of High.	High

<sup>&</sup>lt;sup>3</sup> Many of these values for fauna species have been recorded outside the PSPA, but they are considered likely to be present.

Tonkin & Taylor Ltd Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area Hamilton City Council July 2021 Job No: 1007479.v5

Hamilton City Council
Te kaunihera o Kirikiriroa

15

Key biodiversity features		
<ul> <li>Moderate value for representativeness.</li> <li>High value for rarity and distinctiveness (Roosting and/or foraging and flyway habitats for the Nationally 'Threatened' long tailed bat).</li> <li>Moderate value for diversity and pattern.</li> <li>Moderate value for ecological context, particularly connectivity in the landscape for bats.</li> <li>One high and three moderate values equates to an overall value assessment of 'High'.</li> </ul>		High
Significant Indigenous vegetation remnants ( <b>4.5 ha</b> )	Moderate value for representativeness.     High value for rarity and distinctiveness. Indigenous vegetation < 2% in Ecological District. Roosting and/or foraging and flyway habitats for the Nationally 'Threatened' long tailed bat. Likely presence of nationally 'Threatened' kanuka and manuka (threatened due to threats from myrtle rust).     Moderate value for diversity and pattern.     Moderate value for ecological context, particularly connectivity in the landscape for bats.  One high and three moderate values equates to an overall value assessment of 'High'.	High
Wetlands (7.3 ha) including Riverine & Palustrine wetlands (5.6 ha*) and Ephemeral Seep or Spring wetlands (1.7 ha).	There is insufficient information to assess the ecological value of wetlands within the PSPA as this will first require an assessment of presence and extent based on field investigations and assessment using the Wetland Delineation Protocol (MfE 2020). It is also key to note that the areal extent of wetlands provided in column one is likely to be an underestimate as this only includes wetlands that can be readily detected through analysis of aerial imagery.	Likely to range from Moderate to Very High
Non-significant exotic vegetation (excluding pasture) (47.58 ha)	<ul> <li>Very Low value for representativeness.</li> <li>High value for rarity and distinctiveness as this habitat does provide low value foraging and flyway habitat for the Nationally 'Threatened' long tailed bat.</li> <li>Low value for diversity and pattern.</li> <li>Moderate value for ecological context, does provide connectivity in the landscape for bats so not scored as Very Low.</li> <li>One high, one moderate, one low and one very low equates to an overall value assessment of 'Moderate'</li> </ul>	Moderate
Non-significant exotic vegetation (pasture) (500.33 ha)	Very low value for representativeness. High value for rarity and distinctiveness as this habitat does provide foraging and flyway habitat for the Nationally 'Threatened' long tailed bat. Very low value for diversity and pattern. Moderate value for ecological context, particularly connectivity in the landscape for bats. One high, one moderate and two very low values equates to an overall value assessment of 'Moderate'.	Moderate

Tonkin & Taylor Ltd Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Awa Hamilton City Council July 2021 Job No: 1007479.v5



Key biodiversity features	Biodiversity characteristics and values	Biodiversity Value
Flora species		
ānukā¹ Threatened – Nationally Vulnerable		Very High
Mānuka <sup>1</sup>	Threatened - Nationally Vulnerable	Very High
Poroporo	Threatened – Nationally Vulnerable	Very high
Fauna species		
Long-tailed bats	Nationally threatened species (Nationally Critical) with the PSPA constituting a hot spot for roost sites, foraging habitat and flyways (Table 4.3)	Very High
Forest gecko, moko- piri-ra kau	At Risk (declining) possibly present but not in development area	High
Auckland green gecko, elegant gecko, kākāriki	At Risk (declining) possibly present but not in development area	High
Ornate skink	At Risk (declining) possibly present but not in development area	High
Pacific gecko	At Risk (relict) possibly present but not in development area	Moderate
Grey duck, pārera	Threatened – Nationally Critical	Very High
New Zealand pipit, pīhoihoi	At Risk – Declining	High
White heron, kõtuku	Threatened – Nationally Critical	Very high
Australasian bittern, matuku hûrepo		
North Island fernbird, mātātā	At Risk – Declining	
Long-tailed cuckoo, koekoea	At Risk – Naturally Uncommon	
Bush falcon, karearea	At Risk – Recovering	Moderate
Banded rail, moho pererű	nded rall, moho At Risk – Declining	
New Zealand pied oystercatcher, tõrea	At Risk – Declining	High
Black billed gull, tarāpuka	Threatened – Nationally Critical	Very high
Red billed gull, tarāpunga	At Risk – Declining	High
North Island kākā, kākā	At Risk – Recovering	Moderate
Black shag, kawau	At Risk – Naturally Uncommon	Moderate
Little black shag, kawau tûi	At Risk – Naturally Uncommon	Moderate
Pied shag, karuhiruhi	At Risk – Recovering	Moderate
Royal spoonbill, kõtuku ngutupapa		
New Zealand dabchick, waiwea	At Risk – Recovering	Moderate

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Attachment 11

Hamilton City Council

17

Key biodiversity features	Biodiversity characteristics and values	Biodiversity Value
Marsh crake, koitareke	At Risk – Declining	High
Spotless crake, pūweto	At Risk – Declining	High
Longfin eel, tuna	At Risk – Declining; may be present in river and gully waterways	High
Torrentfish, piripiripohatu	At Risk – Declining; may be present in river and gully waterways	High
Giant kõkopu, taiwharu	At Risk – Declining; may be present in river and gully waterways	High
Koaro	At Risk – Declining; may be present in river and gully waterways	High
Īnanga, inaka	At Risk – Declining; may be present in river and gully waterways	High
Shortjaw kōkopu	Threatened – Nationally Vulnerable; may be present in river and gully waterways	Very high
Lamprey, kanakana	Threatened – Nationally Vulnerable; may be present in river and gully waterways	Very high
Redfin bully	At Risk – Declining; may be present in river and gully waterways	High
Black mudfish	At Risk – Declining; may be present in river and gully waterways	High
Freshwater mussel, kākahi	At Risk – Declining	High
Freshwater snail	Data Deficient	Moderate

Notes: 1 Level of threat status for myrtaceae species is primarily associated with a precautionary approach due to disease risk.

#### 4.2 Magnitude of effects assessment (Step 2)

#### 4.2.1 Overview of potential adverse effects associated with the proposed landuse change

In general terms, habitat loss associated with housing development and associated infrastructure has the potential to create a range of adverse effects on biodiversity values, during enabling works construction (resulting from direct physical disturbance), seasonal construction, and on an ongoing basis. Potential adverse effects on biodiversity values during and after construction may include:

- Vegetation and habitat loss through vegetation clearance and earthworks;
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e., habitat degradation), which may affect habitat suitability for flora and fauna;
- Direct mortality or injury to species, for example all plants and most of the smaller less mobile species (e.g. lizards and invertebrates) may be harmed during vegetation clearance or earthworks activities. Likewise, roosting bats could potentially harmed during vegetation clearance activities. Outside of bird breeding season, bird mortality would be low, however, during breeding season vegetation removal has the potential to result in the destruction of nests, eggs and fledglings;
- Habitat fragmentation and isolation, due to the loss and reduction of available habitat types, and by reducing the ability for plants and animals to disperse across the landscape for food, shelter, and breeding purposes, i.e. severing or partially severing access to habitats that would otherwise be suitable;

Tonkin & Taylor Ltd Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area Hamilton City Council

July 2021 Job No: 1007479.v5



- Construction and operations related noise and vibrations or dust effects; and
- Sediment runoff to wetlands and watercourses that may affect the quality of aquatic habitats.

Potential long-term ongoing adverse effects may include:

- Ongoing habitat degradation associated with habitat loss, edge effects and fragmentation, which permanently affect movement of some species, with possible effects on metapopulation dynamics and increased vulnerability to local extinction;
- Ongoing disturbance effects, particularly on habitat margins/edges, through noise, dust and lighting associated with infrastructure and housing;
- Mortality or injury on roads through strike or road kill for some species;
- The increased presence of people and introduced species in previously less accessible areas;
- Lost opportunities for creating wildlife corridors; and
- Ongoing degradation of aquatic habitat quality through:
  - Contaminated stormwater runoff (sediment, heavy metals and elevated temperature) from road surface to wetlands; and
  - Increased risk of spills of potential toxins (for example, oil or chemicals) from cartage vehicles

# 4.2.2 Overview of likely measures to avoid, remedy or mitigate for potential adverse

Potential adverse effects on terrestrial and wetland values associated with construction and operation should be avoided, remedied or mitigated to the extent possible, through:

- Further refinement of the development footprint to ensure that the vegetation clearance and earthworks footprint is kept to a minimum.
- Seasonal constraints on vegetation clearance. Vegetation clearance is expected to be affected
  by specific timing restrictions to avoid or minimise effects on fauna that are legally protected
  under the Wildlife Act (1953). This should include avoidance of vegetation clearance:
  - Outside of earthworks season (i.e., should not be undertaken from 1 May 1 October)
    due to the need for erosion and sediment controls to be in place in accordance with the
    relevant management plan;
  - During colder months when bats are less active and when roosting bats are less likely to be detected through standard bat tree felling protocol methods;
  - During peak bird breeding season to reduce harm to eggs or chicks (August to December inclusive); and
  - In accordance with seasonal constraints for salvaging and relocating lizards and invertebrates.
- Vegetation clearance protocols should include:
  - Physical delineation of vegetation to be cleared to avoid inadvertent clearance and to minimise potential damage to branches and roots; and
  - Directional felling to prevent damage to vegetation immediately adjacent to the footprint.
- Sediment control measures should be undertaken to avoid or minimise effects on the wider aquatic receiving environment, i.e., wetlands, streams and the Waikato River.
- Vegetation/habitat clearance salvage and relocation operations for nationally 'Threatened',
   'At Risk', Regionally uncommon or legally protected species present or potentially present

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Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

Attachment 11

19

#### onsite. This should include:

- Best practice bat tree felling protocol to reduce the risk of harming roosting bats;
- Lizard salvage and relocation; and
- Redeployment of dead standing wood or fallen logs into native revegetation sites, to mitigate for potential effects on regionally uncommon invertebrates that may be present, e.g., tree weta and peripatus.
- Controls on domestic cats; and
- Mitigation plantings to buffer against light, noise, dust or general disturbance of ecologically significant habitats. These plantings are ideally undertaken before the construction starts, to reduce the time lag needed for planted habitat to become ecologically functional.

These measures to avoid, remedy or mitigate potential adverse effects should be detailed in the respective ecological management plans, as mandated through proposed consent conditions set out in the AEE.

# 4.2.3 Expected magnitude of effects after measures to avoid, remedy or mitigate adverse effects

Table 4.2: Magnitude of effects assessment after measures to avoid, remedy or mitigate for effects (Appendix D, Tables 4 – 5)

Biodiversity value	Direct and indirect effects within the PSPA development footprint	Magnitude of effects after mitigation (Appendix D)
Habitat complexes		
Significant indigenous terrestrial and freshwater fauna habitat: Riparian margins and associated waterways (58.74 ha)	It is assumed that there will be no permanent loss of riparian margins and associated waterways within PSPA. It is assumed that there will be potential effects on these habitat types due to light, noise or general disturbance associated with housing developments or degradation of the associated waterways through stormwater pollutants and potential sedimentation. It is expected that these effects will be appropriately mitigated for, though residual effects are expected.	Moderate
Significant indigenous terrestrial fauna habitat: non-riparian linear features (ecological corridors) (20.49 ha)	available in the landscape. It is assumed that there will be potential effects on these habitat types due to light, noise or general disturbance associated with housing developments. It is expected that these effects will be appropriately mitigated for	
Significant indigenous bat habitat: non- riparian habitat ecological buffers (56.59 ha)	habitat types due to light, noise or general disturbance associated with housing developments, and that these effects will be	
Significant indigenous	It is assumed that there will be no permanent loss of this habitat type. It is assumed that there will be potential effects on these	Low

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5



Biodiversity value	Direct and indirect effects within the PSPA development footprint	Magnitude of effects after mitigation (Appendix D)
vegetation remnants (4.5 ha*)	habitat types due to light, noise or general disturbance associated with housing developments, and that these effects will be appropriately mitigated for, though residual effects are possible.	
Wetlands (7.3 ha) including Riverine & Palustrine wetlands (5.6 ha+) and Ephemeral Seep or Spring wetlands (1.7 ha).	freshwater wetlands due to activity status rules for natural freshwater wetlands set out in the NES-F but some constructed wetlands (ponds) may be lost. Potential effects on these habitat types will result from light, noise or general disturbance associated with housing developments (terrestrial) or degradation of water quality through stormwater pollutants and potential	
Non-significant exotic vegetation (excluding pasture) (47.58 ha)	Permanent loss of 34.36 ha which equates to 72.2% of the available habitat within the PSPA, and which constitutes a moderate proportion of the habitat available in the surrounding landscape.	High
Non-significant exotic vegetation (pasture) (535.73 ha)	Permanent loss of 462.88 ha which equates to 86.4% of the available habitat within the PSPA, and which constitutes a moderate proportion of the habitat available in the surrounding landscape.	High
Species		
Nationally Threatened Long tailed bat	ionally Permanent loss of 3.09 ha of high-quality bat habitat, 34.36 ha of moderate quality bat habitat and 500.33 ha of low quality bat	
Nationally Permanent loss of all kānuka and mānuka within the development footprint, which is expected to be negligible kānuka and Mānuka		Negligible
Nationally threatened poroporo	It is assumed that no Poroporo are present within the development footprint	Negligible
Nationally threatened or 'At Risk' forest and wetlands freshwater wetlands set out in the NES-F but some constructed wetland birds wetlands (ponds) may be lost. Potential effects on these species may occur through light, noise or general disturbance associated with housing developments (terrestrial) or through degradation of water quality through stormwater pollutants and potential		Likely Moderate

Tonkin & Taylor Ltd Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area Hamilton City Council



**Biodiversity** Direct and indirect effects within the PSPA development Magnitude of effects after value footprint mitigation (Appendix D) sedimentation. It is expected that these effects will be appropriately mitigated for, though residual effects are expected. 'At Risk' fish and It is assumed there will be no permanent loss of natural streams. Low freshwater Potential indirect effects on fish and freshwater invertebrates may invertebrate occur through degradation in water quality associated with species stormwater runoff, however there will be corresponding potential positive effects through a reduction in sedimentation and nutrient enrichment associated with farming activities (particularly the presence of livestock in riparian margins).

# 4.3 Levels of effect (Step 3)

Table 4.3 below sets out the potential 'Level of Effects' for habitat complexes based on the assumption that all biodiversity values within the development footprint will be lost, with the exception of wetlands.

Of key importance, even with application of remediation and mitigation measures, urbanisation within the PSPA development footprint, as currently proposed, will likely result in a 'Very High' level of residual adverse effects on bats. This in effect means that the initial design of specific urban subdivisions and infrastructure is critical, and will form the most important part of avoiding significant effects on critical habitats within the PSPA. In practical terms, this means that known roosts should be retained, as should riparian margins, buffers and ecological corridors.

Efforts to address potential adverse effects are considered necessary for all habitats or species that have the potential for a 'Level of Effects' of 'Moderate' or higher. Recommendations for addressing these effects are provided in Section 5 below.

Table 4.3: Level of residual effects on biodiversity values after mitigation (Appendix D Table 6)

Biodiversity value	Biodiversity value category	Magnitude of effects category after mitigation	Level of effects category (after mitigation)
Habitat/vegetation type			
Significant indigenous terrestrial and freshwater fauna habitat: Riparian margins and associated waterways (58.74 ha)	High	Moderate	High
Significant indigenous terrestrial fauna habitat: non- riparian linear features (ecological corridors) (20.49 ha)	High	High	Very High
Significant indigenous bat habitat: non-riparian habitat ecological buffers (56.59 ha)	High	Low	Low
Significant indigenous vegetation remnants (4.5 ha*)	High	Low	Low

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council



Biodiversity value	Biodiversity value category	Magnitude of effects category after mitigation	Level of effects category (after mitigation)
Wetlands ( <b>7.3 ha</b> ) including Riverine & Palustrine wetlands ( <b>5.6 ha*</b> ) and Ephemeral Seep or Spring wetlands ( <b>1.7 ha</b> ).	Moderate to High	Likely Moderate	Potentially high <sup>6</sup>
Non-significant exotic vegetation (excluding pasture) (47.58 ha)	Moderate	High	Moderate
Non-significant exotic vegetation (pasture) (535.73 ha)	Moderate	High	Moderate
Nationally Threatened or 'At Risk' Flora Species			
Nationally threatened (vulnerable) kānuka	Very high	Negligible	Low
Nationally threatened (vulnerable) mānuka	Very high	Negligible	Low
Nationally threatened (vulnerable) poroporo	Very high	Negligible	Low
Nationally Threatened or 'At Risk' Fauna Species			
Nationally threatened (critical) Long-tailed bat	Very high	High	Very high
At Risk (declining) Forest gecko, moko-piri-ra kau	High	Low	Low
At Risk (declining) Auckland green gecko, elegant gecko, kākāriki	High	Low	Low
At Risk (declining) Ornate skink	High	Low	Low
At Risk (naturally uncommon) Pacific gecko	Moderate	Low	Low
Nationally threatened (critical) Grey duck, pārera	Very high	Low	Moderate
At Risk (declining) New Zealand pipit, pīhoihoi	Moderate	Moderate	Moderate
Nationally threatened (critical) White heron, kōtuku	Very high	Negligible	Low
Nationally threatened (critical) Australasian bittern, matuku hūrepo	Very high	Low	Moderate
At Risk (declining) North Island fernbird, mātātā	Moderate	Low	Low
At Risk (naturally uncommon) Long-tailed cuckoo, koekoea	Moderate	Low	Low
At Risk (recovering) Bush falcon, karearea	Moderate	Low	Low
At Risk (declining) Banded rail, moho pererū	High	Negligible	Low
At Risk (declining) New Zealand pied oystercatcher, tōrea	High	Negligible	Low
Nationally threatened (critical) Black billed gull, tarāpuka	Very high	Negligible	Low
At Risk (declining) Red billed gull, tarāpunga	High	Negligible	Low
At Risk (recovering) North Island kākā	Moderate	Low	Low
At Risk (naturally uncommon) Black shag, kawau	Moderate	Low	Low
At Risk (naturally uncommon) Little black shag, kawau tūi	Moderate	Low	Low

<sup>&</sup>lt;sup>6</sup> It is key to note that prohibited activity status applies to a number of activities that may affect natural freshwater wetlands as defined by the National Policy Statement – Freshwater Management 2020 and as set out in National Environmental Standards for Freshwater 2020. Furthermore determining the presence and extent of natural wetlands typically requires field investigations and an assessment against the Wetland Delineation Protocol (MfE, 2020). Correspondingly it is difficult to determine the potential level of effects on wetlands.

Hamilton City Council
Te kaunihera o Kirikiriroa

23

Biodiversity value	Biodiversity value category	Magnitude of effects category after mitigation	Level of effects category (after mitigation)
At Risk (recovering) Pied shag, karuhiruhi	Moderate	Low	Low
At Risk (naturally uncommon) Royal spoonbill, kõtuku ngutupapa	Moderate	Low	Low
At Risk (recovering) New Zealand dabchick, waiwea	Moderate	Low	Low
At Risk (declining) Marsh crake, koitareke	High	Negligible	Low
At Risk (declining) Spotless crake, pūweto	High	Low	Low
At Risk (declining) Longfin eel, tuna	High	Low	Low
At Risk (declining) Torrentfish, piripiripohatu	High	Low	Low
At Risk (declining) Giant kōkopu, taiwharu	High	Low	Low
At Risk (declining) Koaro	High	Low	Low
At Risk (declining) Īnanga, inaka	High	Low	Low
Nationally threatened (vulnerable) Shortjaw kōkopu	High	Low	Low
Nationally threatened (vulnerable) Lamprey, kanakana	High	Low	Low
At Risk (declining) Redfin bully	High	Low	Low
At Risk (declining) Black mudfish	High	Low	Low
At Risk (declining) Freshwater mussel, kākahi	High	Low	Low
Freshwater snail (Data deficient)	Moderate	Low	Low



## 5 Residual effects management

#### 5.1 Residual effects

As set out in Table 5.1, a number of residual adverse effects are expected as a result of the proposed landuse change in the PSPA.

Of key importance, the change from rural to residential landuse within the PSPA will likely result in a 'Very High' level of residual effects on bats after measures to avoid, remedy or mitigate for adverse effects are implemented. This is attributed primarily to the large-scale loss (ca 500 ha) of low- and moderate-value bat habitats in the form of pasture, and exotic vegetation of higher stature as well as the loss of 3.09 ha of habitat assessed as having high value for bats.

We consider this loss of 3.09 ha of high value bat habitat to constitute a 'Very High' level of effects that cannot be adequately or appropriately addressed, and we recommend efforts to protect these areas.

However, while the level of residual effects on low- and moderate-value bat habitat within the PSPA is also 'Very High', it is our view that these effects can be appropriately addressed through habitat restoration and enhancement, with a focus on native revegetation and the control of introduced predatory mammals within suitable protected areas.

Table 5.1: Biodiversity values for which the level of residual effects has been assessed as moderate or higher.

Biodiversity value	Level of effects category (after mitigation)
Significant indigenous terrestrial and freshwater fauna habitat: Riparian margins and associated waterways (58.74 ha)	High
Significant indigenous terrestrial fauna habitat: non-riparian linear features (ecological corridors) (20.49 ha)	Very High
Wetlands ( <b>7.3 ha</b> ) including Riverine & Palustrine wetlands ( <b>5.6 ha*</b> ) and Ephemeral Seep or Spring wetlands ( <b>1.7 ha</b> ).	Potentially high <sup>7</sup>
Non-significant exotic vegetation (excluding pasture) (47.58 ha)	Moderate
Non-significant exotic vegetation (pasture) (535.73 ha)	Moderate
Nationally threatened (critical) Long-tailed bat	Very high
Nationally threatened (critical) Grey duck, pārera	Moderate
At Risk (declining) New Zealand pipit, pīhoihoi	Moderate
Nationally threatened (critical) Australasian bittern, matuku hūrepo	Moderate
At Risk (declining) Spotless crake, pūweto	Moderate

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5

<sup>&</sup>lt;sup>7</sup> It is key to note that prohibited activity status applies to a number of activities that may affect .natural freshwater wetlands as defined by the National Policy Statement – Freshwater Management and as set out in the National Environmental Standards – Freshwater. Furthermore to determine the presence and extent of natural wetlands typically requires field investigations and an assessment against the Wetland Delineation Protocol (MfE, 2020). Correspondingly it is difficult to determine the potential level of effects on wetlands.



5.2 Residual effects management approach

To address residual effects, we recommend a focus on native revegetation (in addition to mitigation plantings), the control of introduced predatory mammals within suitable protected areas, and that these measures follow best practice guidelines to optimise ecological outcomes.

In this instance, the recommended measures to address residual effects are considered to be forms of compensation rather than offsetting. The proposed measures do not meet the definition of offsetting because:

- The loss of degraded exotic-dominated habitat does not include the re-creation of an exotic-dominated wetland with similar ecological characteristics and function. Rather, it is proposed to exchange the permanent loss of exotic dominated habitat with the restoration and enhancement of indigenous biodiversity values in a large, degraded wetland. Importantly, this approach is expected to generate better outcomes for wetland biodiversity than a strict offset approach.
- This preliminary assessment was based on desktop information rather than quantitative data and therefore impacts cannot be demonstrably offset, noting that for most large-scale projects it is not feasible to demonstrably offset biodiversity values with the necessary degree of precision (Baber et al. 2021).

Although biodiversity compensation does not involve the same numerical rigour as offsetting, it is generally recognised that ecological outcomes are improved where offset principles are applied as a guideline when designing compensation packages (Maseyk et al. 2018).

The QBM focused exclusively on bat habitat because bats are a nationally 'Threatened' ('Nationally Critical) species, because they are wide-ranging and use all habitat types currently present, and are expected to be adversely affected by the proposed landuse changes within the PSPA. As such, working towards NNL/NG outcomes for bats is expected to benefit the full suite of biodiversity values found within the PSPA.

### 5.3 Determining the quantum of residual effects management

The type and magnitude of proposed compensation measures for this project will be guided by the application of a Qualitative Biodiversity Model (QBM) (Baber et al., 2021; Tonkin & Taylor 2021) as set out below.

Overall, it is key to recognise that QBMs have limitations, and should therefore be used simply as decision support tools (see Tonkin & Taylor, 2021). As such, their role is to help us understand the rationale and justification for determining compensation measures that are <u>expected</u> to result in tangible NNL/NG outcomes for affected biodiversity values. They do not provide certainty that NNL/NG outcomes will be achieved. Certainty of outcome will not eventuate until *after* habitat restoration/enhancement activities have commenced, and providing that a robust biodiversity monitoring programme has been implemented, and the biodiversity impacts and gains can indeed be quantified with a high degree of accuracy (Baber et al, 2021).

The proposed residual effects management approach seeks to achieve NG outcomes within 25 years for residual effects on PSPA biodiversity values. As necessitated by the project (and effects management) cycle, application of this model will be a staged process. As such, confirmation of NNL/NG biodiversity outcomes is dependent on application of a BOAM and further surveys to be undertaken during, for example, resource consent application stages for developments in the PSPA, and through the development and implementation of relevant management plans in accordance with consent conditions.

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council



### 5.4 Qualitative Biodiversity Model results

As mentioned previously, the PSPA QBM focuses on bats on the basis that the type and quantum of habitat restoration and enhancement measures that are likely required to achieve NNL/NG outcomes for bats, will likely also address residual effects on most, if not all, biodiversity values.

The QBM is based on:

- Available information and expert assessment of the amount and quality of habitat that will be adversely affected at the impact sites;
- Available information and expert assessment of the amount and quality of habitat that will be subject to compensation actions (i.e. habitat restoration and enhancement) at the compensation sites; and
- Assessment of the potential benefits to bats associated with potential habitat restoration and enhancement measures.

In summary, the QBM outputs indicate that habitat restoration, or enhancement activities within all available habitat (185 ha), that is within the PSPA but outside of the development footprint, will go a considerable way towards addressing residual effects.

However, it is unlikely to achieve a Net Gain outcome for long-tailed bats. As described in Section 5.3, further bat habitat restoration and enhancement measures in areas outside of the PSPA are therefore likely required to generate a Net Gain outcome for long-tailed bats.

Table 5.2 below sets out the data inputs into the QBM along with explanations where required. Table 5.3 sets out the impact and compensation gain output scores along with the overall Net Gain outcome.

Table 5.2: PSPA bat habitat model inputs

General model descriptor inputs		
Model inputs Explanation		
Biodiversity type	Long-tailed bats	
Technical expert input(s)	Gerry Kessels (primary) and Matt Baber (peer review)	
Benchmark	Data input: 5  Explanation: The benchmark is set at 5 to align with EcIAG habitat categories. The benchmark constitutes a <a href="https://www.hypothetical.but.realistic.future.state.">hypothetical.but.realistic.future.state.</a> i.e., a large population of long-tailed bats that are located within high value, mature native forest dominated landscape that is subject to long-term pest control and is at carrying capacity.	
Net Gain target	Data input: 20% Explanation: The Net Gain target was set at 20%. In general terms, the greater the assigned Net Gain outcome target, the greater the likelihood that No Net Loss or preferably Net Gain outcomes will be achieved. For compensation we consider a Net Gain outcome target of 20% to be generally appropriate, which equates to a 20% overshoot of No Net Loss, i.e. the Compensation Score is 20% Higher than the Impact Score.	

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council



Impact model inputs and descriptions		
Habitat/site impacted	Low value bat habitat within the development footprint (pasture)	
Impact contingency (Value)	<b>Data input:</b> Very High value (the calculated impact score is multiplied by 1.15, i.e. 15%).	
	<b>Explanation</b> : The impact contingency (value) relates to the modelled biodiversity value and addresses the need to take a more precautionary approach when impacting on habitats or species that are assessed as being of higher ecological value through the EcIAG ecological value assessment. Long tailed bats are considered to be of 'Very High' value based on the EcIAG. For biodiversity values assessed as 'Very High' the calculated impact score is multiplied by 1.15, i.e. 15%).	
	Data input: High uncertainty (the calculated impact score is multiplied by 1.15 (+15%)	
Impact contingency (uncertainty)	<b>Explanation</b> : The impact contingency (uncertainty) addresses the inherent uncertainties in some habitat or species values. This provides for a more precautionary approach when impacting on more complex habitats, or on species for which there is less information regarding species-specific impacts associated with an effect. The impact contingency (uncertainty) in relation to the effects on bats associated with the loss of low value bat habitat was deemed to be 'high'. For impacts assessed as having 'high' uncertainty the calculated impact score is multiplied by 1.15, i.e., + 15%).	
Areal extent of impact (ha)	<b>Data input</b> : 462.88 ha	
	Data input: 0.25  Explanation: Pasture within the PSPA development area has been assigned a score of 0.25 relative to the benchmark of 5, e.g., considered to equate to 5 % the value of benchmark habitats. This assessment is based on the expert opinion of Gerry Kessels, based on desktop and field investigations and using professional Judgement.	
	It is key to note that the EclÁG (2018) does not include criteria for determining habitat suitability for a given species. Since habitat suitability is a key component of a magnitude of effects assessment, this will ideally be addressed in subsequent versions of the EclAG. In the interim, we set out proposed criteria below that applied to all impact and compensation scores in this model:  0 = Habitat not suitable	
Value score prior to Impact	< 1 = Marginal habitat that may be used but is not important for any part of the species or species assemblage life-cycle (s)	
	1 - <2 = Relatively low value habitat that provides some but not all of a species or species assemblages life-history requirements, and/or the habitat is of low quality, and the relative abundance within the habitat is low compared to other habitat types	
	2 - <3 = Relatively moderate value habitat that provides for most if not all of a species or species assemblages life-history requirements and/or the habitat quality is of moderate quality and the relative abundance within the habitat is moderate compared to other habitat types	
	3 - <4 = Relatively high value habitat that would typically provide for all species or species assemblage life-history requirements and/or provides a critical resource or resource(s) for life-history requirements. The habitat quality is high and the relative	

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

July 2021 Job No: 1007479.v5



	abundance within the habitat is, or is likely to be, high compared to other habitat types.
	4 - <5 = Relatively very high value habitat that provides for all species or species assemblage life-history requirements and/or provides a critical resource or resource(s) needed for life-history requirements. The habitat quality is very high and the relative abundance within the habitat is or is likely to be very high compared to other habitat types. Likely to be a local hotspot for that species 5 = Highest quality habitat and/or relative abundance for a given species or species assemblage, likely to be a regional hotspot or benchmark site with the species or species assemblage at carrying capacity. In instances where population densities or relative abundance appears higher in seemingly less suitable habitats than in more suitable habitats, this will need to be addressed and reflected in the relative value scores.
Value score after Impact	Data input: 0 Explanation: A value of 0 has been assigned because it is conservatively assumed that all habitat within the PSPA development footprint will be lost and/or no longer used by bats.
Habitat/site impacted	Moderate value habitat for bats within the development footprint (e.g. non-pasture vegetation that was not assessed as having high value for bats (Kessels and Baber, 2021)
Impact contingency (Value)	Data input: Very High value (the calculated impact score is multiplied by 1.15, i.e. 15%).
	Explanation: See above
Impact contingency (uncertainty)	Data input: High uncertainty (the calculated impact score is multiplied by 1.15 (+15%)
	Explanation: See above
Areal extent of impact (ha)	Data input: 34.36 ha
	Data input: 2
Value score <u>prior to</u> Impact	Explanation: Moderate value habitats within the PSPA development area have been assigned a score of 2 relative to the benchmark of 5, e.g., they are considered to equate to 40 % of the value of benchmark habitats. This assessment is based on the expert opinion of Gerry Kessels based on desktop and field investigations and using professional judgement
Value score <u>after</u> Impact	Data input: 0 Explanation: A value of 0 as it is conservatively assumed that all habitat within the PSPA development footprint will be lost either directly or indirectly (loss of connectivity)
Habitat/site impacted	Vegetation within the development footprint that was assessed as being of High value for bats, e.g. select non-riparian linear shelterbelts and groups of trees (Baber and Kessels, 2021).

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

Attachment 11

Hamilton City Council
Te kaunihera o Kirikiriroa

29

a inn	ut: Very High value	(the calculated	impact score is	multiplied by 1	15 i

Impact contingency (Value)	<b>Data input</b> : Very High value (the calculated impact score is multiplied by 1.15, i.e. 15%).
. ,	Explanation: See above
Impact contingency (uncertainty)	Data input: high uncertainty (the calculated impact score is multiplied by 1.15 (+15%)
(uncertainty)	Explanation: See above
Areal extent of impact (ha)	Data input: 3.09 ha
	Data input: 3.5
Value score <u>prior to</u> Impact	<b>Explanation</b> : Bat habitat within the PSPA development footprint assessed as having high value for bats has been assigned a score of 3.5 relative to the benchmark of 5, e.g., these habitats are considered to equate to 70 % the value of benchmark habitats. This assessment is based on the expert opinion of Gerry Kessels, based on desktop and field investigations and using professional judgement.
Value score <u>after</u> Impact	Data input: 0 Explanation: A value of 0 as it is conservatively assumed that all such habitat within the PSPA development footprint will be lost either directly or indirectly (loss of connectivity)
Compensation model inpu	uts
Compensation type 1	Indigenous revegetation of pasture habitat within river and gully margins, buffer habitat and ecologically corridors considered to be significant or likely significant (Kessels and Baber, 2021). It is assumed that native revegetation will be optimised for bat values through the deployment of artificial roost boxes as well as the planting of small numbers of fast-growing cavity forming exotic trees for roosting.
	Data input: 3%
Discount rate	<b>Explanation</b> : A discount rate of 3 % has been applied to account for the inherent risk in the temporal-lag between the impact occurring (due to the development) and the biodiversity gains being generated (due to the offset actions) has been used. The worked examples provided in the model User Manual apply a discount rate of 3 %, as informed by research conducted as part of the Department of Conservation's research project on biodiversity offsetting in New Zealand.
	Data input: 25 years.
Finite end-point	<b>Explanation</b> : The finite end-point of 25 years represents the time period over which to calculate Net Present Biodiversity value. This equates to the time between the commencement of a revegetation and an assessment of the associated benefits for the modelled biodiversity value.
Compensation	<b>Data input</b> : 'Moderate Confidence' (Calculated compensation gain is multiplied by

Tonkin & Taylor Ltd
Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Area
Hamilton City Council

0.825).

contingency (confidence)

July 2021 Job No: 1007479.v5



	Explanation: Compensation contingency relates to the level of confidence in the likely success of the proposed habitat restoration/enhancement measures and methodology (see above). This reflects that even well-established management methods sometimes fail to achieve targets for a multitude of reasons. The model does not consider confidence in the implementer of the proposed habitat restoration/enhancement activity. Nor does it consider likelihood of abandonment of the project post-impact but prior to the implementation of habitat restoration or enhancement measures.  'Moderate Confidence' equates to a well-known measure that is often implemented, and which has been proven to succeed greater than 75% of the time. However, complicating factors and/or expert opinion precludes greater confidence in this compensation measure. Likelihood of success is greater than 75% but less than 90%. Calculated compensation gain is multiplied by 0.825.
	NB: The approach used to assign contingency aligns with that used in Maseyk et al. (2015) except that the term 'offset' has been changed to 'compensation'.
	Data input: 65.27 ha
Areal extent (ha) of compensation type	<b>Explanation</b> : This equates to the available area of pasture outside the development footprint, which includes 13.74 ha in river and gully margins, 36.85 ha in bat habitat buffer areas and 15.9 ha within bat corridor areas (Kessels and Baber, 2021).
	Data input: 0.25
Value score <u>prior to</u> compensation measure (relative to benchmark)	Explanation: Pasture within these areas have been assigned a score of 0.25 relative to the benchmark of 5, e.g., they are considered to equate to 5 % the value of benchmark habitats. This assessment is based on the expert opinion of Gerry Kessels, based on desktop and field investigations and using professional judgement.
	Data input: 3
Value score <u>after</u> compensation measure (relative to benchmark)	<b>Explanation</b> : When the revegetation and associated habitat enhancement is 25 years old, it is assigned a value score of 3 against the Benchmark of 5. This assessment is based on the expert opinion of Gerry Kessels, based on desktop and field investigations and using professional judgement.
Compensation type 2	Mammalian pest control in perpetuity
Discount rate	Data input: 3%  Explanation: See above
	Data input: 1 year
Finite end-point	<b>Explanation</b> : The finite end-point of 1 years represents the time period over which to calculate Net Present Biodiversity value. This is based on the expectation that pest control will reduce predation risk on roosting bats almost immediately after commencement of pest control operations. It is assumed that the pest control programme will follow best practice methods for reducing predation risk to bats.

Tonkin & Taylor Ltd Preliminary Assessment of Ecological Effects - Peacocke Structure Plan Awa Hamilton City Council

Hamilton City Council

31

0.825).

Explanation: See above

Data input: 119.99 ha

Areal extent (ha) of compensation type

Compensation

contingency (confidence)

**Explanation**: This equates to all bat habitat (51.833 ha, bat habitat buffer (48.01 ha) and bat corridors (20.15ha), which are deemed to be or likely be ecologically significant (Kessels and Baber, 2021))

Data input: 'Moderate Confidence' (Calculated compensation gain is multiplied by

Data input:3.5

Value score <u>prior to</u> compensation measure (relative to benchmark)

**Explanation**: The existing vegetation within the compensation areas has been assigned a score of 3.5 relative to the benchmark of 5, e.g., they are considered to equate to 70 % the value of benchmark habitats. This assessment is based on the expert opinion of Gerry Kessels, based on desktop and field investigations and using professional judgement

Data input:3.75

Value score <u>after</u> compensation measure (relative to benchmark) **Explanation:** The existing tall stature habitat within the compensation areas has been assigned a score of 3.75, relative to the benchmark of 5 once under a pest control regime, i.e. relative to the benchmark a 5% gain in ecological value or the difference in the percentage of bats that are predated on by introduced predatory mammals). This assessment is based on the expert opinion of Gerry Kessels, based on desktop and field investigations and using professional judgement.

Table 5.3: PSPA bat habitat model outputs

Impact model outputs	Totals	Low value bat habitat	Moderate value bat habitat	High value bat habitat
Impact Score	-32.42	-31.026	-1.375	-0.019
Compensation model outputs	Totals	Revegetation	Pest Control	
Compensation Score	18.95	14.15	4.81	
Net gain outcome	-41.55 %			

### 5.4.1 Compensation options outside the PSPA

The compensation model outputs above indicate that the proposed 65.27 ha of revegetation and 119.99 ha of pest control within available habitat in the PSPA will be unlikely to achieve NNL/NG outcomes.

Through model iterations, it was determined that the following would be required in suitable bat habitat outside the PSPA to achieve NNL/NG outcomes with a reasonable degree of certainty $^8$  a Net Gain target of 20 % within 25 years:

- A further 140 ha of native revegetation; or
- 800 ha of intensive mammalian pest control (in perpetuity); or
- A lesser quantum of both would be required outside the PSPA within values that have high bat values.

We have further assessed the relative proportion of revegetation and pest control, and determined that this would require in the order of 60 hectares of native revegetation and 180 hectares of pest control within river or gully margins in the surrounding landscape.

July 2021 Job No: 1007479.v5

<sup>8</sup> Based on the arbitrary setting of a 20% Net Gain target.

Hamilton City Council
Te kaunihera o Kirikiriroa

33

# 6 Applicability

This report has been prepared for the exclusive use of our client Hamilton City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd
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Josh Markham

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Attachment 11



35

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# Appendix A: Waikato Regional Policy Statement – policies regarding biodiversity offset

The Waikato Regional Policy Statement (Waikato Regional Council, 2016) contains the following policies and methods which specifically address biodiversity offsetting and the achievement of no net loss of indigenous biodiversity:

#### Policy 11.1 Maintain or enhance indigenous biodiversity

Promote positive indigenous biodiversity outcomes to maintain the full range of ecosystem types and maintain or enhance their spatial extent as necessary to achieve healthy ecological functioning of ecosystems, with a particular focus on:

- a. working towards achieving no net loss of indigenous biodiversity at a regional scale;...
- ...j. the consideration and application of biodiversity offsets.

# Implementation Method 11.1.3 Avoidance, remediation, mitigation and offsetting (for indigenous biodiversity that is not significant)

Regional and district plans:

- a. for non-significant indigenous vegetation and non-significant habitats of indigenous fauna (excluding activities pursuant to 11.1.4)....
  - should promote biodiversity offsets as a means to achieve no net loss of indigenous biodiversity where significant residual adverse effects are unable to be avoided, remedied or mitigated.

## Policy 11.2 Protect significant indigenous vegetation and significant habitats of indigenous fauna

# Implementation Method 11.2.2 Protect areas of significant indigenous vegetation and significant habitats of indigenous fauna

Regional and district plans shall (excluding activities pursuant to 11.1.4):...

- d. where any adverse effects are unable to be avoided, remedied or mitigated in accordance with (b) and (c), more than minor residual adverse effects shall be offset to achieve no net loss; and...
- f. recognise that remediation, mitigation and offsetting may not be appropriate where the indigenous biodiversity is rare, at risk, threatened or irreplaceable; ...



# Appendix B: Offsetting overview

The definition of biodiversity offsets that has been adapted for and is most closely aligned with the Resource Management Act (RMA) (Maseyk et al. 2018) is:

A measurable conservation outcome resulting from actions designed to compensate for residual, adverse biodiversity effects arising from activities after appropriate avoidance, remediation, and mitigation measures have been applied. The goal of a biodiversity offset is to achieve no-net-loss, and preferably a net-gain, of indigenous biodiversity values. (Maseyk et al. 2018)

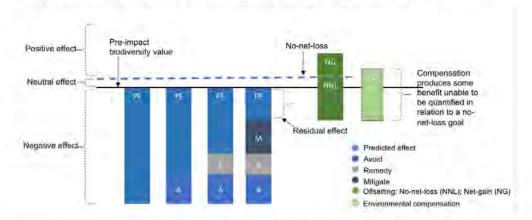


Figure Appendix B.1: Taken from Maseyk et al. 2018. Conceptual illustration of the effects management hierarchy progressing from avoidance (least risk and most certainty) to environmental compensation (greatest risk and least certainty) and showing the difference between a neutral 'no-net-loss' and positive 'net gain' outcome. The no-net-loss line is above the pre-impact biodiversity value as more gains than losses are required to achieve no-net-loss when accounting for uncertainty and time-lags.

Biodiversity offsetting is based on widely accepted principles, the most frequently-cited guiding principles for biodiversity offsetting are those developed by Business for Biodiversity Offsets Programme (BBOP) which includes principles on science, social, culture and policy matters (BBOP 2012). The BBOP principles are:

- Adherence to the mitigation hierarchy: A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimisation and on-site rehabilitation measures have been taken according to the mitigation hierarchy.
- 2 <u>Limits to what can be offset</u>: There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.
- 3 <u>Landscape context</u>: A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.
- 4 No net loss: A biodiversity offset should be designed and implemented to achieve in situ, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.

- Additional conservation outcomes: A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.
- Stakeholder participation: In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.
- 7 Equity: A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.
- 8 <u>Long-term outcomes</u>: The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity.
- 9 Transparency: The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
- 10 <u>Science and traditional knowledge</u>: The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

The intention of the New Zealand Government Guidance (NZ Guidance; https://www.doc.govt.nz/about-us/our-policies-and-plans/guidance-on-biodiversity-offsetting/) was to ensure that solutions addressing residual effects are ecologically sound and demonstrably result in no net loss or a net gain. The NZ Guidance is contextually related to Goal 3 of the New Zealand Biodiversity Strategy (2000), which is to halt the decline in New Zealand's indigenous biodiversity. Although the NZ Guidance is not a statutory document it is a valuable tool for the design and assessment of ecologically sound management of adverse effects and reflects the relevant government departments' view on biodiversity offsetting. It is supported by additional resources that provide more detail on the design, implementation and assessment of biodiversity offsets.

In 2018 the Regional Councils BioManagers Group released its guidance 'Biodiversity Offsetting under the Resource Management Act' (Maysek et al. 2018). The purpose of this Local Government Guidance (LG Guidance; https://www.lgnz.co.nz/our-work/our-policy-priorities/3-environment/biodiversity/) is to provide councils and resource consent applicants with guidance on applying biodiversity offsets under the RMA. The document draws on international best practice informed by BBOP and was designed to be consistent with the NZ Government Guidance.

Several of the BBOP principles, especially those regarding cultural values and knowledge, stakeholder consultation, and the effects management hierarchy are already embedded within the RMA. However several principles are not embedded in the RMA but are of key importance in designing an offset proposal (Appendix B Table 1).



Appendix B Table 1: Principles of biodiversity not explicitly captured in the RMA

Principle	Explanation (paraphrased from Maseyk et al. 2018)
Limits to offsetting	Many biodiversity values are not able to be offset, and if they are impacted then they will be permanently lost. This principle reflects a standard of acceptability for offsetting, and offsetting should not be seen as a pathway to allow uncompensated losses.
No net loss	The goal of a biodiversity offset is a measurable outcome that can reasonably be expected to result in no net loss, and preferably a net gain of biodiversity. A no-net-loss outcome requires that at a specified point in time biodiversity values will be returned to the point they would have been if the impact and offset had not occurred.
Landscape context	The design of a biodiversity offset should consider the landscape context of both the impact site and the offset site, taking into account interactions between species, habitats, and ecosystems, spatial connections, and system functionality.
Ecological equivalence	Ecological equivalence describes the degree to which the biodiversity gain attributable to an offset is <u>balanced</u> with the biodiversity losses due to development across type, space, and time; and therefore, whether the exchange achieves <u>no net loss</u> . Typically, achieving ecological equivalence will require a "like-for-like" exchange (same type of biodiversity). Demonstrating ecological equivalence differentiates biodiversity offsetting from environmental compensation.
Additionality	A biodiversity offset must achieve gains in biodiversity above and beyond gains that would have occurred anyway in the absence of the offset.
Permanence	The biodiversity benefits at an offset site should be managed to secure outcomes that last at least as long as the impacts and preferably in perpetuity.

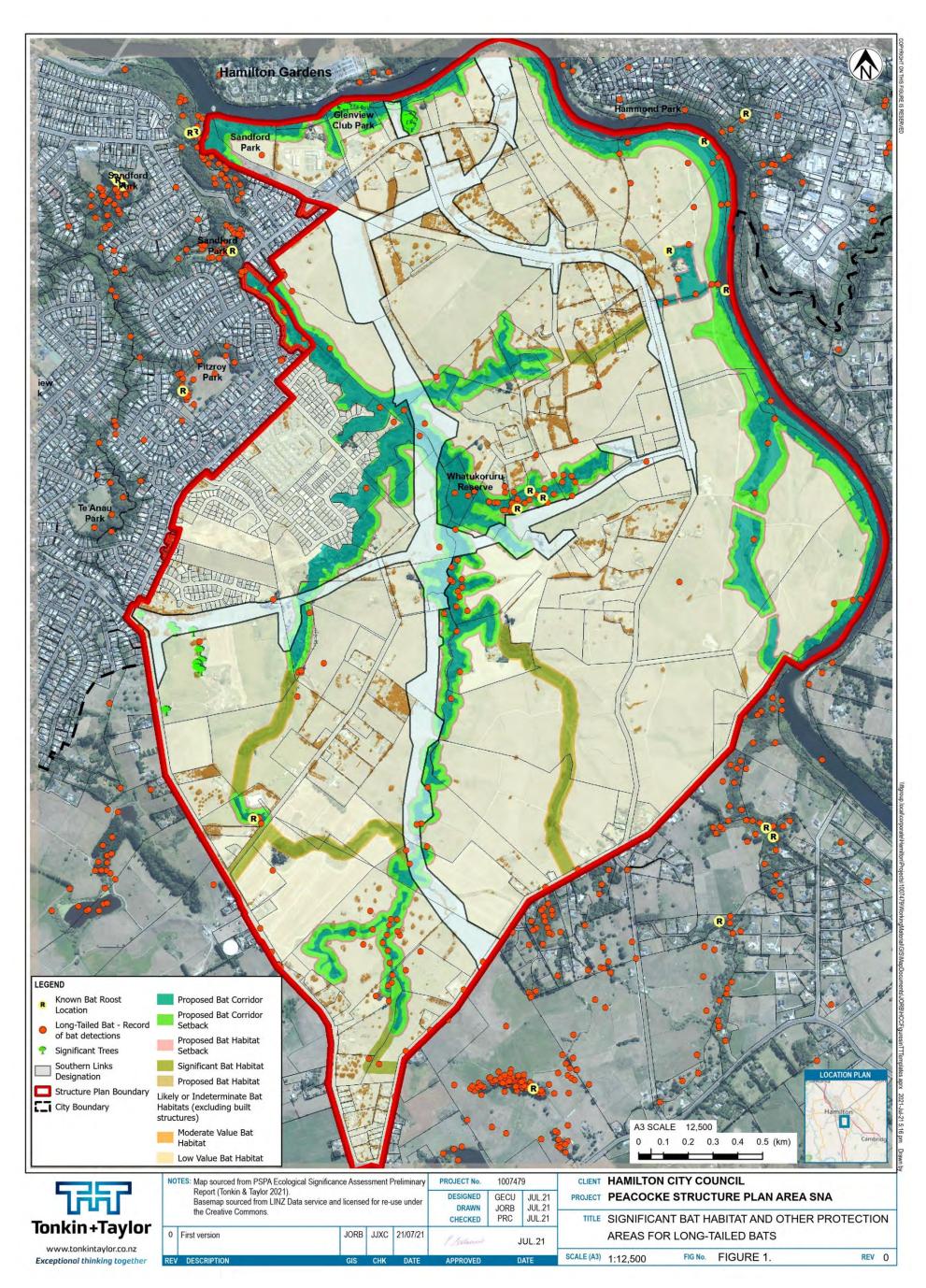
The principle of following the mitigation (effects management) hierarchy before applying biodiversity offsets or environmental compensation is fundamental to biodiversity outcomes when it is lost to subdivision and other development. The RMA does not explicitly require the application of the 'mitigation hierarchy' and provides no preference between avoid, remedy, mitigate. However, the principle is advocated by BBOP, internationally accepted as good practice and is increasingly being incorporated into statutory planning instruments across New Zealand, including within Policy 11.2.2 of the operative Waikato Regional Policy Statement (WRPS). The Hamilton District Plan requires offsets to be used as a tool through Rule 24.3.3(d); "The amount of money and/or land needed to offset any adverse environmental effects including river and gully restoration that cannot otherwise be avoided, remedied or mitigated."

Thus biodiversity offsetting or compensation should be applied only *after* measures have been undertaken to avoid, remedy and mitigate adverse effects (Figure 1, Appendix C). This ensures that offsets or compensation are not inappropriately used to address adverse effects that could otherwise be managed earlier in the hierarchy. It also reduces the level of risk, scale of ongoing management and uncertainty of achieving no net loss, especially associated with compensation measures.



# Appendix C: Figure

Hamilton City Council
Te kaunihera o Kirikiriroa





Appendix D: Ecological Impact Assessment

**Guidelines Tables** 



## Appendix D Table 1: Biodiversity values assigned to species (adapted from EIANZ, 2018)

Value	Species values
Very high	Nationally Threatened - Endangered, Critical or Vulnerable.
High	Nationally At Risk – Declining.
Moderate-high	Nationally At Risk - Recovering, Relict or Naturally Uncommon.
Moderate	Not Nationally Threatened or At Risk, but locally uncommon or rare.
Low	Not Threatened Nationally, common locally.

## Appendix D Table 2: Biodiversity values assigned to habitats (adapted from EIANZ, 2018)

Matters	Attributes to be considered
Representativeness	Attributes for representative vegetation and aquatic habitats:
	Typical structure and composition
	Indigenous species dominate
	Expected species and tiers are present
	Attributes for representative species and species assemblages:
	Species assemblages that are typical of the habitat
	Indigenous species that occur in most of the guilds expected for the habitat type.
Rarity/	Attributes for rare/distinctive vegetation and habitats:
distinctiveness	Naturally uncommon, or induced scarcity
	Amount of habitat or vegetation remaining
	Distinctive ecological features
	National priority for protection
	Attributes for rare/distinctive species or species assemblages:
	Habitat supporting nationally Threatened or At Risk species, or locally uncommon species
	Regional or national distribution limits of species or community
	Unusual species or assemblages
	Endemism.
Diversity and	Level of natural diversity, abundance and distribution
Pattern	Biodiversity reflecting underlying diversity
	Biogeographical considerations – pattern, complexity
	Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation.
Ecological context	Site history, and local environmental conditions which have influenced the development of habitats and communities
	The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA)
	Size, shape and buffering
	Condition and sensitivity to change
	Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material
	Species role in ecosystem functioning – high level, key species identification, habita as proxy.

Attachment 11



#### Appendix D Table 3: Scoring for sites or areas combining values for four matters in (Appendix D Table 2)

Value	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in Appendix D Table 4. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or Area rates High for 1 of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Low or Very Low for remainder.

#### Appendix D Table 4: Criteria for describing magnitude of effect (EIANZ, 2018)

Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features/ of the existing baseline <sup>1</sup> conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR
	Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR
	Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR
	Having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating the 'no change' situation; AND/OR
	Having negligible effect on the known population or range of the element/feature.

<sup>&</sup>lt;sup>1</sup>Baseline conditions are defined as 'the conditions that would pertain in the absence of a proposed action' (EIANZ, 2018).



## Appendix D Table 5: Timescale for duration of effects (EIANZ, 2018)

Timescale	Description
Permanent	Effects continuing for an undefined time beyond the span of one human generation (taken as approximately 25 years).
Long-term	Where there is likely to be substantial improvement after a 25 year period (e.g. the replacement of mature trees by young trees that need > 25 years to reach maturity, or restoration of ground after removal of a development) the effect can be termed 'long term'.
Temporary <sup>1</sup>	Long term (15-25 years or longer – see above)  Medium term (5-15 years)  Short term (up to 5 years)  Construction phase (days or months).

<sup>&</sup>lt;sup>1</sup>Note that in the context of some planning documents, 'temporary' can have a defined timeframe.

# Appendix D Table 6: Criteria for describing overall levels of effects on biodiversity values (EIANZ, 2018)

Biodiversity value (Appendix D Table 2)  Magnitude (Appendix D Table 4)	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Attachment 11

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REPORT

# **APPENDIX L**

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Attachments Page 1233



# **Table of contents**

1	Intro	duction		3		
	1.1	Backgrou	und and context	3		
	1.2	Report p	urpose and scope	6		
2	Meth	odology		6		
	2.1	Backgrou	und	6		
	2.2	Determi	nation of candidate sites	6		
	2.3	Candidat	te site assessments	7		
	2.4	Significa	nce assessment and relative level of significance	7		
	2.5	Qualifying Threshold Criteria relevant to PSPA				
		2.5.1	Determining significant habitats for nationally at-risk, threatened species	, or		
			regionally rare species (Criterion 3)	9		
		2.5.2	Determination of under-representation (Criterion 4)	10		
		2.5.3	Determination of significant wetland habitat (Criterion 6)	10		
		2.5.4	Determination of aquatic habitat that is critical to an indigenous species			
			(Criterion 8)	11		
		2.5.5	Determination of habitat that provides ecological corridors or buffers			
			(Criterion 11)	11		
	2.6	Assignme	ent of significance categories for each candidate site	11		
	2.7	Confider	nce levels	12		
3	Ecolo	gical Conf	text	12		
	3.1		us Vegetation Communities	12		
	3.2		ly Threatened Land Environments	13		
4	Ecolo	gical Sign	ificance Assessment	15		
	4.1	Extent of	f ecologically significant areas	15		
	4.2	Terrestri	al Indigenous Plant Communities	20		
	4.3		nt vascular plant species	20		
	4.4	Ecologically significant wetlands & habitats of freshwater indigenous fauna				
	4.5		ally significant habitat for indigenous fauna	24		
		4.5.1	Invertebrates	24		
		4.5.2	Fish	24		
		4.5.3	Lizards	24		
		4.5.4	Birds	25		
		4.5.5	Long-tailed bat habitats	25		
		4.5.6	Protection of long-tailed bat habitat	28		
5	Concl	usion & r	ecommendations	30		
6	Appli	cability		31		
7		-	Bibliography	32		
Appe	ndix A	:	Key Source Literature & Databases			
Appendix B :			Confidence Level Definitions			
Appe	Appendix C :		Nationally At Risk and Threatened Species Lists			

Tonkin & Taylor Ltd Peacocke Structure Plan Area: Ecological Significance Assessment Hamilton City Councill



# **Executive summary**

Tonkin & Taylor Ltd (T+T) has been engaged by Hamilton City Council (HCC) to undertake an assessment of significance of indigenous biodiversity within the Peacocke Structure Plan Area (PSPA) against the criteria for determining significance of indigenous biodiversity set out in Section 11A of the Waikato Regional Policy Statement (WRPS).

The assessment will assist the plan change process to support a land use change from rural and semirural to intensive residential and commercial uses in the PSPA. This assessment is informed in part by the PSPA bat report (Mueller et al. 2021). Collectively, the assessment and bat report contribute to the PSPA Biodiversity Management Framework (Baber and Kessels, 2021), which seeks to assist with achieving No Net Loss outcomes for indigenous biodiversity values across the PSPA and surrounding landscape.

In 2012 HCC identified several significant natural areas (SNAs) within the PSPA based primarily on the presence of significant indigenous vegetation (Cornes *et al.*, 2012). However, we understand that the 2012 study did not assess potentially significant habitats for indigenous fauna or all wetlands.

Ecological surveys indicate that a number of animals listed as nationally 'At Risk' or 'Threatened', notably the 'Nationally Critical' long-tailed bat, use a range of habitats in the PSPA as part of their habitat requirements. This habitat can include exotic vegetation such as willows or exotic pine species in gully, wetland, shelter belt, stream or river edge habitat. Indigenous animals, particularly long-tailed bat, can rely on such exotic habitats as essential components of their life cycles, for breeding, moving through the landscape between core habitats, since indigenous vegetation is so depleted within this landscape. This exotic habitat will therefore be used even if it is of marginal quality. The WRPS ecological significance criteria do not differentiate between indigenous and exotic plants as habitat for these native animals.

To assess significance of indigenous biodiversity in the PSPA, we:

- Conducted a desktop review of all available information within the PSPA and immediate surrounds, including recent bat studies in the locality, along with a review of up-to-date aerial imagery; and
- Assessed the proposed sites against the WRPS ecological significance criteria for each site, along with maps and associated data shapefiles identifying those sites.

The Mangakōtukutuku Gully and Waikato River margin areas comprise a mixture of indigenous and exotic vegetation. These areas provide important habitat for the nationally threatened long-tailed bat and many indigenous bird and fish species. Consequently, a number of areas of indigenous vegetation or habitats within the PSPA have been identified in this assessment as significant habitat for indigenous biodiversity. This includes areas that provide existing habitat for indigenous fauna and areas that are critical for protecting the long-term viability of such through the maintenance of ecologically connectivity, i.e., ecological corridors.

Key findings associated with this ecological significance assessment are that:

- 1 The analysis has identified an increase in extent of ecologically significant habitats compared to those identified as SNAs in the operative District Plan. These areas now collectively include habitats of significant indigenous fauna, as well as significant indigenous vegetation and wetlands.
- 2 Areas identified as ecologically significant include those that currently provide significant indigenous vegetation or habitat for significant indigenous fauna, and areas considered critical to the long-term persistence of these significant habitats through buffering and/or the maintenance of ecologically connectivity in the landscape (particularly for long-tailed bats).

Tonkin & Taylor Ltd

Peacocke Structure Plan Area: Ecological Significance Assessment

Hamilton City Council

July 2021 Job No: 1007479.0040.v4

JOD NO: 1007479.0040.V4



3 Ecological knowledge of the PSPA is incomplete. Planning mechanisms need to acknowledge and account for incomplete scientific knowledge and incorporation of new information which may alter the results of the ecological significance analysis presented in this report.

Attachments



1 Introduction

### 1.1 Background and context

Tonkin & Taylor Ltd (T+T) has been engaged by Hamilton City Council (HCC) to undertake an assessment of significance for indigenous biodiversity within the Peacocke Structure Plan Area (PSPA). The assessment will provide technical information for the plan change process to support a land use change from rural and semirural to intensive residential and commercial uses in the PSPA. The assessment is informed by the PSPA bat report (Mueller *et al.*, 2021) and other literature and databases relating to indigenous biodiversity values in the PSPA area and immediate surrounds. In turn, these documents contribute to the PSPA Biodiversity Management Framework (Baber & Kessels, 2021), which seeks to assist with intended No Net Loss objectives for indigenous biodiversity values across the PSPA and surrounding landscape.

The PSPA comprises approximately 750 ha of rural land on the southern fringe of Hamilton and was initially zoned in 2007 to provide a framework for guiding urban development (Figure 1.1). The Peacocke Structure Plan (PSP) was originally developed in 2009 to provide a framework for guiding development within the PSPA. The PSPA is Hamilton City's primary growth area and when fully developed, is likely to accommodate up to 7,500 homes.

HCC is currently reviewing the PSP to address changes in the infrastructure needs of the city in this locality and to accommodate changes in the policy framework to which the PSP must adhere. This framework includes a requirement to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna (section 6(c) Resource Management Act 1991) in accordance with the criteria for determining significance of indigenous biodiversity set out in Section 11A (Table 11-1) of the Waikato Regional Policy Statement (WRPS) (herein 'WRPS criteria'). These criteria are set out in Table 2.1.

We understand the structure plan process will then consider the further protection or management of areas assessed as being ecologically significant as part of this analysis (over and above land already set aside for amenity or conservation purposes, such as esplanade reserves and stormwater wetlands, as well as other areas for urbanisation or infrastructure already consented). For example, areas that will be used for roading and ecological mitigation associated with the Southern Links designation have not been mapped in this assessment, but these areas will require coordinated consideration during the plan change process.

The PSPA presently includes four Significant Natural Areas (SNAs) already identified in the Operative Hamilton City District Plan:

- SNA 56 is situated within the mid-lower section of the Peacocke's Mangakōtukutuku subcatchment:
- SNA 55 is situated within the Te Anau sub catchment; and
- SNA 48 and SNA 54 are located within the Waikato River corridor.

Other SNAs have been identified by the Waikato Regional Council in neighbouring districts outside the PSPA (Figure 1.1).

The existing SNAs were identified as having significant ecological character or value based primarily on indigenous vegetation. However, the PSPA has yet to be assessed against the WRPS criteria relating to significant habitat for fauna or for all wetland types.

The identification and protection of these areas of significant habitat for indigenous fauna is particularly important for the long-term persistence of the nationally 'Threatened' long-tailed bat (*Chalinolobus tuberculatus*) given that it has a threat status of 'Nationally Critical', i.e. the highest possible threat category. Furthermore, because long-tailed bats are a highly mobile, wide-ranging

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Peacocke Structure Plan Area: Ecological Significance Assessment

Hamilton City Council

species and use a diversity of habitat types, this species also serves as an 'umbrella species' whereby efforts to address effects on bats also serve to protect all or most other biodiversity values in the landscape.

Figure 1.1 shows the current extent of SNAs within the HCC boundary (red), as well as within Waipa District (orange) and Waikato District (yellow). The map indicates that SNA assessments in the adjacent Waipa and Waikato districts include a number of gully, stream and river margins identified as significant because of the significant indigenous fauna habitats they provide.

Attachment 12

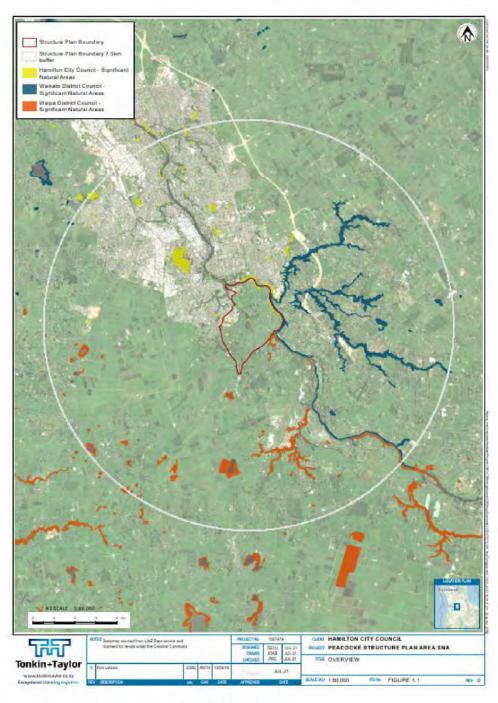


Figure 1.1: Previously mapped SNAs in relation to the PSPA.

Tonkin & Taylor Ltd Peacocke Structure Plan Area: Ecological Significance Assessment Hamilton City Council July 2021 Job No: 1007479.0040.v4



#### 1.2 Report purpose and scope

This report provides an assessment of significance for indigenous biodiversity to inform HCC's plan change process for the PSPA. The report will assist HCC with policy and rule development as it relates to Council's obligations under section 6(c) of the Resource Management Act 1991 (RMA), and associated policies and objectives of both the Operative Hamilton City District Plan and the Waikato Regional Policy Statement (WRPS). This assessment contributes directly to the PSPA Biodiversity Management Framework (Baber & Kessels, 2021), which seeks to assist with intended No Net Loss objectives for indigenous biodiversity values across the PSPA and surrounding landscape.

For this assessment, this report presents the findings of:

- A desktop review of available ecological information within the PSPA and immediate surrounds along with a review of up-to-date aerial imagery to identify potential candidate sites for further assessment; and
- An assessment of the ecological values of each candidate site against the WRPS ecological significance criteria (Table 2.1).

#### 2 Methodology

#### 2.1 **Background**

While the WRPS ecological significance criteria set out the ecological matters to be considered for the determination of significance, a methodology, including 'qualifying threshold criteria', is required to provide a robust and transparent framework for this assessment.

Previous SNA assessments for Waikato Regional Council (WRC) and other territorial authorities have developed best practice which is appropriate for the Waikato region (e.g. Kessels et al, 2010; van der Zwan & Kessels, 2017). WRC has also provided guidelines to allow interpretation of the WRPS significance criteria. Specifically, in 2002, WRC produced guidelines to assist with the application of assessment criteria and the determination of relative importance (or value) of each SNA (WRC and Wildland Consultants, 2002). A recently updated version of these guidelines (WRC and Wildland Consultants, in prep.) has also been used to assist in the determination of ecological significance and relative importance of ecologically significant areas for this study. While these guidelines have no legal status, they are helpful in the assessment of ecological significance as applied in this instance.

In addition, the draft National Policy Statement on Indigenous Biodiversity (NPS-IB, 2019) was also used to inform the determination of thresholds for ecological significance within the PSPA.

#### 2.2 **Determination of candidate sites**

Available literature, databases and maps were reviewed to identify candidate sites for subsequent assessment of ecological significance (i.e. potentially significant sites). A list of key information sources used for this literature review is provided in Appendix A. GIS shapefile data of the previously mapped HCC SNA sites and orthorectified aerial imagery of the PSPA was provided by WRC.

A series of spatial datasets were overlaid on the PSPA to provide a combined dataset. Vegetation coverage was established using three key tools; orthorectified aerial photography. Land Information New Zealand (LINZ) topographic spatial data and the draft WRC Biodiversity Validation dataset (BIOVEG, 2017), to establish preliminary polygon boundaries. In addition, all vegetation (exotic and indigenous) was differentiated by spatial analysis using Aerial Photography, ArcGIS, and google earth imagery.

Normalised Difference Vegetation Index raster generation was used to obtain a vegetation mapping layer for the PSPA. Definitions and examples of vegetation/habitat structural classes and broad

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vegetation types are as defined in Atkinson (1985). Indigenous vegetation type classifications were classified based on Singers and Rogers (2014), where applicable.

For the purposes of this project the minimum mapping unit was 0.05 ha  $(500 \text{ m}^2)$  per individual polygon, rounded to the nearest 0.01 ha  $(100 \text{ m}^2)$ . Areas of indigenous vegetation or habitats smaller than 0.05 ha were not mapped or assessed unless such areas were determined to have a significance level of at least "Regional" (see Section 2.4).

## 2.3 Candidate site assessments

The information on each candidate site was then collated to inform the subsequent assessment of ecological significance.

Attribute data for each candidate site were presented in the form of an Excel spreadsheet to collate site description and significance assessment information. This spreadsheet (hereafter referred to as the 'Master dataset') included the following information to inform the assessment of each site:

- Site name and number;
- Protection status:
- Land Environments classification;
- Pre-European vegetation cover, recent vegetation cover and vegetation history;
- Ecological District Bioclimatic Zone;
- Aerial map and oblique photography review;
- Area (ha) and mid-point grid reference;
- Where available, source literature references for ecological information;
- Nationally 'Threatened' and/or 'At-risk', or regional rare or endemic fauna and flora known or likely to be present within the area assessed as ecologically significant;
- WRPS significance criteria met or likely to be met;
- Other distinctive features;
- Relative significance (i.e. either international, national, regional, local or 'not significant') and level of confidence (see section 2.6 below); and
- Explanation/justification.

The methodology used for each key stage, including assessment of each candidate site against the WRPS significance criteria (Table 2.1), is described in more detail in the sections below.

# 2.4 Significance assessment and relative level of significance

In determining whether a site is significant in terms of section 6(c), ecologists apply a set of criteria in conjunction with professional judgement. The following section outlines the approach used when determining a suitable qualifying threshold for ecological significance of candidate sites within the PSPA.

Each candidate site was assessed to determine its significance in relation to Section 6(c) of the RMA and to assign a relative level of significance in a Waikato region context. Relevant attributes were completed in the Master Dataset.

To determine whether a candidate site was significant, the following 11 criteria defined in Section 11A of the WRPS were used to identify areas of significant indigenous biodiversity and their characteristics as they existed when the criteria were applied.

Tonkin & Taylor Ltd

Peacocke Structure Plan Area: Ecological Significance Assessment

Hamilton City Council

July 2021 Job No: 1007479.0040.v4



Criteria may be specific to a habitat type including water, land or airspace or be more inclusive to address connectivity, or movement of species across habitat types.

A site was considered significant if at least one of the criteria were met.

Table 2.1: Criteria for determining significance of indigenous biodiversity Waikato Regional Policy Statement (Table 11-1 WRPS)

Crit	eria
1	It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Ngā Whenua Rāhui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.
2	In the Coastal Marine Area, it is indigenous vegetation or habitat for indigenous fauna that has reduced in extent or degraded due to historic or present anthropogenic activity to a level where the ecological sustainability of the ecosystem is threatened.
3	It is vegetation or habitat for indigenous species or associations of indigenous species that are:  classed as threatened or at risk, or endemic to the Waikato region, or at the limit of their natural range.
4	It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.
5	It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, chenier plain, or karst ecosystems, hydrothermal vents or cold seeps.
6	It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities) that has not been created and subsequently maintained for or in connection with:  Waste treatment;  Wastewater renovation;  Hydro-electric power lakes (excluding Lake Taupō);  Water storage for irrigation; or  Water supply storage; unless in those instances they meet the criteria in Whaley et al. (1995).
7	It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type. Note this criterion is not intended to select the largest example only in the Waikato region of any habitat type.
8	It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self-sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.

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# Criteria It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because: • its structure, composition, and ecological processes are largely intact; and if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. stock discharges, erosion, sediment disturbance), can maintain its ecological sustainability over time. It is an area of indigenous vegetation or habitat that forms part of an ecological sequence, that is 10 either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type. It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either 11 naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse

Whaley et al. (1995) listed the following core ecological concepts which should be considered when determining ecological significance across all of the relevant WRPS criteria listed above:

- Representativeness: How representative is the area of the full range of ecological diversity in the present natural landscape?;
- Diversity and pattern: What is the diversity of the ecological units and pattern of vegetation types represented?;
- Rarity/special features: Presence of locally or nationally threatened species or ecosystems;
- Naturalness/intactness: Extent of indigenous species and natural communities in the area;
- Size and shape: Influence of size and shape of the area on ecological viability;
- Inherent ecological viability/long-term sustainability: Will the features of the area maintain themselves in the long-term?;
- Buffering/surrounding landscape/connectivity: Extent to which an area is buffered from modifying influences. Distance from modifying influences and other natural areas;
- Fragility and threat: Threat process and agents, effects of proposed modification; and
- Management input: Nature and scale/intervention necessary & restoration potential.

The application of these core concepts to determine qualifying thresholds for key WRPS criteria is described in further detail below.

## 2.5 Qualifying Threshold Criteria relevant to PSPA

# 2.5.1 Determining significant habitats for nationally at-risk, threatened species, or regionally rare species (Criterion 3)

Relevant species for the assessment of this vegetation or habitat include those that are 'Threatened' or 'At Risk' within the New Zealand Threat Classification System (Townsend *et al.* 2008) or those that are regionally rare species in the Waikato Region (Overdyck, 2019). As part of the ecological significance assessment process, past records of threatened indigenous fauna species were reviewed. However, many species, such as NZ kākā and NZ falcon, are only occasional users of the PSPA area as part of their vast home ranges; their occasional presence in highly modified habitat is therefore not considered sufficient to assign WRPS criterion 3 and hence to assess an area as ecologically significant.

Tonkin & Taylor Ltd

Peacocke Structure Plan Area: Ecological Significance Assessment

Hamilton City Council

Attachments

July 2021 Job No: 1007479.0040.v4

Other fauna species, such as the long-tailed bat, regularly use or are dependent on the PSPA throughout the year. Qualifying thresholds are required to determine which areas or habitats are significant and which are not, often on the basis of an incomplete understanding of the animals' usage of this landscape (see below). Importantly, the significance of a habitat for 'Threatened' or 'At Risk' species is often heavily dependent on ecological context i.e., all else being equal, similar habitat types may differ markedly in their significance for 'Threatened' or 'At-Risk' species based on surrounding landuse dynamics and ecological connectivity.

Mueller et al. (2021) has determined habitat for bats based on where bat home ranges and core areas were located, combined with known roost sites. Where data was lacking, mature exotic tree shelterbelts and stands likely to provide habitat were included, both within and adjacent to the PSPA. This dataset has been used to assist in the assessment of significant habitats for long-tailed bats within the PSPA.

Some indigenous plant species which are otherwise common in the wider landscape or ecological region/district are listed as nationally 'Threatened' or 'At Risk' due to the threat posed by myrtle rust, which can infect species in the Myrtaceae family. The presence of these species alone will not necessarily trigger criterion 3 in this assessment. However, given the rarity of kānuka forest (and in fact any indigenous forest remnant) in the Hamilton ED, kānuka forest triggers criterion 4 because it is considered significant as an under-represented vegetation community type (rather than because of its 'At-Risk' status due to myrtle rust).

#### 2.5.2 Determination of under-representation (Criterion 4)

Criterion 4 of the WRPS significance criteria requires assessment of ecosystem types that are underrepresented (20% or less of it is known or likely original extent remaining) in an Ecological District, Ecological Region, or nationally (Singers & Rogers 2014).

#### 2.5.3 Determination of significant wetland habitat (Criterion 6)

For the purpose of this assessment for the PSPA, criterion 6 of the WRPS significance criteria has been used to determine ecologically significant wetlands in relation to section 6c of the RMA. These wetlands include Riverine, Palustrine and Ephemeral Spring or Seep wetlands<sup>1</sup>.

We determined what constitutes a significant wetland following the approach used by Whaley et al. (1995). Generally, wetlands were determined to be significant where it was apparent that indigenous wetland vegetation formed the predominant vegetation cover and/or it was known habitat for aquatic or wetland indigenous fauna species.

Determination of wetland presence and extent requires implementation of the Ministry for the Environment (MfE) wetland delineation protocols (MfE, 2020). Additionally, determination of what constitutes a 'natural wetland' is defined by the National Policy Statement for Freshwater Management (NPS-FM). We consider not all 'natural wetlands' as defined by the NPS-FM are significant as assessed against criterion 6, which requires its own assessment. Determination of wetland presence, extent, and significance, in many instances cannot be verified or detected based on desktop analysis of aerial photography. Wetland determination would require specific field surveys to validate and/or improve certainty of this desk-top assessment. Also of key importance, we note that the National Environmental Standards Freshwater 2020 regulations may significantly constrain development in or near to wetlands regardless of wetland values.

<sup>&</sup>lt;sup>1</sup> Wetland definitions are as defined by Johnson, P. & Gerbeaux, P. 2004. Wetland Types in New Zealand. Science & Research Unit, Science Technology and Information Services, Department of Conservation, Wellington



2.5.4 Determination of aquatic habitat that is critical to an indigenous species (Criterion 8)

Criterion 8 requires an assessment of aquatic habitat<sup>2</sup> (excluding certain artificial water bodies,) that is critical to the self-sustainability of an indigenous species within a catchment of the Waikato Region, or within the coastal marine area. In this context 'critical' means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.

The application of this criterion in relation to the PSPA focussed on the aquatic habitats of Mangakōtukutuku Gully Stream and the Waikato River, both of which provide critical habitat for the life-cycles of a number of freshwater fish species (refer to section 4.5.2 for a summary of the fish species found within waterways within or adjacent to the PSPA).

# 2.5.5 Determination of habitat that provides ecological corridors or buffers (Criterion

Ecological buffers and corridors are required within the PSPA to protect ecologically significant habitats for a number of indigenous fauna species, most importantly for long-tailed bats (Mueller et al., 2021). The adverse effects of urbanisation associated with the PSPA are the primary trigger for criterion 11 requiring consideration within the PSPA ecological significance assessment. With respect to protecting significant habitat for long-tailed bats within the PSPA, the Mueller et al. (2021) report recommends:

- buffering of key habitat features (such as the Waikato River and Mangakōtukutuku Gully) to protect these key habitats and to create foraging and commuting habitats; and
- creating bespoke 'bat' corridors to link key bat habitats through urban areas and to also create additional habitat.

#### 26 Assignment of significance categories for each candidate site

For each criterion, each candidate site was assessed as either:

- "Significant", because there was sufficient evidence for the site to trigger at least one of the 11 WRPS significance assessment criteria (Table 11-1 – WRPS);
- "Likely" to be significant where the information available indicated the site had a high likelihood of meeting one or more of the 11 criteria, but where this needed to be verified with more information, such as from field surveys;
- "Indeterminate" where there was insufficient information to determine if the site could meet any of the 11 criteria, or be classified in the "Likely" or "Not significant" categories. More information is needed for these sites, preferably from a field survey if possible; or
- "Not significant" where, based on the information available, it was certain that the site did not meet any of the 11 criteria.

The assessment of each criterion followed Table 2.1 of "Guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region" (WRC and Wildland Consultants, 2019 - in prep.). If a site was found to be significant, then it was further assessed to determine a level of significance, i.e. "International", "National", "Regional", or "Local", following Table 2.1 of these guidelines.

Tonkin & Taylor Ltd Peacocke Structure Plan Area: Ecological Significance Assessment Hamilton City Council

July 2021

Job No: 1007479.0040.v4

<sup>&</sup>lt;sup>2</sup> 'Aquatic habitat' in this context includes habitat within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins.



#### 2.7 Confidence levels

Since this assessment was based on desktop information rather than on detailed investigations, it was important to distinguish between those sites that were expected or likely to be assessed as ecologically significant based on field investigations, versus those sites that were unlikely to be significant. This distinction in categories recognises that this may change as further information comes to light.

Confidence levels are applied to reflect the quality and quantity of information available for a given site. For each area deemed to be ecologically significant, a confidence level is applied to each criterion depending on the degree of information available. Assigned confidence levels are:

- High well-researched sites, where ecological information about the site is comprehensive, reliable, applicable and/or recent, and site specific;
- Medium Ecological information about the site is relatively comprehensive, reliable, not entirely applicable/recent, and/or more likely to be general than site-specific, e.g. the information applies to a larger tract of indigenous vegetation, of which the site is a relatively small part; and
- Low sites with little available ecological information. Information is not comprehensive, is unreliable, out-dated or general.

Sites with lower confidence levels, e.g. most sites on private land, are higher priority for field surveys than those with higher confidence levels. The qualifying thresholds for confidence levels are defined in Appendix B.

#### 3 **Ecological Context**

#### 3.1 **Indigenous Vegetation Communities**

The PSPA is situated within the Hamilton Ecological District (ED). Within this flat to gentle rolling hill landscape, low mounds or ridges of alluvial plains emerge by moderately to well-drained alluvium from the Hinuera formation which predominantly supported mixed conifer-broadleaf forest. In shallow depressions or swales the alluvium has more silt and clay and the poorer drainage in these soils created boggy areas that were dominated by kahikatea semi-swamp forests. In lower terraces beside the Waikato River, the alluvium has more sand and gravel and is better drained. These well drained areas suited totara-matai-kowhai forest types (Clarkson et al., 2007). Very few peat areas are situated in the PSPA, but areas of poorly drained gley-soils, as well as the small areas of peat historically hosted a range of vegetation types including submerged vegetation, swamp forest, sedgelands, shrublands and restiad bogs (Clarkson et al., 2007).

As Cornes et al. (2012) states:

"Hamilton City, at 11,080 ha, makes up 7.0% of the 159,375 ha of Hamilton Ecological District (ED). Hamilton ED is confined to the Hamilton Basin with some of the surrounding hills and foothills included (McEwen, 1987). Leathwick et al. (1995) found less than 2% of natural vegetation that once existed in the ecological district pre 1840s still remains. Wetlands and conifer forests were the dominant ecosystems of Hamilton ED before human settlement (Harding, 1997). These two ecosystems also suffered the highest percentage reduction through anthropogenic activities. All past vegetation types are less than 2% cover within the district."

Gullies are a feature of Hamilton City. It is estimated that these were formed about 15,000 years ago through a process called 'spring sapping'. As the Waikato River cut down into its banks, small streams were exposed which eroded steep-sided troughs that eventually became Hamilton's gully system. Gullies have two main land units: the steep gully sides, and the gully floor. On the sides, soil

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Attachment 12

Hamilton City Council

13

material is well-drained, generally from the Hinuera formation and once supported totara-mataikowhai forest. The gully floors are more poorly drained and were dominated by kahikatea-pukateaswamp maire forest (Clarkson et al., 2007). These gully systems comprise the Mangaone, Mangaonua, Mangakōtukutuku and Mangaharakeke gullies in the proximity of the PSPA. The Mangakōtukutuku Stream gully complex traverses the western side of the PSPA. Vegetation in this gully is now dominated by exotic treeland and pastureland, with almost no indigenous vegetation remaining. Despite the large portion of exotic vegetation, the gully system provides important habitat for a range of indigenous fauna species.

Evidence from soil core samples and pollen analysis suggests that historically, most of the PSPA was once covered in conifer-broadleaf forest (Newnham et al. 1989). On slightly elevated mounds and ridges rimu/tawa forest would have been typical, and kauri and hard beech forests would have been found in the northern extent of the Hamilton ED. In the PSPA, kahikatea semi-swamp forest would have been dominant in the wetter, low-lying areas). The well drained terraces adjacent to the Waikato River would once have sustained totara-matai-kowhai forest.

#### 3.2 **Nationally Threatened Land Environments**

Taking a wider national perspective on the importance of the remaining natural values within Hamilton City, Land Environments of New Zealand (LENZ) threat classification system can be used to show the scarcity of habitats left for maintaining biodiversity. LENZ is a surrogate for the likely past (pre-human) pattern of terrestrial ecosystems and their associated biodiversity. The LENZ classification system has been used to classify "National Priority 1" threatened environments (MfE, 2007a, 2007b): those with 20 percent or less remaining in indigenous cover. The maps of National Priority 1 show land environments with 20% or less remaining indigenous vegetation from a New Zealand wide perspective. These land environments have been deemed to be the most critically threatened and of highest priority for protection in New Zealand (Walker et al., 2015).

Figure 3.1 shows that the vast majority of Hamilton City is categorised as 'Acutely Threatened'-National Priority 1 and thus any significant habitats of indigenous flora and fauna in this category are the most threatened at a national level.



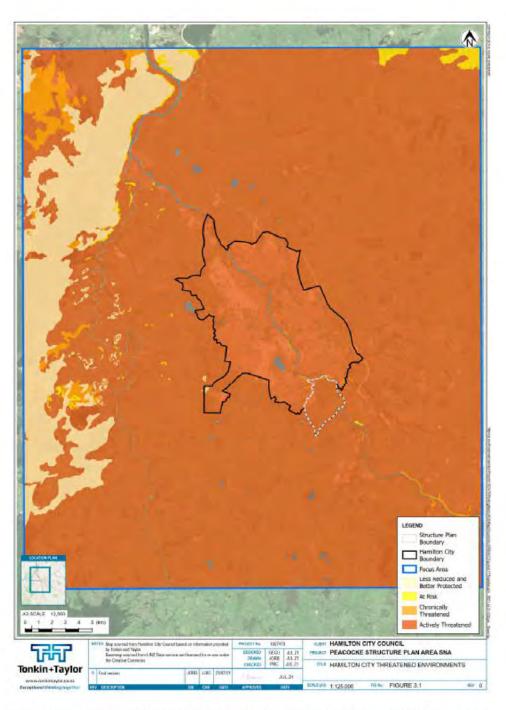


Figure 3.1: National Priority 1 Threatened Environments within The Upper Waikato basin including Hamilton City (after Kessels Ecology 2016 – expert evidence for development of the Hamilton City District Plan)

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15

#### 4 **Ecological Significance Assessment**

#### 4.1 **Extent of ecologically significant areas**

A wide range of vegetation or habitats for indigenous fauna have been identified being ecologically significant within the PSPA based on WRPS significance criteria. These significant ecological areas have been assigned into ecological significance categories based on the ecological values they provide.

Table 4.1 provides a summary of the various habitat types found within the PSPA including their areal extent, key ecological attributes and which WRPS significance criteria they trigger.

Figure 4.1 and Figure 4.2 show the spatial distribution of these different ecological significance categories over the PSPA. As discussed in Section 2, the original assessment of significance undertaken for HCC focussed on indigenous vegetation habitats, and as Figure 4.1 shows, the SNAs identified in that study (Cornes et al., 2012) covered a small portion of the PSPA. However, section 11A of the WRPS requires that habitat of significant indigenous fauna and wetland habitats is also assessed, which has greatly increased the extent of identified ecologically significant areas within the PSPA.



Table 4.1: Key ecological features within the PSPA, their ecological significance, location relative to the development footprint and areal extent (a considerable amount of this will be permanently lost due to southern links; refer to section 2.6 for definitions of significance categories).

Key Ecological Features and their aerial extent	General location	Description	Ecological characteristics and values	Key WRPS Ecological Significance Criteria Triggered
Ecologically signific	cant areas of ind	igenous biodiversity		
Significant indigenous terrestrial and freshwater fauna habitat: Riparian margins and associated waterways (58.74 ha)	Mostly outside the current development footprint	This includes mostly exotic forest and shrubland vegetation present along the Waikato River, Mangakōtukutuku Gully and associated tributaries in the PSPA. There are areas of wedland and stream habitats interspersed throughout. Most of this vegetation is exotic though small areas of habitat is dominated by indigenous vegetation in places and exotic dominated vegetation typically also includes native species.	These habitat types provides significant habitat for indigenous vegetation and fauna present on site, and are particularly important as roost, foraging and flyway habitat for the 'Threatened' (nationally critical) long-tailed bat and important for At Risk bird species including kākā, pied shag, little shag, little black shag, black shag and New Zealand dabchick. The waterways in this habitat complex also provide habitat for several 'At Risk' fish species, while the riparian margins enhance or protect the waterway habitat. It may also provide habitat for indigenous lizard species.	Criterion 3: Long-tailed bats and 'At Risk' fish species have been confirmed to use these habitats.  Criterion 4, criterion 6, criterion 8: Under-represented stream and riparian margin habitat is utilised by a range of aquatic species.  Criterion 11: Parts of this habitat provide an ecological buffer, linkage and corridors which are necessary to protect significant habitat from external adverse effects.
Significant Indigenous terrestrial fauna habitat: non- riparian linear features (ecological corridors) (20.49 ha)	Mostly Inside the current development footprint	This includes shelterbelts that provide connectivity across the landscape. The vegetation is largely exotic.	This is important foraging and flyway habitat for long-tailed bats and indigenous bird species.	Criterion 3: Long-tailed bats have been confirmed to use, or likely to use, these habitats.  Criterion 11: This habitat provides an ecological buffer, linkage and corridors necessary to protect significant habitat from external adverse effects.
Significant indigenous bat	Mostly Inside the	This includes any vegetation, including pasture, within 20 m of	This is foraging and flyway habitat for long- tailed bat.	<u>Criterion 3</u> : Long-tailed bats have been confirmed to use, or likely to

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Peacocke Structure Plan Area: Ecological Significance Assessment Hamilton City Council

July 2021 Job No: 1007479.0040,v4

Page 1250 Attachments



Key Ecological Features and their aerial extent	General location	Description	Ecological characteristics and values	Key WRPS Ecological Significance Criteria Triggered
habitat: non- riparian habitat ecological buffers (56.59 ha)	current development footprint	significant riparian margins and associated waterways and significant non-riparian linear features		use, these habitats for foraging and as flyways.  Criterion 11: This habitat provides an ecological buffer, linkage and corridors necessary to protect significant habitat from external adverse effects.
Significant Indigenous vegetation remnants (4.5 ha*)	Mostly outside development footprint	This includes small fragments, groups or individual mature indigenous trees along the margins of the Waikato River and associated tributaries in the PSPA.	This vegetation is important due to its rarity in the landscape, and provides important habitat for native flora and fauna as well as native vegetation, and fauna present on site and is potentially important as roosting, foraging and flyway habitat for the 'Threatened' (nationally critical) long-tailed bat.	Criterion 4: These small indigenous remnants are under-represented within the Hamilton Ecological District. Criterion 3: Long-tailed bats have been confirmed to use, or likely to use, these habitats
<b>Ecologically Signific</b>	cant wetlands ar	nd wetlands where significance is Like	ly or Indeterminate	
Wetlands (7.3 ha) including Riverine & Palustrine wetlands (5.6 ha+) and Ephemeral Seep or Spring wetlands (1.7 ha).	Mostly outside the development footprint, but some wetlands are within pasture areas within the development footprint	The wetland areas comprise a mixture of exotic and native rushes and sedges, sometimes with a canopy of exotic deciduous trees, and native tree ferns.	Wetlands are threatened ecosystem types and may include wetland associated 'Threatened' or 'At Risk' species and are potentially important as roosting, foraging and flyway habitat for 'Threatened' (nationally critical) long tailed bat.	Significant. Some wetland areas are Likely or Indeterminate until further site-specific surveys are undertaken. Criterion 4, criterion 6, criterion 8: Under-represented wetlands and wetland habitat which is utilised by a range of aquatic and terrestrial indigenous species.

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July 2021 Job No; 1007479,0040.v4

Attachments



Key Ecological Features and their aerial extent	General location	Description	Ecological characteristics and values	Key WRPS Ecological Significance Criteria Triggered
Long-tailed bat hal	oitats assessed a	s Indeterminate		
Potential long- tailed bat habitat: Linear features or groups of trees non-riparian and non-buffer linear features (shelterbelts) (40.95 ha)	Mostly Inside development footprint	This includes shelterbelts or groups of trees that provide connectivity across the landscape for long-tailed bats or roosting. The vegetation is largely exotic.	This is deemed to be potentially utilised for bat roosting, foraging or commuting based on structural characteristics of the linear or groups of trees, but where survey data is inconclusive in terms of determining habitat usage (Mueller et al. 2021).	Significance status is <u>Indeterminate</u> until further site-specific surveys are undertaken. <u>Criterion 3</u> : Longtailed bats may use these habitats but there is currently no evidence to validate usage. <u>Criterion 11</u> : These treescapes could provide an ecological buffer, linkage and corridors necessary to protect significant habitat from external adverse effects, but there is no evidence at this point in time to validate these ecological functions.
		s Indeterminate or Not Significant		1 an ina
Bat habitat: predominantly scattered trees, pasture grass and existing built structures (561 ha)	Mostly inside the development footprint	This includes open grassland, scattered trees, houses, roads and other built structures that are > 20 m (Mueller et al. 2021) away from any significant habitat types. Further survey is required to validate the status of these areas	Where not directly adjacent to (further than 20 m from) identified bat habitats, pasture areas are unlikely provide significant habitat for long-tailed bats, noting that these habitats may still be used sporadically for foraging or commuting.	Significance status Indeterminate until further site-specific surveys are undertaken or Not Significant in terms of build structures.  Much of these open pasture may be used occasionally by indigenous fauna, but are not likely to provide significant habitat for indigenous long-tailed bats. However, further studies may indicate that long-tailed bats require specific parts of these areas. Should further studies identify regular usage of some localities within the PSPA not

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July 2021 Job No: 1007479.0040,v4

Attachments

6	Hamilton	City	Counci
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Key Ecological Features and their aerial extent	General location	Description	Ecological characteristics and values	Key WRPS Ecological Significance Criteria Triggered
				identified as significant, then criterion 3 and/or criterion 11 could be triggered. Build areas are not significant habitats for indigenous fauna.

NB: \*Existing SNA and some wetlands have been included in the sum total for riparian margins and associated waterways therefore the overall spatial extent of ecologically significant areas is less than the sum of all significant areas

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# 4.2 Terrestrial Indigenous Plant Communities

Leathwick *et al.* (1995) calculated the decline in indigenous vegetation since 1840 and current percentage cover. Since 1840, the Hamilton ED has had a 97.8% reduction in indigenous vegetation. Percentage cover of indigenous vegetation in 1995 was about 1% forest and less than 1% scrub and wetland for the entire Hamilton ED. Therefore, any structurally intact plant communities dominated by indigenous vegetation within the PSPA are considered ecological significant in accordance with criterion 4 of the WRPS significance criteria ("It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally").

Within the PSPA only very small and scattered fragments of indigenous forest, shrubland and wetland remain, all of which are secondary growth and modified to some extent. These SNAs were identified and mapped by Cornes *et al.*, (2012) as shown Figure 4.1 and have been included in the Master Dataset as being ecologically significant.

### 4.3 Significant vascular plant species

Table C1, Appendix C, lists the nationally 'At-Risk' and 'Threatened' plant species found or likely to be found within the PSPA.

Poroporo (Solanum aviculare var. aviculare), which is 'Threatened – Nationally Vulnerable' (de Lange et al., 2018), has been recorded as being present in the vicinity of the PSPA. While this species could potentially be present within the PSPA, it has not been recorded there.

Aside from this species, several species now classified as 'Threatened' due to the threat posed by Myrtle rust are present and naturally occurring, in particular kānuka and mānuka. However, as discussed in section 2.5.1 above, these species have been listed as 'At-Risk' due to the risk posed by myrtle rust, and sites where these species are present are not considered to be significant habitat in terms of the WRPS criteria on this basis alone. However, given its rarity in the Hamilton ED, kānuka forest is considered ecologically significant and is one of the four sites mapped as an SNA by Cornes *et al.* (2012; Figure 4.1) and is hence included in the Master Dataset.

# 4.4 Ecologically significant wetlands & habitats of freshwater indigenous fauna

Wetlands, waterways and artificially created ponds have been mapped as shown on Figure 4.2. However, it is key to note that the composition of wetland vegetation cover, especially for small wetlands cannot be determined accurately through GIS desktop analysis. Many of the wetlands mapped as artificially created areas, such as 'detention ponds', 'culvert damming' 'farm pond' or aesthetic pond' are unlikely to meet criterion 6 of the WRPS significance set (but could trigger other criteria, such as criterion 3). Ground truthing is required to determine a more accurate representation of ecologically significant wetlands within the PSPA.

For the purposes of this desktop assessment, all areas identified as Riverine, Palustrine, Ephemeral Spring or Seep wetlands (as defined by Johnson & Gerbeaux 2004) are considered ecologically significant, meeting criterion 6 of the WRPS criteria, and the specific areas have been assigned as such in the Master Dataset.

As discussed in section 4.5.2, indigenous fish and freshwater invertebrates listed as nationally 'At Risk' or 'Threatened' by the Department of Conservation use freshwater streams and wetland habitats in the PSPA as part of their full life cycle requirements. Where this habitat is buffered by well-vegetated riparian margins, often exotic, these areas are considered to trigger either criterion 3, criterion 6, criterion 8 or criterion 11 of the WRPS significance criteria. These areas have been

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Hamilton City Council

Attachment 12

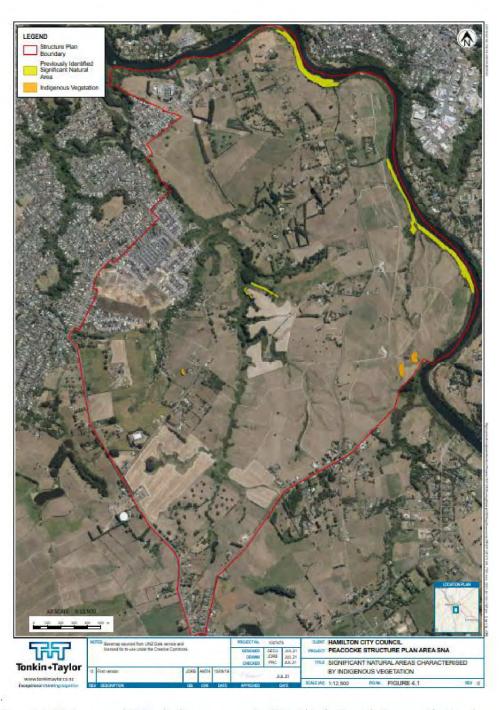
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Te kaunihera o Kirikiriroa

21

assigned as being significant, either being captured in the significant wetland layer or the significant bat habitat GIS layers, and have also been included in the Master Dataset.

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 ${\it Figure~4.1: Existing~mapped~SNA~and~indigenous~vegetation~SNA~within~the~Peacocke~Structure~Plan~Area~(as~identified~by~Cornes~et~al.,~2012)}$ 

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Hamilton City Council

Hamilton City Council
Te kaunihera o Kirikiriroa

23

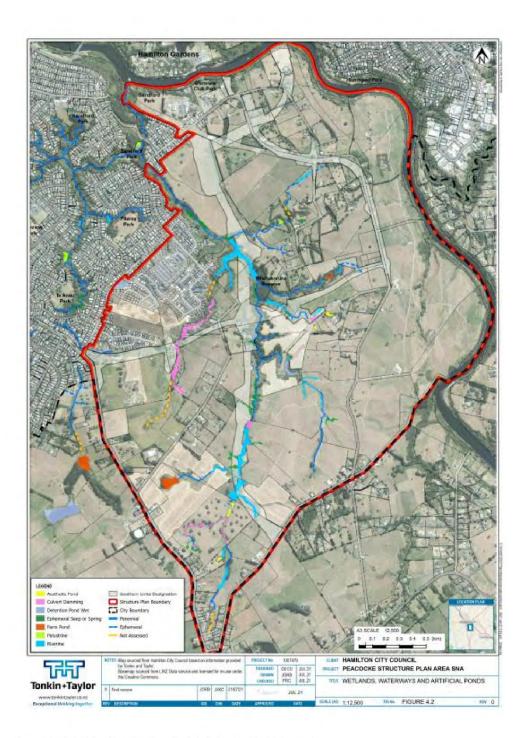


Figure 4.2: Wetlands found within the Peacocke Structure Plan Area

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### 4.5 Ecologically significant habitat for indigenous fauna

Within the PSPA, indigenous animals rely on exotic habitats as essential components of their life cycles, for breeding or migration, or buffering waterways. Because indigenous vegetation is so depleted within this landscape, this habitat is the only habitat available, even if it is of marginal habitat quality and is very weedy. The WRPS significance criteria do not differentiate between indigenous and exotic plants as habitat for these 'At Risk' and 'Threatened' animals.

As Wildlands & WRC (in prep.) state: "Areas of vegetation and habitats of indigenous fauna are not static in the environment; they will change with natural processes, climatic changes, and as a result of active management. Consequently the ecological values of a site can change over time and a site which may previously have been assessed as Not Presently Significant may be assessed as Significant or of Indeterminate Significance at a later date."

Where habitat is shown to be regularly used by nationally 'Threatened' and 'At Risk' fauna, criterion 3 of the WRPS is met, making those areas ecologically significant. Appendix C contains tables which list the nationally 'Threatened' and 'At Risk' fauna species recorded as being present, or likely to be present, in the PSPA. The following sections provide a summary of the key indigenous fauna, including nationally 'At-Risk' and 'Threatened' species, present or potentially present in the PSPA.

### 4.5.1 Invertebrates

Two terrestrial invertebrate species listed as regionally uncommon – Auckland tree weta and velvet worm (*Peripatus novaezelandiae*) – may be present within forested vegetation (Overdyk *et al.*, 2019). Although they have not been recorded within the PSPA, they are found in the Hamilton Ecological District and indigenous vegetation remnants in the gully areas may be suitable habitat for these species.

In terms of freshwater invertebrates, kākahi – freshwater mussel (*Echyridella menziesii*) - At Risk – Declining, and the freshwater snail – (*Austropeplea tomentosa*) – Data Deficient - have been recorded within waterways in proximity to the PSPA and may be present in the Mangakōtukutuku Gully Stream and the Waikato River.

### 4.5.2 Fish

The Hamilton Ecological District is home to a wide range of fish species as identified in Dunn *et al.* (2018) and those species potentially found within the PSPA are summarised in Table C3, Appendix C. The New Zealand Freshwater Fish Database (NZFFDB) indicates the presence of longfin eel (*Anguilla diefenbachii*), lamprey (*Geotria australis*), īnanga (*galaxias maculatus*), giant kōkopu (*Galaxias argenteus*), shortjaw kōkopu (*Galaxias postvectis*), torrentfish (*Cheimarrichthys fosteri*), redfin bully (*Gobiomorphus huttoni*), koaro (*Galaxias brevipinnis*), and black mudfish (*Neochanna diverus*), all classified as 'At Risk' or 'Threatened'.

The presence of 'At Risk' or 'Threatened' indigenous fish within the streams and wetlands of the PSPA triggers criterion 3, criterion 6 and criterion 8 of the WRPS ecological significance criteria.

### 4.5.3 Lizards

Three lizard species have been recorded in the locality (DOC BioWeb database). The most common of these is the copper skink, (*Oligosoma aeneum*), which is widespread in the Waikato and not threatened (Hitchmough *et al.*, 2016). Faecal material attributed to forest gecko (*Mokopirirakau granulatus*) has been reported in the Hakarimata Ranges, some 30 km to the north. DOC also has a

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Peacocke Structure Plan Area: Ecological Significance Assessment
Hamilton City Council

July 2021 1007479.0040.v4

Job No: 1007479.0040.v4



record of the threatened elegant gecko (*Naultinus elegans*) from Hakarimata (BioWeb database). Ornate skink (*O. ornatum*) may also be present as may Pacific gecko (Dactylocnemis pacificus).

Only copper skink and the introduced Australian plague skink (*Lampropholis delicata*) are known to be present within the PSPA footprint. The presence of copper skink in the PSPA, not being an 'At Risk' or 'Threatened' species, does not trigger any of the WRPS ecological significance criteria.

### 4.5.4 Birds

The PSPA has a diverse bird assemblage, which includes both terrestrial species, and species associated with wetland/water habitats, reflecting its location directly adjacent to the Waikato River. In terms of abundance, the avifauna assemblage is dominated by naturalised introduced species which are common in the agricultural landscape surrounding Hamilton (Fitzgerald & Innes, 2013). Common indigenous birds, such as tūī (*Prosthemadera novaeseelandiae novaeseelandiae*), kererū (*Hemiphaga novaeseelandiae*), grey warbler (*Gerygone igata*), shining cuckoo (*Chrysococcyx lucidus lucidus*), fantail (*Rhipidura fuliginosa placabilis*) and kingfisher (*Todiramphus sanctus vagans*), are found throughout the Hamilton Basin area, particularly within the larger areas of bush, and are all found in the PSPA, particularly in the gully and river habitats. The 'At Risk (naturally uncommon) Long-tailed cuckoo (*Eudynamys taitensis*) may also be present on occasion.

Table C5 in Appendix C lists a range of 'Threatened' and 'At Risk' bird species which have been recorded in proximity to the PSPA, but not specifically within the PSPA. These species include grey duck (Anas superciliosa), pipit (Anthus novaeseelandiae novaeseelandiae), kõtuku (Ardea modesta), Australasian bittern (Botaurus poiciloptilus), fernbird (Bowdleria punctata vealeae), banded rail (Gallirallus philippensis assimilis), pied oystercatcher (Haematopus finschi), dabchick (Poliocephalus rufopectus), black billed gull (Larus bulleri), red billed gull (Larus novaehollandiae scopulinus), royal spoonbill (Platalea regia), marsh crake (Porzana pusilla affinis) & spotless crake (Porzana tabuensis tabuensis). While habitat is available for these species, there is not data confirming their presence or absence at this point in time.

Several 'At Risk' bird species that have been regularly detected in the wider Hamilton City area and are potentially present within the PSPA include the North Island kākā (*Nestor meridionalis septentrionalis*), karearea (*Falco novaeseelandiae ferox*), and pied shag (*Phalacrocorax varius varius*), all of which are classified as 'At Risk – recovering'; and the little black shag (*Phalacrocorax sulcirostris*) and black shag (*Phalacrocorax carbo novaehollandiae*), both of which are classified as 'At Risk – Naturally Uncommon'. The riparian margin vegetation along the Waikato River may be utilised by the shag species for roosting and/or nesting. Like other rural and urban parts of the Hamilton area, kākā may visit the site when dispersing during winter, or as a short visit, but are unlikely to inhabit the area for long periods (Fitzgerald & Innes, 2013). Therefore, the occasional use of habitat in the PSPA by kākā or kārearea is not considered sufficient to trigger criterion 3 of the WRPS criteria as containing significant habitats for these species.

## 4.5.5 Long-tailed bat habitats

The New Zealand long-tailed bat is considered vulnerable to extinction and is ranked as 'Threatened - Nationally Critical', which is the highest threat ranking in the Department of Conservation's threat classification system. The species meets this threat ranking because it is undergoing a "very high ongoing or predicted decline (> 70%)." (O'Donnell *et al.*, 2018).

Mueller *et al.*, (2021) summarise several studies which show long-tailed bats use a variety of habitats within the PSPA for roosting, commuting, and foraging as shown in Figure 4.3. These are likely to be important habitats for long-tailed bats in this locality. The variety of inter-connected habitats in this southern part of Hamilton means this is the most important locality for long-tailed bat habitat within Hamilton City.

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Hamilton City Council



The Mueller et al., (2021) report considers that the most valuable bat habitats are those dominated by indigenous or exotic forest, open water, water ways, and parkland habitats. Research shows that the least selected habitats for long-tailed bats are pastoral, urban and industrial areas. While research demonstrated that bats will disperse across open grassland, this is not preferred habitat since even when flying over pasture bats appear to require structural cues, such as vegetation edges, to bounce their echolocation calls off to navigate and to forage efficiently. This foraging mostly occurs in pasture adjacent to shrubland, trees and open water adjacent to linear features, edges and gaps (Mueller et al., 2021).

Nonetheless, Mueller *et al.*, (2021) state that shelterbelts and clusters of mature trees within the existing pastoral landscape of the PSPA are likely an important part of bat habitat. The connectivity of the tree networks has been found to be important to allow bats to commute across the landscape. These treescapes (usually exotic) can just be a single line of trees but they still provide structural cues, shelter from the wind, and darkness so bats can move along the edges of them without being detected by predators.

The Mueller *et al.*, (2021) report provides a detailed summary of the roosting habitat preferences of long-tailed bats, particularly in relation to the PSPA. Long-tailed bats preferentially roost in the oldest and largest trees in the landscape (exotic and indigenous species). They switch roosts often and use roosts with different characteristics during different stages of their life cycle. Communal roosts are known to be frequented by reproductive females and their young, whilst solitary roosting bats are mainly males and post-lactating females.

Thus, the most important habitats for bats appear to be riparian and gully margins, with dense indigenous and exotic trees and shrubs associated with riverine and gully landscapes, as well as mature tree shelter belts and stands of trees (exotic or indigenous). Bats depend on access to key resources associated with these environments. In particular, these habitats provide:

- Mature exotic and indigenous vegetation for roosting purposes;
- Emergent aquatic insect prey for foraging;
- Freshwater for drinking; and
- Linear features providing corridors for movement and navigation.

On this basis, the Mueller  $et\ al.$ , (2021) report mapped and assigned a value to long-tailed bat habitats of 'high value', 'moderate value' or 'low value' (see Figure 4.3) as follows:

- 'High value' habitats included the margins of the Waikato River, Mangakōtukutuku Gully and known roost sites:
- 'Moderate value' habitats included areas containing:
  - vegetation,
  - edge pasture habitat near high value habitat which may be utilised by bats as commuting corridors,
  - foraging habitats, or
  - potential bat roost trees
- 'Low value' habitats included areas of open pasture and scattered trees which may provide occasional foraging or commuting habitat for bats.

Human-made structures, such as buildings and roads, are highly unlikely to provide habitat for bats.

Attachment 12

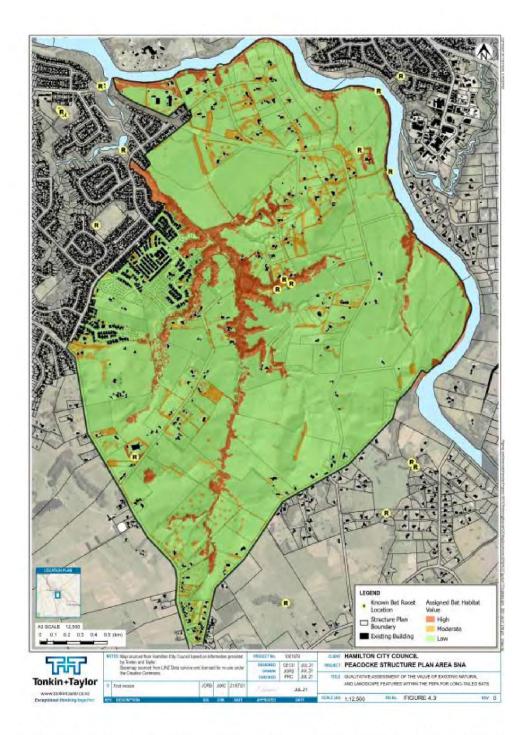


Figure 4.3: Qualitative assessment of the value of existing natural and landscape features within the PSPA for long-tailed bats. (from Mueller et al., 2021).

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### 4.5.6 Protection of long-tailed bat habitat

The habitat identification and assignment applied by the Mueller *et al.*, (2021) report, and shown in Figure 4.3, was used to apply the WRPS criteria to determinate ecological significance. Applying the Mueller *et al.*, (2021) habitat valuation assessment, the following habitat protection areas for long-tailed bats are recommended (Figure 4.4):

- a) Significant Bat Habitats: Significant Bat Habitats have been determined on the basis of known roost sites and/or known clearly defined habitats regularly used by bats for foraging, flyway navigation as identified in the Mueller et al.(2021) report as "High" value habitat refer to Figure 4.3. These habitats include Waikato River and Mangakōtukutuku Gully and known roost sites. The Significant Bat Habitats also include areas where acoustic surveys or radio tracking of bats indicates regular use of vegetation for aids to flyway navigation and/or foraging associated with these habitats. These Significant Bat Habitats meet criterion 3 of the WRPS significance criteria.
- b) Significant Bat Buffer Habitat: Adjacent to significant bat habitats, a 20 m Significant Bat Buffer Habitat has been applied as surveys show regular usage by long-tailed bats in these 'eco-tone' margins' (see Mueller et al., 2021). This buffer area has also been applied to buffer the Significant Bat Habitats and protect the functional attributes of these edge habitats as bat foraging and flyway habitat (Mueller et al., 2021). Specific planning consideration will be required to create and restore these buffer habitats over time as the PSPA urbanises. The Significant Bat Buffer areas meet criterion 3 and criterion 11 of the WRPS significance criteria.
- c) <u>Bat Corridors</u>: Three indicative Bat Corridors have been mapped. These indicate areas in the landscape where specific planning consideration is required to create and restore habitat over time which promotes flyway corridors between key significant bat habitats as the PSPA urbanises. These are indicatively 50 m wide to allow for protection and creation of bespoke tree corridors and other habitat to facilitate usage by bats (see Mueller et al. 2021). The Bat Corridor areas will meet criterion 3 and criterion 11 of the WRPS significance criteria.
- d) <u>Bat Setback Areas</u>: A 5 m Bat Setback area is recommended to be applied on the outside of the Bat Buffer Habitats and Bat Corridor Habitats based on information provided in Mueller et al. 2021. This setback area is a mitigation measure for urbanisation of the PSPA, forms part of the Ecological Buffer Area and hence triggers criterion 11 of the WRPS criteria. Planning mechanisms are recommended in these setbacks to create bespoke measures which assist in the avoidance of adverse effects of land use change activities on Significant Bat Habitats, Bat Buffer Habitats and Bat Corridors, such as adverse effects associated with artificial lighting.
- e) <u>Likely or Indeterminate Bat Habitats:</u> The PSPA contain a number of linear and clusters of mature exotic trees which may be potentially utilised by bat for roosting, foraging or commuting, but where existing studies suggest these areas are likely to be of 'moderate' to 'low' value habitat for long-tailed bats (Mueller et al. 2021). However, survey data is currently inconclusive in terms of determining the significance of this habitat usage for bats.

<sup>&</sup>lt;sup>3</sup> An ecotone is a transition area between two biological communities, where two communities meet and integrate. It may be narrow or wide, and it may be local (in this case the zone between pasture and forest/treeland) or regional (the transition between forest and grassland ecosystems). An ecotone may appear on the ground as a gradual blending of the two communities across a broad area, or it may manifest itself as a sharp boundary line.

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Te kaunihera o Kirikiriroa

29

Attachment 12

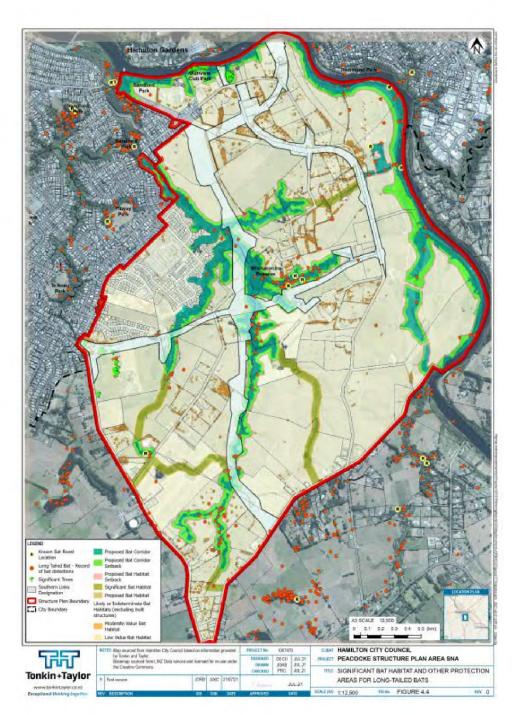


Figure 4.4: Significant Bat Habitats within the Peacocke Structure Plan Area

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# 5 Conclusion & recommendations

The Mangakōtukutuku Gully and Waikato River margins comprise a mixture of indigenous and exotic vegetation. These areas contain remnant wetlands, forest fragments, and provide important habitat for many indigenous bird and fish species, as well as for long-tailed bats. The ecological significance criteria of the WRPS do not differentiate between indigenous and exotic ecosystems as significant habitat for these 'At Risk' and 'Threatened' plants and animals.

This assessment of significance of indigenous biodiversity within the PSPA highlights several ecological management aspects which likely will require consideration at the policy and regulatory level for HCC in the preparation of the Peacocke Structure Plan change. These are:

- This analysis recommends a much greater and wider extent of ecologically significant areas than previously identified in the HCC SNA report (Cornes *et al.*, 2012). In addition, buffer and corridors are recommended to protect habitats for long-tailed bats. These ecologically significant areas identify buffer zones and future corridors to protect the functional values of key habitats for bats as the structure plan area becomes urbanised. Many of these habitats are dominated by exotic vegetation or are situated within private ownership.
- The Master dataset of candidate areas for ecological significance is based on our desktop review of recent studies and databases, as well as review of recent aerial imagery. However, further surveys and research may provide scientific information which provides greater certainty as to the significance ranking of these sites. In particular, habitats for long-tailed bats and wetlands identified were in some cases, valued as 'likely' or 'indeterminate' as candidate areas for ecological significance because of the lack of absolute certainty associated with a desktop analysis.
- Planning mechanisms need to acknowledge and account for incomplete scientific knowledge and incorporation of new information which may affect the ecological significance analysis presented in this report.

Attachments

Attachment 12

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31

**Applicability** 

This report has been prepared for the exclusive use of our client Hamilton City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd Report prepared by: Authorised for Tonkin & Taylor Ltd by: Gerry Kessels Peter Cochrane (Consulting Ecologist, Bluewattle Ecology) **Project Director** Report prepared by: Matt Baber (Consulting Ecologist, Alliance Ecology Ltd) Technical review by Georgia Cummings, Ecologist p:\1007479\1007479.0040\issueddocuments\20210721 pspa ecological significance assessment preliminary report.docx

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Attachment 12

Hamilton City Council

33

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Attachments

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## **Appendix A:** Key Source Literature & Databases

Dataset	Source
Biodiversity Vegetation (BIOVEG) 2012 - GIS Layer	The dataset currently contains mapped polygons representing terrestrial vegetation, palustrine wetlands, mangroves, and saline wetlands within Waikato Regional Council boundary. The data set was digitised off the 2012 WRAPS imagery using a simplified version of the Land cover database (LCDB) classifications. This work is licensed under a Creative Commons Attribution 4.0 International License International (CC BY 4.0). © Waikato Regional Council 2017.
Aerial Photography – WRAPS 2017	Colour digital orthophotography for the Waikato region. This work is licensed under a Creative Commons Attribution 4.0 International License. © Waikato Regional Council 2017.
Aerial Photography - Kauri Dieback Oblique Imager	This work is licensed under a Creative Commons Attribution 4.0 International License © Waikato Regional Council 2016. Kauri Dieback Surveillance – Oblique Aerial Photography. Surveyed by Biospatial Limited. Licensed under CC BY 4.0.
Hamilton City Council Significant Natural Areas	Hamilton City Council
Land Environments of New Zealand (LENZ) Threatened Environment Classification (TEC)	Land Information New Zealand (2019)
WRC Vegetation Type data (draft – based on Singers & Rogers 2014)	Waikato Regional Council (2018)
Protected areas	Land Information New Zealand (2019)
Freshwater fish	NIWA NZ Freshwater Fish Database (2019)
Bats	DOC National Bat Database (2019) Recent published research as cited
Threatened plants	Department of Conservation BioWeb (2012)
Herpetofauna	Department of Conservation BioWeb (2012)
Bird casual observation records	Department of Conservation BioWeb (2012)
Random observations – multiple taxa	iNaturalist (2018; research grade observations only)
Summaries of Hamilton City biennial bird counts	Fitzgerald and Innes (2013) and Ornithological Society of New Zealand census summaries (Cornes et al., 2012a)
New Zealand Plant Conservation Network plant distribution database information	New Zealand Plant Conservation Network drawn from National Vegetation Survey Database (NVS)
Leathwick, J.R.; Clarkson, B.D.; Whaley, P.T. 1995. Vegetation of the Waikato Region: Current and Historical perspectives.	Landcare Research contract report LC9596/022. Waikato Regional Council, Hamilton
Clarkson B.; Downs, T.; Merrett, M. (eds.) 2002. Botany of the Waikato.	Waikato Botanical Society Inc., Hamilton
Harding, M. 1997. Waikato Protection Strategy. A report to the Forest Heritage Fund Committee.	Published by the Forest Heritage Fund, Wellington



## **Appendix B: Confidence Level Definitions**

Definitions and factors to consider when applying a Confidence Level to the significance assessment of a site. (after van der Zwan & Kessels, 2017)

Confidence level	Definition
High	High level of confidence in assessment.
	Ecological information about the site is:
	Comprehensive
	Reliable
	Applicable and/or recent
	Site specific
	Sites with a high confidence rating include:
	Relatively large, well-studied, protected areas.
	Protected areas that are well known as habitats for threatened species, e.g.     Mahoenui giant weta Scientific Reserve, Mapara Scenic Reserve (a habitat for kokako).
	Unprotected sites that have been identified as recommended areas for protection in a protected natural areas survey.
	Other sites that have been the subject of fauna and/or flora surveys and the information is comprehensive, reliable, recent and site-specific.
	Sites with a high confidence level have a low requirement for field survey
Medium	Moderate level of confidence in assessment.
	Ecological information about the site is:
	Relatively comprehensive
	Reliable
	Not entirely applicable/ recent
	<ul> <li>More likely to be general than site-specific, e.g. the information applies to a larger tract of indigenous vegetation, of which the site is a relatively small part.</li> <li>Sites with a moderate confidence rating include:</li> </ul>
	Sites where the assessment is based on ecological information that does not meet all of the criteria for a high confidence level.
	Sites that are contiguous with a site that has a high confidence level, and information about the contiguous site is assumed to be applicable to the site that is being assessed.
	Sites that have been assessed as nationally or regionally significant on the basis of a record of a single species (such as kererū) without meeting other criteria for national or regional significance.
	Sites for which incomplete ecological information exists, and for which targeted surveys may result in records of threatened species.
	Sites with a medium confidence level have a requirement for field survey.



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Confidence level	Definition
Low	Low level of confidence in the assessment.
	Ecological information about the site is not available or is:
	Not comprehensive
	Unreliable
	Out-dated
	General
	Sites with a low confidence rating include:
	Very small protected sites e.g. marginal strips.
	Unprotected sites within ecological districts where a protected natural areas survey has not been undertaken.
	Sites that have met criteria for national significance, solely on the basis of a record of a species (e.g. kiwi, kokako) that is probably extinct at the site.
	Sites with a low confidence level have a high requirement for field survey.



# Appendix C: Nationally At Risk and Threatened Species Lists

#### Vascular plants

Appendix C Table C1: Threat status of vascular plant species that have been recorded in the PSPA (or are likely within the PSPA)

Species Name	Common/Māori Name	Threat Status
Kunzea ericoides	Kānuka	Threatened – Nationally Vulnerable
Leptospermum scoparium	Mānuka	Threatened – Nationally Vulnerable
Solanum aviculare var. aviculare	Poroporo	Threatened – Nationally Vulnerable

#### Freshwater invertebrates

Appendix C Table C2: Threat status of freshwater invertebrate species recorded in the locality of the PSPA. (Names and threat status obtained from NZFFDB, Grainger et al., 2014).

Species Name	Common/Māori Name	Threat status
Echyridella menziesii	Freshwater mussel, kākahi	At Risk – Declining
Austropeplea tomentosa	Freshwater snail	Data Deficient

#### Freshwater fish

Appendix C Table C3: Threat status of freshwater vertebrate species recorded in the PSPA. (Names and threat status obtained from NZFFDB, Goodman et al., 2014).

Species Name	Common/Māori Name	Threat status
Anguilla dieffenbachii	Longfin eel, tuna	At Risk – Declining
Cheimarrichthys fosteri	Torrentfish, piripiripohatu	At Risk – Declining
Galaxias argenteus	Giant kōkopu, taiwharu	At Risk – Declining
Galaxias brevipinnis	Koaro	At Risk – Declining
Galaxias maculatus	Īnanga, inaka	At Risk – Declining
Galaxias postvectis	Shortjaw kōkopu	Threatened – Nationally Vulnerable
Geotria australis	Lamprey, kanakana	Threatened – Nationally Vulnerable
Gobiomorphus huttoni	Redfin bully	At Risk – Declining
Neochanna diversus	Black mudfish	At Risk – Declining

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#### Lizards

Appendix C Table C4: Threat status of herpetofauna species recorded in the vicinity of the PSPA. (Names and threat status obtained from DOC BioWeb Herpetofauna Database 2013, BIMS, Hitchmough et al., 2016).

Scientific name	Common/Māori name	Threat status
Mokopirirakau granulatus	Forest gecko, moko-piri-ra kau	At Risk – Declining
Naultinus elegans elegans	Auckland green gecko, elegant gecko, kakariki	At Risk – Declining
Oligosoma ornatum	Ornate skink	At Risk – Declining

#### Avifauna (Birds)

Appendix C Table C5: Threat status of avifauna species recorded in the vicinity of the PSPA. (Names and threat status obtained from DOC BioWeb Casual Observations Database 2013, BIMS, Robertson et al., 2017).

Scientific name	Common/Māori name	Threat status
Anas superciliosa	Grey duck, pārera	Threatened – Nationally Critical
Anthus novaeseelandiae novaeseelandiae	New Zealand pipit, pīhoihoi	At Risk – Declining
Ardea modesta	White heron, kōtuku	Threatened – Nationally Critical
Botaurus poiciloptilus	Australasian bittern, matuku hūrepo	Threatened – Nationally Critical
Bowdleria punctata vealeae	North Island fernbird, mātātā	At Risk – Declining
Eudynamys taitensis	Long-tailed cuckoo, koekoea	At Risk – Naturally Uncommon
Falco novaeseelandiae ferox	Bush falcon, karearea	At Risk – Recovering
Gallirallus philippensis assimilis	Banded rail, moho pererū	At Risk – Declining
Haematopus finschi	New Zealand pied oystercatcher, tōrea	At Risk – Declining
Larus bulleri	Black billed gull, tarāpuka	Threatened – Nationally Critical
Larus novaehollandiae scopulinus	Red billed gull, tarāpunga	At Risk – Declining
Nestor meridionalis septentrionalis	North Island kaka, kākā	At Risk – Recovering
Phalacrocorax carbo novaehollandiae	Black shag, kawau	At Risk – Naturally Uncommon
Phalacrocorax sulcirostris	Little black shag, kawau tūi	At Risk – Naturally Uncommon
Phalacrocorax varius varius	Pied shag, karuhiruhi	At Risk – Recovering
Platalea regia	Royal spoonbill, kõtuku ngutupapa	At Risk – Naturally Uncommon
Poliocephalus rufopectus	New Zealand dabchick, waiwea	At Risk – Recovering
Porzana pusilla affinis	Marsh crake, koitareke	At Risk – Declining
Porzana tabuensis tabuensis	Spotless crake, pūweto	At Risk – Declining



#### Mammals

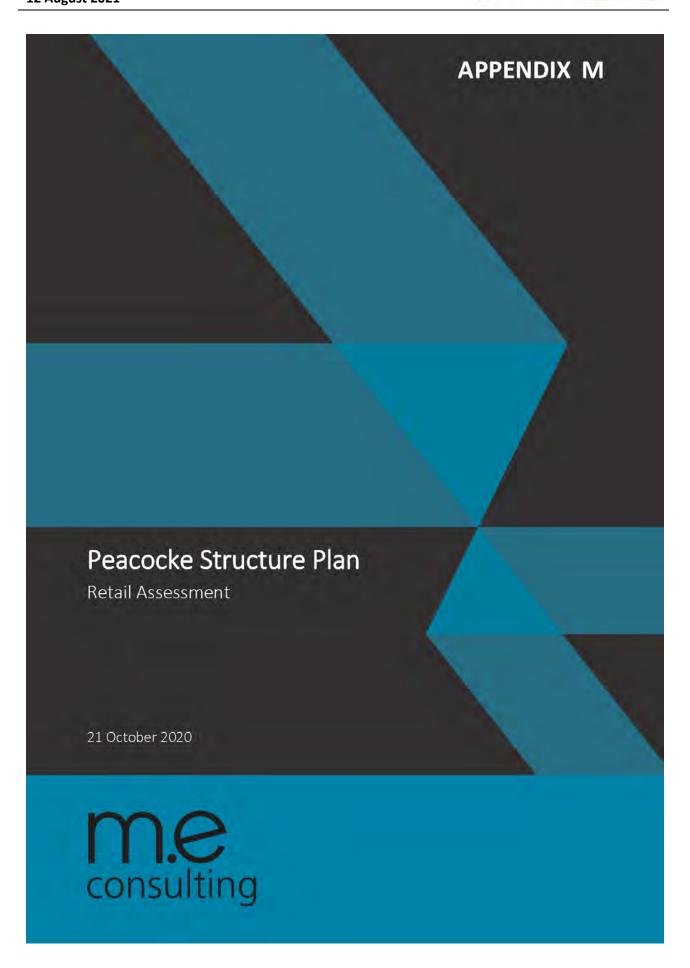
In the vicinity pf the PSPA only one threatened terrestrial mammal exists, the North Island long-tailed bat.

Appendix C Table C4: Threat status of mammal species recorded in the Waikato District. (Names and threat status obtained from DOC BioWeb Casual Observations Database 2013, BIMS, O'Donnell et al., 2017)

Species Name	Common/Māori Name	Threat status
Chalinolobus tuberculatus "North Island"	North Island long-tailed bat, pekapeka	Nationally Critical

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### Peacocke Structure Plan

Retail Assessment

## Prepared for

Hamilton City Council

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Report author(s): Derek Foy, Rebecca Foy

Director approval: Greg Akehurst

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## Contents

1	INTRODUCTION	3
1.1	Background	3
1.2	CURRENT POSITION	3
1.3	Objective	3
2	PEACOCKE STRUCTURE PLAN	2
2.1	PSP OBJECTIVES	4
2.2	LOCATION	4
2.3	KEY METRICS	5
2.4	Preferred zoning	<del>(</del>
2.5	Yields	7
2.6	Staging	8
3	RETAIL DEMAND ASSESSMENT	10
3.1	Approach	10
3.2	Household projections	., 15
3.3	TOTAL FLOORSPACE SUPPORTED IN ALL LOCATIONS	15
3.4	FLOORSPACE SUPPORTED IN PSP AREA	17
3.5	CENTRE LOCATIONS	20
4	CONCLUSION	26

## **Figures**

FIGURE 2.1: PEACOCKE LOCATION	5
FIGURE 2.2: PSP LAND AREA BY ACTIVITY TYPE (HA)	6
FIGURE 2.3: PSP DWELLING YIELDS BY ZONE	8
FIGURE 2.4: Devel object thanks assumed for retail assessment	o



FIGURE 3.1: HAMILTON RETAIL SPEND DESTINATION BY CENTRE TYPE (MARKETVIEW)	
FIGURE 3.2: AVERAGE LFR STORE MARKET SIZE	12
FIGURE 3.3: PEACOCKE FRINGE AREAS INCLUDED IN ASSESSMENT	14
FIGURE 3.4: STUDY AREA HOUSEHOLD PROJECTIONS	15
FIGURE 3.5: TO TAL RETAIL DEMAND GENERATED AND SUPPORTED IN ALL LOCATIONS (\$M)	16
FIGURE 3.6: TOTAL RETAIL FLOORSPACE GENERATED AND SUPPORTED IN ALL LOCATIONS (GFA, M <sup>2</sup> )	17
FIGURE 3.7: MARKET CAPTURE ASSUMPTIONS	18
FIGURE 3.8: PSP AREA SUSTAINABLE FLOORSPACE (GFA, M <sup>2</sup> )	19
FIGURE 3.9: NEIGHBOURHOOD CENTRE PROVISION AROUND THE PSP PERIPHERY	21
FIGURE 3.10: CONFIGURATION 1: PSP NEIGHBOURHOOD CENTRES	23
FIGURE 3.11: CONFIGURATION 2: MORE NEIGHBOURHOOD CENTRES	23
FIGURE 3.12: CONFIGURATION 1: NEIGHBOURHOOD CENTRE SUSTAINABLE FLOORSPACE (GFA, M <sup>2</sup> )	24
FIGURE 3.13: CONFIGURATION 2: NEIGHBOURHOOD CENTRE SUSTAINABLE FLOORSPACE (GEA. M2)	25





## 1 Introduction

#### 1.1 Background

Peacocke is a significant growth cell in Hamilton City, and urban development in that location will play an important part of contributing to Hamilton being an attractive place to live. The vision for Peacocke is to enable the development of an attractive and sustainable community. The Peacocke growth cell is now likely to be available for development earlier than originally anticipated. As a consequence, detailed assessments are required across various disciplines to refresh the assessments that were undertaken to inform the existing Peacocke Structure Plan (2012).

The Peacocke Structure Plan ("PSP") area is south of the city and is approximately 746ha of land. It has remained undeveloped for the last thirty years due to the prohibitive cost of infrastructure needed to make the land suitable for residential living, including roads, water, wastewater and stormwater. Hamilton has seen significant growth over recent years, and it is likely to continue into the future with projected growth from 60,600 households in 2020 to nearly 84,000 by 2040, growth of 38% or 1,150 households per year. As a result of the increased growth pressure that the city is currently experiencing, Hamilton City Council ("HCC") has recently agreed to fast-track development of the area, and it will become one of the city's top priorities.

The yield estimates on which this assessment is based indicate that there is capacity for nearly 7,300 dwellings in the PSP area, plus an additional 800 in the first stage (in the west, adjacent to Dixon Dr) that are already under development or complete. Of the total 746ha in the Structure Plan area, some 304ha will be set aside for reserves, open space, wetlands, community facilities and infrastructure (including arterial roads), leaving 442ha proposed to be used for residential dwellings or centres (although at least 200ha of that will be used for local roads).

### 1.2 Current position

The PSP is now being revisited to take into account recent and expected growth trends, to address administrative and legal issues resulting from decisions made by the Environment Court in relation to the Operative District Plan. The revised PSP will take the opportunity to review expected dwelling yields and the appropriate provision of centre space, although any changes made are expected to be refinements more than starting from a clean slate, particularly given progress that has been made with certain roading and other infrastructure which will influence the overall urban form of the PSP area.

### 1.3 Objective

The PSP has identified a network of centres to provide for the needs of the future Peacocke population, including a Suburban Centre and four community focal points. The objective of this report is to review that proposed provision, and to review the number, type, size and location of those centres to ensure they are appropriate to provide for the needs of the Peacocke community.

Page | 3





## 2 Peacocke Structure Plan

This section provides an overview of the PSP's assumptions, geographic layout, and dwelling yields as the basis for the following retail assessment.

### 2.1 PSP objectives

The 2012 version of the PSP is being updated to reflect work undertaken since its completion, particularly in regards to stormwater, biodiversity and ecology requirements, and given the effect these changes will have on dwelling yield. In brief, expected dwelling yield from the PSP area is now somewhat lower than in the 2012 PSP, given the greater requirements for non-developable areas that will form part of the green network. That reduction is countered somewhat by an assumed higher density yield in some of the residential zones, in line with an emerging acceptance of higher density typologies, particularly terraced housing, by property owners and by developers.

Nevertheless, the net result is a reduction in dwelling yield from the PSP area since the 2012 PSP was completed, and that reduction will have implications for retail demand and centre size. Centres are a core part of the urban fabric of new growth areas, and help to make attractive places to live, with the types of amenity that contribute to an attractive and sustainable community. That outcome is consistent with the vision for the Peacocke Programme, which includes the delivery of Peacocke's strategic network infrastructure, community facilities, resource consenting and building consenting activities, ecological protection and enhancement, funding, monitoring and reporting and commercial activities.

#### 2.2 Location

The Peacocke growth cell is located in the southern part of Hamilton, and is bordered by the established residential suburbs of Glenview and Fitzroy in the west, the Waikato River to the north and east, and the southern boundary of Hamilton City in the south (Figure 2.1).

Page | 4





Figure 2.1: Peacocke location



### 2.3 Key metrics

The PSP area is 746ha in total, of which just over a third (268ha) will be able to be developed to accommodate either dwellings or centres (Figure 2.2). Large parts of the total area will not be developable (labelled "Not Developable Area" in Figure 2.2), being required for roads and other infrastructure (water and electricity), or set aside as a green network focussed around the area's extensive stream network and bordering the Waikato River.

Page | 5





Figure 2.2: PSP land area by activity type (ha)

	Net developable area	Not developable area	Total area
Residential and centres			
Residential	262	174	435
Centres	6	541	6
Residnetial and centres	268	174	442
Other uses Reserves/open space	14	193	193
Infrastructure	(%)	103	103
Community facilities	1.5	8	8
Other uses		304	304
Total	268	478	746

#### 2.4 Preferred zoning

This assessment is based on the zoning configuration and urban form proposed in the current (October 2020) version of the PSP. Notable elements of that zoning include:

- The proposed Suburban Centre in the mid-east of the PSP area.
- A network of four Neighbourhood Centres, intended to provide walkable access to a limited range of commercial goods and services.
- Major transport links, including north-south and east-west major arterial routes, a minor (north-south) arterial road through the eastern part of the area and a new bridge across the river (connecting into Cobham Drive just east of Hamilton Cemetery).
- The influence of three natural character areas;
  - Terrace Area: the high amenity area adjacent to the Waikato River, where mostly high density residential development is proposed.
  - Gully Area: The environmentally sensitive Mangakotukutuku Gully network runs through the centre of Peacocke, where lower densities are appropriate.
  - Hill Area: The undulating topography in the south is proposed for lower density, with steep slopes intended to keep their natural form.
- · The significant green network and presence of wetland areas.
- The constrained areas proposed for residential activity and centres.
- The staging proposed. The exact timing of development on the ground will be flexible and will change as development proceeds, however the current staging indicates best current thinking as to sequencing of development as influenced by factors such as capital

Page | 6

12 August 2021





expenditure approval for infrastructure and location in relation to established urban areas (stages 1A and 1B are under development now) and areas of high amenity (2A and 2B adjacent to the River are scheduled to be next to develop). The retail assessment in this report translates that sequence to an indicative timing to describe when centre supply sill be sustainable, however the most important indication from that assessment at present is the total quantum of space required (and location), rather than timing, which will be subject to change as development progresses.

#### 2.5 Yields

Information provided by HCC for planning and assessment purposes has divided the PSP area into 67 residential growth areas, and separately identified other areas for potential centres and open space, etc. That structure allows HCC to apply assumed dwelling densities to each residential area, accounting for the underlying zoning. The current assumptions applied are described in Figure 2.3. Those assumptions may be subject to change as development planning for the area progresses, and, for example, in response to matters raised in submissions or by HCC officers as other disciplines complete assessments and advances in infrastructure timing and funding are made.

Key observations from the current assumptions are:

- The highest density zone is planned to be the Peacocke High Density Overlay Area, 120ha of gross land area that would yield 72ha of developable land and nearly 2,800 dwellings at average densities of 40-60 dwellings per developable hectare (that density varies depending on where within the PSP area the high density area is).
- The Medium Density Zone is planned to achieve 25-40 dwellings/ha, and just over 4,500 dwellings total, across 272ha gross land area, and 163ha net.
- A further 812 dwellings are anticipated to be developed in Peacocke Stage 1A, which is currently underway.
- Nearly 200 dwellings are provided for in the proposed Sports Park, which zone is over 8ha total area.
- A total dwelling yield of 8,381 dwellings on 273ha of developable land (464ha gross).
- A Suburban Centre spread across two sides of the minor arterial route through the eastern side of Peacocke, indicatively of around 4ha, and located in anticipation of leveraging off connection with the Waikato River to its east.
- Four Neighbourhood Centres, ranging in size from 1,000m<sup>2</sup> (land area) to 1.35ha (the
  centre in the north-west near the Water Treatment Station) (gross and net, assuming no
  part of the areas identified is required for roading).

Page | 7





Figure 2.3: PSP dwelling yields by zone

	Total area (ha)	Net developable area (ha)	Dwelling density (dwg/ha)	Dwelling yield
High Density Overlay Area	120.1	71.8	40-60	2,788
Medium Density Zone	272.1	163.3	25-40	4,528
Peacocke Stage 1A	43.3	32.5	25	812
Proposed Sports Park	22,5	5.0	n/a	198
Suburban Centre	4.1	0.9	n/a	55
Neighbourhood Centre	2.0		n/a	-
Total	464.1	273.5		8,381

In addition to the dwelling yields described in Figure 2.3 additional households in the fringe around the PSP area will be expected to direct some part of their retail spending into Peacocke's centres. Those areas are identified in Figure 3.3.

#### 2.6 Staging

There is not yet any firm indication of when the various stages of Peacocke will be developed, and these will be influenced as planning timeframes progress, and will be influenced by a range of factors such as market uptake and capital funding for infrastructure. The timing is of some importance to this assessment, however perhaps the more critical output will be the appropriate centre size (and location), with timing of each centre's development likely coincident with broader development in each area. That is certainly true for the neighbourhood centres which have a limited geographic catchment, and would appropriately be developed at the same time as dwellings around them.

Timing is possibly of more importance in relation to the suburban centre, which will provide for an amount of floorspace that will be supported by households living across Peacocke (and to adjacent areas). The full extent of the Peacocke suburban centre may not be supportable before Peacocke's residential development is nearing capacity, and a staged approach to the centre could be appropriate.

For these reasons we have made assumptions about a potential development timing for the PSP area, using the stages identified in the current proposed version of the PSP. That assumed profile is subject to change, but provides a fair indication of broad temporal trends using the best information currently available. One factor guiding the assumed timing was to provide a consistent average annual dwelling completion rate, of around 350 dwellings per year, which would mean Peacocke would take around 25 years to be fully developed.

Page | 8





Figure 2.4: Development timing assumed for retail assessment

	pre 2020	2020-23	2023-28	2028-33	2033-38	2038-43	Post 2043	Total	Dwellings
1A	40%	40%	20%					60%	812
1B		80%	20%					100%	334
2A			40%	40%	20%			100%	2,194
2B			30%	30%	30%	10%		100%	1,251
3A			20%	25%	35%	20%		100%	1,875
3B					15%	70%	15%	100%	1,133
4					10%	60%	30%	100%	782
Peacocke total		7%	23%	21%	21%	22%	5%	100%	8,381
Dwellings/year		197	371	344	344	352			





### Retail demand assessment

The dwelling yields assessed above are used as the basis of the retail demand assessment contained in this section. This assessment assumes that each dwelling will accommodate one household, and all households will generate retail spending. Some proportion of that spending will be directed to centres within Peacocke, with much leaving the area to be directed to larger centres within Hamilton. The sales directed to PSP centres will then require floorspace to support retail and services businesses in centres, and quantification of the space supported is the core output from the assessment.

#### 3.1 Approach

#### 3.1.1 Market capture

To inform assumptions about market capture, we have used Marketview data. Marketview data identifies credit and debit card transactions from BNZ customers, and establishes the geographic link between the residential address of the cardholders and the location and type of merchant involved in the transaction. It is estimated that the Marketview transactions data accounts for approximately 15% of all spending in the NZ economy. Marketview data is only made available in an aggregated form that protects the confidentiality of customers and the commercial sensitivity of merchants.

Data for this project was provided by HCC, and sourced from a dataset commissioned by Council from Marketview, which covers the 2008-2019 calendar years. For this assessment we used only data from 2018 and 2019, which is most representative of current retail patterns. That data was used to show the structure of retail spending in Hamilton by storetype, and identified:

- The origin of spend in businesses in Hamilton (9 origins: north-east, north-west, west, central, east, south, south-east, rest of Waikato, out of Waikato)
- The destination of spend in Hamilton by people from each origin (Central City zone and District Plan business zones 1-7)
- Seven storetypes (apparel, department stores/furniture/appliances, food and liquor, hardware and homeware, hospitality and accommodation, non-retail businesses, other retail).

That data provides an understanding of retail flows within, into and out of Hamilton, and gives a basis for estimating what flows might occur in Peacocke.

The destination of retail spend from the Marketview data is shown in Figure 3.1. Key observations from that data, relevant to this assessment, are:

> The Central City Zone ("CCZ") and Sub-Regional Centres ("SRCs", The Base and Chartwell) are dominant retail destinations for most categories, attracting 97% of Hamilton resident's spend on apparel, 77% in the group department stores/furniture/appliances, and 67% of other retail.

Page | 10

Hamilton City Council



Those CCZ and SRCs have lowest shares for food and liquor, hospitality and non-retail businesses, the categories in which Suburban centres have the highest share.

Figure 3.1: Hamilton retail spend destination by centre type (Marketview)

Category	Central City Zone	B1 (Commercial Fringe)	B2 (Events Pacifirms Fringe)	83 (Sub- Segional Centre)	B4 (Large Former Retall)	B5 (Suburban Centre Core)	B6 (Nhoco Centre)	B7 (Frankton Commercial (ringe)	Total
Apparel	30%	0%	0%	67%	0%	2%	1%	0%	100%
Dept stores/Furniture/Appliances	26%	0%	0%	51%	14%	8%	0%	1%	100%
Food and Liquor	38%	2%	0%	7%	7%	32%	13%	0%	100%
Hardware and Homeware	9%	0%	8%	30%	47%	1%	0%	5%	100%
Hospitality and Accommodation	48%	5%	3%	8%	2%	18%	12%	4%	100%
Non-retail businesses	32%	4%	3%	20%	5%	27%	7%	2%	100%
Other retail	35%	3%	4%	32%	4%	13%	6%	3%	100%

There is nothing to indicate that households in the PSP area will be atypical of the average current Hamilton household, and therefore it is appropriate to apply the average spend destination structure identified in Figure 3.1 to projections of Peacocke households' spending, to estimate how much space they will support in each location. For the purposes of this assessment, we focus on the amount of spend those households will support in Peacocke's Suburban and Neighbourhood centres. Discussion about the potential for other centre or retail nodes types is provided in section 3.1.2.

#### Peacocke centre types 3.1.2

As discussed in section 1 previous work undertaken for the PSP 2012 (and prior) settled on an appropriate provision of centres in the PSP area being a Suburban centre and several small Neighbourhood centres. While Peacocke households will generate demand supporting space in a wide range of retail categories, it will not be feasible to provide for all of those different categories within the PSP area.

Take for example large format retail ("LFR") space. LFR is a space extensive retail format that requires large sites to operate from, and typically services a large catchment and many thousands of households, with each brand requiring few sites within all but the very largest retail markets. We have assessed the average market size for some of NZ's largest retail chains, and those are representative of LFR stores generally. That assessment shows:

- On average, across all of NZ, there is one The Warehouse for around 20,000 households, one Farmers per 32,000 households, and Rebel and Briscoes typically require more than 40,000 households per store (Figure 3.2).
- Supermarkets require around 4,000 households, on average to support a store, accepting that there are a wide range of sizes of supermarkets, and many smaller stores supporting smaller communities. The largest stores such as Pak'n Saves are less common and have much larger catchments (average 31,000 households per store) than smaller stores (10,000-15,000 households per store).
- Within Hamilton City most brands have a number of stores similar to what would be expected based on the national average number of households per store.

Page | 11





Figure 3.2: Average LFR store market size

	NZ	total	Hamilt	on City
	Store count	Households per store	Actual stores	Stores expected (from NZ average)
The Warehouse	93	20,200	3	3.0
Farmers	59	31,900	3	1.9
Rebel	38	49,500	1	1.2
Briscoes	46	40,900	2	1.5
Countdown	184	10,200	8	5.9
New World	140	13,400	4	4.5
Pak'n Save	60	31,300	2	1.9
Smkts generally*	463	4,100	16	14.9

\* i.e. ianorina supermarket brand

The expected yield from the PSP area is nearly 8,400 households. That indicates those households will not by themselves support any of those most common LFR stores in Figure 3.2 (aside from supermarkets). PSP area households will support parts of stores that might establish elsewhere, however there would not be a need to provide those stores in Peacocke, and they would more appropriately be located elsewhere, especially given proximity of the PSP area to the Central City. The lack of need and support for those LFR stores in the PSP area indicates that other LFR stores (furniture stores, appliances etc.), which typically share a very similar catchment size with stores such as Farmers and The Warehouse, would also not be needed, or appropriately provided, in Peacocke. Ultimately that appropriateness comes down to a policy decision about how to provide for Hamilton's retail needs at a city-wide level. LFR provision will be required somewhere, and District Plan rules for retail of >1,000 m² indicate that it is envisaged in the Central City and Sub-Regional Centres (permitted) and Large Format Retail zone (Restricted Discretionary), but not in the Commercial Fringe (discretionary) or Suburban and Neighbourhood centres (non-complying).

So unless a new LFR zone servicing a broad part of Hamilton is decided to be pursued in Peacocke (which seems unlikely given indications in the PSP and adequacy of city-wide LFR supply now), there is little need for the PSP area to provide for any LFR space, including building and home improvement retailers such as Mitre 10 and Bunnings. This allows us to conclude that limiting centre provision to Suburban and Neighbourhood centres in the PSP area is appropriate.

There are currently 11 Suburban centres in Hamilton City, serving an average of around 5,400 households each. Neighbourhood centres have much smaller catchments, and the City's 67 Neighbourhood centres have catchments averaging 800-900 households each. At a coarse level that indicates that the following are broadly appropriate in the PSP area:

- 1 Suburban centre
- 9 Neighbourhood centres.

However, those are only a guide, and are based on existing Hamilton centres. There are a number of very small (i.e. one or two tenancy) Neighbourhood centres in Hamilton now, and some Neighbourhood centres do not offer any convenience retail supply, and are instead effectively spot zones for some non-retail

Page | 12





activity such as an automotive workshop or service station. Taking those into account, the average catchment for Neighbourhood centres is somewhere in the range of 1,000-1,200 households, indicating that the PSP area would support 7-8 Neighbourhood centres once the additional north-western fringe area (described below in section 3.1.3) is accounted for. This is only an indicative centre yield, and the appropriate provision of Neighbourhood centres will be influenced by topography and accessibility, but the indication is useful as a cross check.

#### 3.1.3 Catchment

The catchment for the PSP area's Suburban and Neighbourhood centres will be very strongly focussed on the PSP area, although not entirely limited to that. The nearest alternative retail supply node to the south is some distance away in Te Awamutu or Cambridge, indicating that some of the population of the large rural area in between Peacocke and those places may direct some of their spend to centres in the PSP area. However, that potential is limited by several factors, including:

- The fact that there are other retail destinations in urban Hamilton that would require travel
  that is not that much greater than it would take to get to centres in Peacocke, including
  the Central City and the Glenview Suburban centre.
- The proposed location of the Suburban centre in the PSP area will limit the accessibility of that centre for people living east of the Waikato River and west of State Highway 3.
- The presence of the Airport to the south will affect travel patterns, and, we expect act as a
  physical constraint to the southern edge of the catchment a Peacocke Suburban centre
  might draw from.
- The extent of the Suburban centre's catchment to the north and west will be limited by the
  existence of the Glenview Suburban centre, and by the Central City.

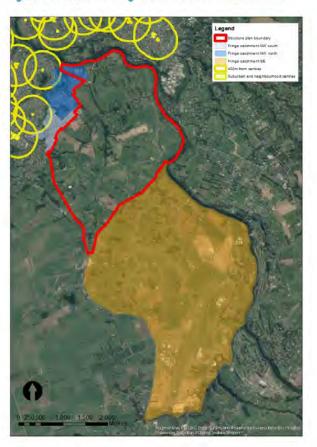
Taking these factors into account, we consider that the catchment of the Peacocke Suburban centre would be all of the PSP area, and also include the Fringe Rural area to the south-east (Figure 3.3). That rural area is sparsely populated, with less than 300 households resident there in 2019, projected to increase to around 400 by 2043. That area would make up only 4% of the Peacocke Suburban centre's catchment by household numbers, however, is included for completeness.

Page | 13





Figure 3.3: Peacocke fringe areas included in assessment



Peacocke's Neighbourhood centres will also attract some spend from outside of the PSP area, although again State Highway 3 will act as a conduit that might be expected to direct spend from the south and west towards Glenview and the Central City rather than to the interior of Peacocke. In any case, very few households live west of State Highway 3 within range of Peacocke's potential Neighbourhood centres, with only around 30 households in the area that might direct Neighbourhood centre spend to Peacocke, and so that area is not included in the catchments in Figure 3.3.

For that reason we have limited the spatial extent of Peacocke's Neighbourhood centre catchments to the PSP area plus a small fringe area in the north-west that is east of the Mangakotukutuku Gully network (blue areas in Figure 3.3). There are currently 750 households living in those two north-west fringe areas, and they are poorly served by Neighbourhood centres, being east of the gully when supply is to the west. Households in those two fringe areas are projected to increase to 1,050 by 2043, and would contribute a significant proportion of the total demand for the most north-western Neighbourhood centre in the PSP area.

Page | 14





#### 3.2 Household projections

The dwelling yield estimates for the PSP area were provided in Figure 2.3, and fringe area household projections were discussed briefly in section 3.1.3. Drawing those together, household projections for the PSP area and fringe areas that will support some centre space in the PSP area are provided in Figure 3.4.

Figure 3.4: Study area household projections

Catchment	2020	2023	2028	2033	2038	2043	2048	Growth :	2020-48
Catchinent	2020	2023	2026	2033	2038	2043	2048	n	%
PSP area	325	917	2,774	4,496	6,214	7,976	8,381	8,056	2480%
North west fringe	757	901	923	938	958	990	1,022	265	35%
South east fringe	295	313	341	362	384	405	426	131	44%

Note that for the purposes of these projections we have assumed there are no households resident in the PSP area now, apart from those existing in Stage 1A, and so the household projections will understate household numbers in 2020. There are around 200 households in the PSP area now, and it is unclear what will happen to those: how many will be removed and replaced by comprehensive residential redevelopment and how many will be retained, albeit likely on smaller lots. That uncertainty makes it difficult to predict how that small number of rural households in the PSP area will affect total household numbers, beyond the fact that at full build-out of the PSP area they would equate to less than 3% of total households.

### 3.3 Total floorspace supported in all locations

The PSP area has very few households at present, and they generate a correspondingly small amount of retail spend. The fringe areas to the north-west and south-east are currently much larger markets, although this will not be the case for long as development in the PSP area proceeds. At full build-out, the PSP area is projected to be home to nearly 8,400 households, generating \$281m of retail spend annually in the categories identified (Figure 3.5). That will provide a large pool of spending able to be captured by PSP centres and businesses, notwithstanding the likely limited range of retail offer provided in the PSP. Only a part of that total spend will be directed to PSP businesses/centres, with most flowing out to other centres such as the Central City, and likely even as far as The Base and Chartwell.

Page | 15





Figure 3.5: Total retail demand generated and supported in all locations (\$m)

Hereat and	2	220	2	000		220	_	022	_	020	-	042	7	0.40	Gr	owth	2020-48
Storetype	20	020	2	023	20	028	2	033	4	038	- 2	043	4	2048		n	%
PSP area															Ţ		
Supermarket/Grocery	\$	3	\$	8	\$	25	\$	42	\$	61	\$	82	\$	91	\$	88	3286%
Other food	\$	0	\$	1	\$	4	\$	7	\$	10	\$	13	\$	15	\$	14	3323%
Department Stores	\$	1	\$	2	\$	7	\$	11	\$	17	\$	22	\$	25	\$	24	3315%
Apparel	\$	1	\$	2	\$	5	\$	9	\$	12	\$	17	\$	18	\$	18	3292%
Furn./Appliances/Housewares	\$	1	5	2	\$	8	\$	14	\$	20	\$	27	\$	29	\$	28	3333%
Other retail	\$	1	\$	3	\$	9	\$	16	\$	23	\$	31	\$	34	\$	33	3326%
Hardware and Garden	\$	1	\$	3	\$	10	\$	17	\$	24	\$	33	\$	36	\$	35	3353%
Hospitality	\$	1	\$	3	\$	9	\$	15	\$	22	\$	29	\$	32	\$	31	3306%
Total	\$	8	\$	24	\$	76	\$	130	\$	189	\$	255	\$	281	\$	273	3312%
North west fringe					7				7				7		T		
Supermarket/Grocery	\$	8	\$	8	5	9	\$	10	5	10	\$	11	\$	12	\$	5	60%
Other food	\$	1	5	1	\$	1	\$	2	5	2	5	2	\$	2	\$	1	61%
Department Stores	\$	2	\$	2	\$	2	\$	3	\$	3	5	3	5	3	5	1	60%
Apparel	\$	1	\$	2	\$	2	\$	2	\$	2	\$	2	\$	2	\$	1	59%
Furn./Appliances/Housewares	\$	2	\$	2	\$	3	5	3	\$	3	5	3	\$	4	\$	1	61%
Other retail	\$	3	\$	3	\$	3	\$	4	5	4	\$	4	\$	5	5	2	60%
Hardware and Garden	\$	3	\$	3	\$	3	\$	4	\$	4	\$	4	\$	5	\$	2	61%
Hospitality	5	3	5	3	5	4	\$	4	\$	4	5	5	\$	5	\$	2	60%
Total	\$	23	\$	25	\$	28	\$	30	\$	32	\$	35	\$	37	\$	14	60%
South east fringe																	
Supermarket/Grocery	\$	5	\$	5	\$	6	\$	6	\$	7	\$	7	\$	8	\$	3	70%
Other food	\$	1	\$	1	\$	1	\$	1	\$	1	\$	1	\$	1	\$	1	68%
Department Stores	\$	1	\$	1	\$	1	5	2	\$	2	5	2	5	2	\$	1	71%
Apparel	\$	1	\$	1	\$	1	\$	1	\$	1	\$	2	\$	2	\$	1	69%
Furn./Appliances/Housewares	\$	1	\$	1	\$	2	\$	2	\$	2	\$	2	\$	2	\$	1	69%
Other retail	\$	2	5	2	5	2	5	3	5	3	5	3	\$	3	\$	1	67%
Hardware and Garden	\$	2	\$	2	\$	2	\$	2	\$	2	\$	3	\$	3	\$	1	70%
Hospitality	\$	3	\$	3	\$	3	\$	3	\$	3	\$	4	\$	4	\$	2	64%
Total	5	15	\$	16	\$	18	5	20	\$	22	\$	24	\$	26	\$	11	68%

That spend will support floorspace across Hamilton (and elsewhere). Applying national average sales productivity figures (\$/m²) yields an estimate of how much floorspace the PSP area, and the fringe areas, would support in all locations. The PSP area's \$281m of spend in 2048 would support around 39,100m² of GFA, with smaller amounts supported by the fringe areas. That quantity of GFA supported in 2048 reflects the PSP being fully developed with nearly 8,400 dwellings, and space supported until then will increase nearly linearly, in line with the assumptions that growth will average around 350 dwellings a year.

Page | 16





Figure 3.6: Total retail floorspace generated and supported in all locations (GFA, m²)

Percent	2020	2022	2020	2022	2038	2043	2048	Growth	2020-48
Storetype	2020	2023	2028	2033	2038	2043	2048	n	%
PSP area									
Supermarket/Grocery	300	700	2,300	3,800	5,400	7,100	7,700	7,400	2842%
Other food	100	200	500	800	1,200	1,600	1,700	1,600	2819%
Department Stores	200	500	1,500	2,400	3,400	4,500	4,900	4,700	2858%
Apparel	100	300	900	1,500	2,200	2,900	3,100	3,000	2878%
Furn./Appliances/Housewares	200	500	1,600	2,700	3,800	5,000	5,400	5,300	2914%
Other retail	200	500	1,400	2,400	3,300	4,400	4,800	4,600	2886%
Hardware and Garden	200	500	1,500	2,400	3,500	4,600	4,900	4,800	2922%
Hospitality	200	600	2,000	3,300	4,700	6,200	6,700	6,500	2882%
Total	1,300	3,800	11,700	19,500	27,600	36,300	39,100	37,800	2870%
North west fringe									
Supermarket/Grocery	700	800	800	900	900	1,000	1,000	300	41%
Other food	200	200	200	200	200	200	200	100	61%
Department Stores	400	500	500	500	600	600	600	200	45%
Apparel	300	300	300	300	400	400	400	100	35%
Furn./Appliances/Housewares	500	500	600	600	600	700	700	200	41%
Other retail	500	500	500	500	600	600	600	200	44%
Hardware and Garden	400	500	500	500	600	600	600	200	45%
Hospitality	700	800	800	900	900	1,000	1,000	300	41%
Total	3,800	4,000	4,300	4,500	4,700	5,000	5,200	1,500	40%
South east fringe									
Supermarket/Grocery	500	500	500	600	600	600	700	200	44%
Other food	100	100	100	100	100	200	200	100	88%
Department Stores	300	300	300	300	300	400	400	100	38%
Apparel	200	200	200	200	200	300	300	100	53%
Furn./Appliances/Housewares	300	300	300	400	400	400	400	100	34%
Other retail	300	300	400	400	400	400	500	100	31%
Hardware and Garden	300	300	300	300	400	400	400	100	37%
Hospitality	600	600	700	700	800	800	900	300	50%
Total	2,500	2,600	2,900	3,100	3,200	3,500	3,700	1,200	48%

### 3.4 Floorspace supported in PSP area

Of that space supported in all locations only part will be supported within Peacocke, with much of the spend resident in the PSP area being directed to Hamilton's larger retail centres (Central City, The Base and Chartwell). This section explains how that locally supported space has been assessed and summarises how much space might sustainably be located in Peacocke's centres.

#### 3.4.1 Market capture

To assess locally supported space we have applied assumptions from the Marketview data presented in Figure 3.1. All market capture rates applied are sourced from that Marketview data, with the exception of supermarket floorspace.

Page | 17





Figure 3.7: Market capture assumptions

Storetype	B5 (Suburban Centre Core)	B6 (N.hood Centre)
Supermarket/Grocery	65%	13%
Other food	32%	13%
Department Stores	8%	0%
Apparel	2%	1%
Furn./Appliances/Housewares	8%	0%
Other retail	13%	6%
Hardware and Garden	1%	0%
Hospitality	18%	12%

Supermarkets were not provided as a distinct category in the Marketview data, and have a significant local focus, indicating that they are likely to have a high capture of PSP-resident spending, especially given the lack of other supermarkets nearby. The nearest supermarket is the relatively small New World (c.2,600m2) at Glenview, and beyond that the Central City's Countdown and Pak'n Save (4km from the closest part of the PSP area, and 6-7km from the majority of it). Most supermarkets attract the majority of their sales from within 2-3km, and 6-7km is a very long distance to travel to a supermarket in a New Zealand urban context. That alone indicates there is likely to be at least one supermarket in the PSP area, given the quantum of demand resident there (section 3.3), and any supermarket(s) in the PSP area would likely be attractive to consumers given the relative inaccessibility of other supermarkets. For that reason a 65% market capture rate is applied.

#### 3.4.2 Activities included

The floorspace projections in Figure 3.6 are only for the identified retail categories, which will form the core of activities in Suburban and Neighbourhood centres. Additional space in those centres is also required to provide for services activities, which are not captured in Figure 3.6 because they do not form part of the Retail Trade Survey on which our retail models are based. There is a strong relationship between retail and services activities, and the latter tend to comprise 25-35% of the floorspace in most Suburban and Neighbourhood centres, not only in Hamilton but also in other urban economies (and less in much larger centres). For this assessment we have made allowance for services space to comprise 30% of the total retail and services space in each centre.

That 30% makes allowance for services activities such as hairdressers, laundromats and dry cleaners, medical professionals, real estate and travel agents, banks and postal services to operate from the PSP centres, which are contained within various activities under the District Plan's definitions. In the 'services' category in this assessment we include public-facing activities such as those that might locate at ground level in centres (e.g. banks, medical and real estate agents), but not activities that are not reliant on exposure to draw in potential customers (such as professional and administrative offices).1

Page | 18

<sup>1</sup> Our summary categories do not align exactly with District Plan definitions. For example, we consider that public facing parts of the "commercial offices" activity would be included in our 'services' group, while non-public facing components (of which there





We also include 'offices' as a category, which incorporates all the non-public facing office activities that are excluded from our services category. There is very little presence of these across Hamilton's Suburban centres now, and while it is appropriate to make some limited provision for these non-public facing offices within the Suburban centre, such as for small accountants or legal offices, there is unlikely to be much space required for this, and offices could be located above the ground floor level. For that reason we have allowed for a set amount of 300m<sup>2</sup> of office space, or enough to accommodate around 15-20 office workers.

#### 3.4.3 Floorspace sustainable in the PSP area

Applying the market capture assumptions in Figure 3.7 to the total floorspace supported in all locations generates estimates of the floorspace that is sustainable in the PSP area (from Figure 3.6). For this assessment the Suburban centre and Neighbourhood centres are assessed separately, although all Neighbourhood centre space is grouped, with discussion about an appropriate spatial distribution of that space provided in section 3.5. All floorspace numbers presented are gross floor area ("GFA"), which include back of house, admin and storage areas.

The existing population in the area would support very little space within Peacocke, which is why there is no such space there now. As the population grows, the amount of space that will be needed to provide for the community's needs will increase, and by 2028 around 5,000m² of floorspace would be sustainable in the Peacocke Suburban centre, increasing to 9,400m² by 2038, and reaching 12,700m² by 2048 (Figure 3.8). It should be noted that the amount of space sustainable at the Peacocke Suburban centre only reaches the District Plan's indication of a typical Suburban centre GFA (10-20,000m²) by around 2040.

Figure 3.8: PSP area sustainable floorspace (GFA, m')

Centre type	2020	2023	2028	2033	2038	2043	2048
Suburban centre							
Supermarket	800	1,000	1,900	2,700	3,600	4,500	4,800
Other retail	900	1,200	2,100	3,000	3,900	4,900	5,300
Services (incl medical)	400	500	900	1,300	1,700	2,100	2,300
Offices		100	100	200	200	300	300
Total Suburban centre	2,000	2,800	5,000	7,200	9,400	11,900	12,700
Neighbourhood centres	500	700	1,200	1,700	2,200	2,900	3,100

Consistent with the District Plan's explanation of Suburban centres, our assessment indicates that the PSP Suburban centre would be anchored by a supermarket, which would be appropriately sized at around 3,000m<sup>2</sup> in the mid-2030s, and 4,500m<sup>2</sup> by the mid-2040s. It will be sometime before a supermarket would be financially viable in the Suburban centre, given the household base that is required to support full-service supermarkets (around 4,000 households would support a store of close to 3,000m<sup>2</sup>). So it is likely

Page | 19

would likely be very few in these smaller type of centres, would not be included, (e.g. the administrative offices required to regional bank headquarters, etc.)

<sup>&</sup>lt;sup>2</sup> Offices less than 250m<sup>2</sup> are permitted in Suburban centres, although Discretionary in Neighbourhood centres



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that for the early stages of development, say at least the 2020s, the PSP area will be without a supermarket, and possibly also a Suburban centre in anything but a much smaller form that is ultimately sustainable.

We note that once the PSP area is fully developed the quantity of sustainable supermarket space would nearly be enough to support two supermarkets, say a 2,500 m2 and a 3,000 m2 store, especially if market capture is higher than the (relatively conservative) 65% modelled. That dual supermarket outcome is conceivable if both Foodstuffs and Woolworths became interested in the area, and would sit well with effectively staging supermarket supply in line with population growth. However, the one or two store outcome could be reliant on the plans of the first mover, which may effectively shut out an opportunity for a competitor by sizing itself ahead of the market.

Neighbourhood centres capture much smaller shares of the total floorspace supported in all locations (from Figure 3.6), and total Neighbourhood centre space supported would increase by around 100m2 per year over the development timeframe of the PSP area. At that rate of development total Neighbourhood centre space supported would be around 1,200m2 by 2028, 2,200m2 by 2038 and 3,100m2 by 2048 (Figure 3.8). That space would be supported across multiple centres, and while the District Plan explanation for Neighbourhood centres is a floorspace range of 500-5,000m2, we anticipate that the appropriate size of centres in the PSP area would be at, or even slightly below the end of that range, at say 300-800m2. Discussion about the location of those centres is provided in section 3.5.

#### 3.5 Centre locations

#### 3.5.1 Suburban centre

Having established that a Suburban centre is viable in the PSP area, and described the sustainable size of that centre, the next step is to review the potential location of that centre. That location is proposed in the PSP to be in the east of the PSP area adjacent to the Waikato River, and on the minor arterial (north-south) route through the area. Our initial thoughts on that location were that a location more central within the PSP area would be more appropriate and accessible, however having considered a range of factors we agree that the more eastern location is appropriate:

- The existing Glenview Suburban centre constrains how far west it is appropriate to locate the Peacocke Suburban centre.
- The proposed location is relatively central on a north-south axis.
- The potential link into the Waikato River would be attractive from an amenity perspective.
- There are some land use constraints further east, in the vicinity of the intersection between the north-south and east-west arterials, where there are wetlands and the stream network.

Ultimately non-economic considerations will be a stronger influence on the location of the Suburban centre than economic matters, which are largely limited to accessibility within the area. We understand that a wide range of factors have been considered in preferring the riverside location of the Suburban centre, and defer to that planning process and consideration of those other matters.

Page | 20

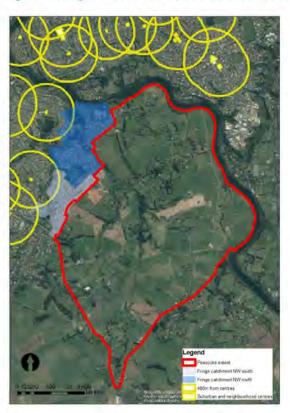




#### 3.5.2 Neighbourhood centres

Location is much more important for Neighbourhood centres, which depend on being highly accessible to their immediate catchments for their success and to adequately provide for community needs. A 400m walkable catchment is often applied to small convenience centres such as these Neighbourhood centres to show accessibility, and to indicate adequacy of coverage in urban environments. In the existing urban areas within Hamilton there is a very good coverage of Neighbourhood centre zones, with most parts of the urban area being within 400m of a centre. Not all of those centres offer retail-based services, with some limited to commercial (office) or industrial (e.g. automotive) businesses, however there is a comprehensive network of Neighbourhood centre zones around the PSP periphery, and across most of the rest of Hamilton. That network is evident in Figure 3.9 which shows 400m catchments (yellow circles) around Neighbourhood centres (yellow dots) around the PSP periphery, and indicates that a similar network of Neighbourhood centres is an appropriate target in the PSP area.

Figure 3.9: Neighbourhood centre provision around the PSP periphery



One exception to that supply of Neighbourhood centres is the area covered by the two north west fringe area identified in Figure 3.9 (light and dark blue). Those areas are east of the Mangakotukutuku Gully network, and there is currently insufficient population in those areas to support a thriving Neighbourhood centre. Households in that area will support Neighbourhood centre space, and for that reason are included in the potential catchment of a PSP Neighbourhood centre somewhere close to the north-western edge of

Page | 21



the PSP area. The absence of centre supply in those fringe areas now also indicates the challenge that will arise in distributing Neighbourhood centres throughout the PSP area, given the extensive green and stream network identified in the PSP.

Two options for providing for Neighbourhood centres are provided below:

- Configuration 1: In addition to the Suburban centre, six Neighbourhood centres are identified.
- Configuration 2: An amended version of configuration 1, with three additional centres, where the single centre servicing the north-east (A in Figure 3.10) splits to two (A1 and A2 in Figure 3.11), the centre immediately south of the Suburban centre (B) splits to two (B1 and B2) and a new centre is introduced in Stage 1A of the PSP area (labelled "E" in Figure 3.11).

Other configurations, including variations of them such as adding or removing a single centre, are also possible, however the following constraints are included:

- There is a Neighbourhood centre proposed within Stage 1B, forming part of the master plan for that stage and consistent with the Operative District Plan. That site is assumed to be the location of a Neighbourhood centre.
- The Suburban centre will effectively function as a Neighbourhood centre for some nearby residents, and so that centre forms part of the network of Neighbourhood centres.
- A need to service the existing residential areas just outside the north-western boundary of the PSP area (the fringe zones identified in Figure 3.9.

Those three centres are shown as the orange circle/star in the graphics below, and are considered to be 'locked in', which helpfully limits the sensible location of remaining centres. Other possibilities for Neighbourhood centre locations are show as yellow circles/stars, and two different configurations of those are shown.

The following assessment summarises the size of each Neighbourhood centre that would be required to provide for the local convenience needs of the immediately surrounding neighbourhood. That assessment disaggregates the total Neighbourhood centre space identified in Figure 3.8, and also distributes that space in line with population living around each centre.

Note that although an attempt is made to quantify the floorspace that would be sustainable in each centre, the accuracy of that is limited by the resolution at which underlying dwelling yields are available. In some cases a relatively large block is applied in the PSP yield analysis, and that could be included in the natural catchment of more than one Neighbourhood centre. However, each residential development block has been allocated to only a single centre for this assessment, so the sustainable floorspace identified below should be read with an associated margin of error.

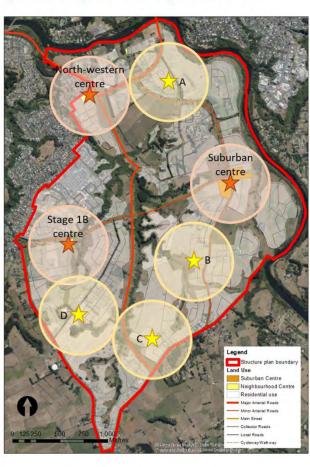
The sustainable floorspaces discussed below focus on size at full PSP build-out, which for most centres happens quickly given the localised nature of catchments, unlike the Suburban centre where the whole of PSP area catchment continues to be influenced by growth over the entire development timeframe.

Page | 22



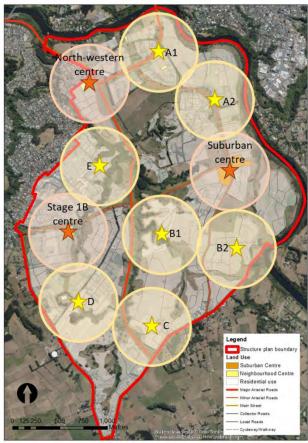


Figure 3.10: Configuration 1: PSP Neighbourhood centres



Page | 23

Figure 3.11: Configuration 2: More Neighbourhood centres







Under Configuration 1, the largest Neighbourhood centres in the PSP area would be expected to be those in the Stage 1B area (around 800m²), the centre in the North-West (600m²) and the centre labelled D in Figure 3.10 (Figure 3.12).

Figure 3.12: Configuration 1: Neighbourhood centre sustainable floorspace (GFA, m2)

Neighbourhood centre location	2020	2023	2028	2033	2038	2043	2048
North-western centre	200	200	300	500	500	500	600
Stage 1B centre	200	500	600	700	800	800	800
NC at A	1.5	8	200	300	400	400	400
NC at B	15.1	-	100	200	300	300	400
NCatC		=	-	-	-	200	300
NC at D	1 8	B.	-	100	200	500	600
Total Neighbourhood centres	400	700	1,200	1,800	2,200	2,700	3,100

The centres at A, B and C would be smaller, and only in the vicinity of 300-400m<sup>2</sup> would be supported in each. Those GFAs are smaller than the indicative 500m<sup>2</sup> minimum identified in the District Plan for Neighbourhood centres, and would accommodate no more than five stores in each centre. Configuration 1 covers a relatively broad part of the PSP area, with notable absences of:

- Much of the Stage 1A area, which we understand is to have a dairy.
- The eastern-most residential area, which is a relatively small number of households that are just beyond 400m from the Suburban centre.
- The southern-most part of the PSP area south of the centres at C and D, which will accommodate a small number of households.
- Areas that are 400-600m away from each centre. If a 600m radius had been applied instead
  of 400m, much larger parts of the PSP area would have been within the circles drawn. We
  note that 600m is still a reasonable walkable distance to plan the provision of this type of
  centre on.

Under Configuration 2, the three largest centres would be a similar size, and the smaller Neighbourhood centres (A, B and C from Configuration 1) would become smaller, with A1, A2, B1, B2 and C all being 100-300m². That is at below the scale anticipated for Neighbourhood centres by the District Plan, and indicates that only 1-3 shops would be viable in each location. That very small centre size indicates that a trade-off would be made for providing more limited range of stores (and potentially only a single dairy) in those centres as opposed to a slightly larger provision in slightly less accessible locations.

Our opinion is that a distribution of centres as described in Configuration 1 would be more appropriate, allowing each centre to be between around three to seven stores in size, and providing good accessibility to most of the PSP area population.

We note that the location of the centres identified is indicative, and would need to be settled with reference to other factors such as proximity to transport links (pedestrian, and not just road) and other community features (parks, areas of high amenity etc). It is outside the scope of this report, and in any case

Page | 24



at present premature, to provide a more detailed recommendation about specific sites until considerably more certainty exists around urban form and layout.

Figure 3.13: Configuration 2: Neighbourhood centre sustainable floorspace (GFA, m²)

Neighbourhood centre location	2020	2023	2028	2033	2038	2043	2048
North-western centre	200	200	300	500	500	500	600
Stage 1B centre	200	500	600	700	700	800	800
NC at A1			100	100	100	100	100
NC at A2	2.	2	100	200	300	300	300
NC at B1	19.11	72,	9	100	100	100	100
NC at B2	Lab.	(4)	100	100	200	200	200
NC at C	- 4	*		-	14	200	300
NC at D	( -	÷.	+ 4	100	200	500	600
NC at E		\$1			2	_ 5-	_
Total Neighbourhood centres	400	700	1,200	1,800	2,100	2,700	3,000





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### Conclusion

The Peacocke Structure Plan area, south of the Central City, encompasses 746ha of land that has remained undeveloped for the last 30 years due in part to the prohibitive cost of infrastructure needed to make the land suitable for residential living. Hamilton has experienced significant growth over recent years, and that growth is expected to continue, and will be broadly equivalent to approximately 1,150 households per year out to 2040. Current yield estimates indicate that there is capacity for nearly 8,400 dwellings in the PSP area.

A Structure Plan was previously developed for the area, and that is currently being reviewed to ensure that the best urban form outcomes and liveable communities are created. The PSP identified a network of retail and commercial centres to provide for the needs of the future Peacocke population, including a Suburban centre and four community focal points. This report has examined the likely dwelling yields by location within the PSP area to estimate the likely floorspace requirements for resident households and considered the spatial layout of those centres.

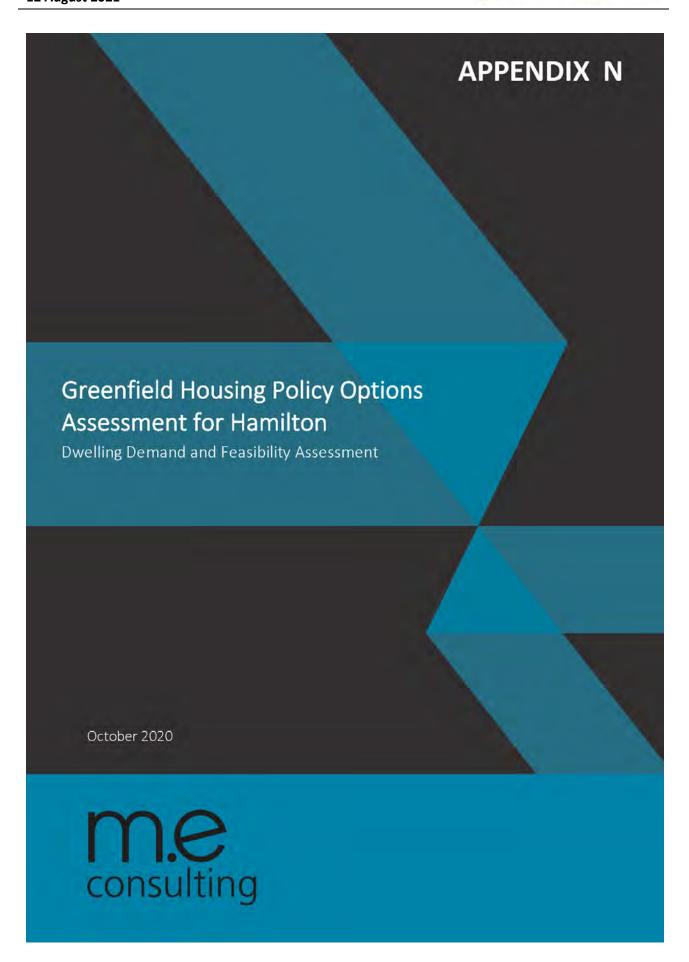
We estimate that of the 39,100m2 GFA retail floorspace supported by resident households in 2048 (Suburban and Neighbourhood centres), that approximately 40% should be provided for locally within the Peacocke centre, with the balance being directed to other larger sized centres in Hamilton including the CBD, The Base and Chartwell. A Suburban centre of 11,900m2 GFA will be able to be supported by 2043, increasing to 12,700m2 by 2048. At the same time, a network of Neighbourhood centres will also be required to provide approximately an additional 3,100m2 GFA of retail for convenience retail goods and services.

The Suburban centre would be able to accommodate at least one larger supermarket of 3,500m<sup>2</sup> to 4,500m2 GFA, or alternatively two smaller supermarkets of around 2,500m2 GFA each. After reviewing a range of non-economic factors, we agree with Council's positioning of the proposed Suburban centre, in the eastern area of the PSP alongside the Waikato River.

In our opinion a distribution of six Neighbourhood centres in the PSP area in accordance with the layout presented in Figure 3.10 would be the most appropriate outcome. That layout would enable Neighbourhood centres to be comprised of approximately three to seven stores in size and would provide good accessibility to the majority to the PSP area population.

Page | 26











# Greenfield Housing Policy Options Assessment for Hamilton

# Prepared for

# Hamilton City Council

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# Contents

PART 1:	MARKET ECONOMICS' ASSESSMENT	1
1	INTRODUCTION	2
1.1	Assessment Objectives	2
1.2	STRUCTURE	3
2	DEMAND FOR DWELLINGS	4
2.1	PROJECTED HOUSEHOLD GROWTH	4
2.2	DEMAND FOR DWELLINGS	6
2.3	DEMAND BY DWELLING VALUE BAND	9
3	COMMERCIAL FEASIBILITY OF DEVELOPMENT OPTIONS	18
3.1	APPROACH TO COMMERCIAL FEASIBILITY	18
3.2	CURRENT (2020) SITUATION	21
3.3	SHORT-TERM (2020-2023) PROJECTION	22
3.4	MEDIUM-TERM (2020-2030) PROJECTION	23
3.5	LONG-TERM (2020-2050) PROJECTION	24
3.6	FEASIBILITY BY DWELLING TYPOLOGY AND SIZE	25
3.7	SUMMARY TO INFORM THE DEVELOPMENT OF PLANNING DENSITY PARAMETERS	29
4	DEVELOPMENT OPTIONS & DEMAND	32
5	CONCLUDING REMARKS	40
PART 2:	4SIGHT'S ASSESSMENT	41
6	INTRODUCTION	42
6.1	SUMMARY OF MARKET ECONOMICS REPORT	43
6.2	Assessment Objectives	43
6.3	STRUCTURE	44
7	URBAN DESIGN CONSIDERATIONS	45
7.1	DELIVERING MEDIUM DENSITY HOUSING IN NEW ZEALAND	45



Hamilton City Council
Te kaunihera o Kirikiriroa

7.2	BENEFITS OF MEDIUM DENSITY RESIDENTIAL DEVELOPMENT	45
7.3	Key urban design considerations for Delivering Medium Density within G	REENFIELD LOCATIONS
7.4	PEACOCKE AREA URBAN DESIGN ASSESSMENT	53
7.5	WHAT DO THESE TYPOLOGIES LOOK LIKE?	59
8	URBAN DESIGN CASE STUDIES	70
8.1	HALSWELL NORTH ODP AREA	70
8.2	HOBSONVILLE POINT	77
8.3	Kensington Park	81
8.4	KEY LEARNINGS FROM CASE STUDY EXAMPLES:	83
8.5	CONCLUSION AND CONSIDERATIONS (URBAN DESIGN LENS)	83
9	PLANNING BACKGROUND	86
9.1	OPTIONS (TOOLBOXES)	86
9.2	REVIEW OF ODP AND PEACOCKE PLAN PROVISIONS	89
9.3	Conclusion ,	98
10	PEACOCKE ANALYSIS	99
10.1	GREENFIELD DEVELOPMENT IN PEACOCKE TO DATE	99
10.2	MISSED OPPORTUNITIES	100
10.3	STRATEGIC PLANNING ASSESSMENT	101
11	RECOMMENDATIONS & OPTIONS	103
11.1	Considerations Informing Recommendations	103
11.2	RECOMMENDATIONS,	105
11.3	Analysis of Strategic Planning Options for Peacocke	110
12	RECOMMENDED APPROACH	
APPEN	IDIX 1 PLANNING TOOLBOX EXAMPLES	121





# **Figures**

FIGURE 2-1: HAMILTON CITY PROJECTED HOUSEHOLDS BY PROJECTION SERIES	5
FIGURE 2-2: STRUCTURE OF HAMILTON CITY PROJECTED HOUSEHOLD GROWTH	5
Figure 2-3: Projected Dwelling Demand by Type and Size in Hamilton, 20	020-2050 7
Figure 2-4: Current (2020) Dwelling Demand by Value Band: Hamilton	City10
Figure 2-5: Current (2020) and Long-Term (2050) Dwelling Demand City – 0.5% p.a. Real Household Income Growth	
Figure 2-6: Current (2020) and Long-Term (2050) Demand by Dwellin 0.5% p.a. Real Household Income Growth	
Figure 3-1: Current (2020) Development Feasibility by Dwelling Type an	ID SIZE: PEACOCKE21
Figure 3-3: Short-Term (2020-2023) Development Feasibility by Dwelli	ng Type and Size: Peacocke 23
Figure 3-4; Medium-Term (2020-2030) Development Feasibility by Dwei	LLING TYPE AND SIZE: PEACOCKE 24
Figure 3-5: Long-Term (2020-2050) Development Feasibility by Dwellin	IG TYPE AND SIZE: PEACOCKE 25
Figure 3-6: Feasibility by Density and Time for Detached 1-2 Bedroom D	WELLINGS: PEACOCKE26
Figure 3-7: Feasibility by Density and Time for Detached 3+ Bedroom Dw	VELLINGS: PEACOCKE27
Figure 3-8: Feasibility by Density and Time for Attached 1-2 Bedroom D	WELLINGS: PEACOCKE28
Figure 3-9: Feasibility by Density and Time for Attached 3+ Bedroom Dw	VELLINGS: PEACOCKE29
FIGURE 7-1: PETROL CONSUMPTION AND URBAN DENSITY IN 32 CITIES OF THE D	EVELOPED WORLD50
Figure 7-2: Walksheds and Density Analysis.	51
Figure 7-3: Diagram A representing net 6,000m² developable lot out of	OVERALL TOTAL OF 1HA 54
Figure 7-4: Diagram A1 showing 10 dwellings achieved in the 6,000m <sup>2</sup>	вьоск55
Figure 7-5: Diagram B showing 23 dwellings per hectare net	56
FIGURE 7-6: DIAGRAM C SHOWING 33 DWELLINGS PER HECTARE NET USING ME	метнор57
FIGURE 7-7: DIAGRAM D SHOWING 40 DWELLINGS PER HECTARE NET USING ME	METHODOLOGY 57
Figure 7-8: Diagram E showing 50 dwellings per hectare net	58
Figure 7-9: Detached dwelling typology with double garage on street	(GREATER THAN 400M2)



Hamilton City Council
Te kaunihera o Kirikiriroa

FIGURE 7-10. DETACHED HOUSE WITH DOUBLE GARAGE LAYOUT (400M-SITE) AT 25 DWELLINGS PER HECIAKE NET.
FIGURE 7-11: DETACHED TOWNHOUSE WITH GARAGE OFF LANE LAYOUT (300M <sup>2</sup> SITE) AT 20 DWELLINGS PER HECTARE
FIGURE 7-12: TOWNHOUSE TYPOLOGY (MINIMUM LOT SIZE 250M <sup>2</sup> ).
FIGURE 7-13: BROAD-TERRACE HOUSING EXAMPLE
FIGURE 7-14: TOWNHOUSE LAYOUT AT 55 DWELLINGS PER HECTARE NET
FIGURE 7-15: BROAD TERRACE HOUSING LAYOUT
FIGURE 7-16: ATTACHED BROAD TERRACE LAYOUT
FIGURE 7-17: NARROW TERRACE HOUSE LAYOUT
FIGURE 7-18: MAISONETTE EXAMPLE (150m²)
FIGURE 7-19: MAISONETTE (4 UNIT) APARTMENTS LAYOUT (SITE SIZE: 468m²) AT 80 DWELLINGS PER HECTARE. 66
FIGURE 7-20: MIXED USE APARTMENTS TYPOLOGY EXAMPLE
FIGURE 7-21: WALK UP APARTMENTS TYPOLOGY EXAMPLE
FIGURE 7-22: APARTMENT TYPOLOGY EXAMPLE LAYOUT
FIGURE 8-1: BLOCK LAYOUT FROM THE NEIGHBOUR DEVELOPMENT PLAN
FIGURE 8-2: ALLOTMENT LAYOUT FROM THE NEIGHBOURHOOD DEVELOPMENT PLAN
FIGURE 8-3: TYPOLOGIES FROM THE NEIGHBOURHOOD DEVELOPMENT PLAN
FIGURE 8-4: MEADOWLANDS NEIGHBOURHOOD CONCEPT PLAN
FIGURE 8-5: EXISTING STABLES HAVE BEEN CONVERTED INTO A MONTESSORI SCHOOL IN A PARK SETTING
FIGURE 8-6: DERELICT HOMESTEAD HAS BEEN RESTORED AS A COMMUNITY BUILDING
FIGURE 8-7: ATTACHED TERRACES OVERLOOKING THE GREENWAYS
FIGURE 8-8: MIXTURE OF ATTACHED AND DETACHED, SINGLE AND TWO STOREY
FIGURE 8-9: THE GREENWAYS DELIVERED WITH PLAY EQUIPMENT, SEATING AND PRODUCTIVE GARDENS
FIGURE 8-10: HOUSING IS DEVELOPED OVERLOOKING THE GREENWAYS WITH PARKING FROM LANE
FIGURE 8-11: HOBSONVILLE POINT ILLUSTRATIVE CONCEPT PLAN (SOURCE HOBSONVILLE POINT, 2020)
FIGURE 8-12: KENSINGTON PARK APARTMENT BUILDING (SOURCE: HAYDN & ROLLETT, 2020)





FIGURE 8-13: KENSINGTON DRIVE MIXED TYPOLOGIES (SOURCE: SOUTHPARK CORPORATION, 2020)	82
FIGURE 9-1: CURRENT STRATEGIC PLANNING FRAMEWORK FOR MANAGING GREENFIELD GROWTH IN PEACOCKE	91
FIGURE 12-1: RECOMMENDED STRATEGIC PLANNING APPROACH	115

# **Tables**

TABLE 2-1: PROJECTED DWELLING DEMAND BY TYPE AND SIZE IN HAMILTON
TABLE 2-2: PROJECTED NET CHANGE IN DEMAND BY DWELLING VALUE BAND AND DWELLING TYPE: HAMILTON CITY,
Short, Medium and Long-Term – 0.5% p.a. Real Household Income Growth
TABLE 2-3: TOTAL MARKET DEMAND FOR DWELLINGS BY DWELLING VALUE BAND AND DWELLING TYPE: HAMILTON
CITY, SHORT, MEDIUM AND LONG-TERM – 0.5% P.A. REAL HOUSEHOLD INCOME GROWTH
TABLE 2-4: PROJECTED NET CHANGE IN DEMAND BY DWELLING VALUE BAND AND DWELLING TYPE: HAMILTON CITY,
SHORT, MEDIUM AND LONG-TERM — 1% P.A. REAL HOUSEHOLD INCOME GROWTH
TABLE 2-5: TOTAL MARKET DEMAND FOR DWELLINGS BY DWELLING VALUE BAND AND DWELLING TYPE: HAMILTON
City, Short, Medium and Long-Term — 1% p.a. Real Household Income Growth
TABLE 3-1: MODELLED AVERAGE LAND PARCEL SITE SIZE PER DWELLING BY DWELLING TYPE AND DENSITY20
TABLE 3-2: ESTIMATED COMMERCIALLY FEASIBLE DEVELOPMENT DENSITIES AND DWELLING VALUE BANDS IN
PEACOCKE BY TIME PERIOD AND DWELLING SIZE/TYPE
Table 4-1: Comparison of Projected Hamilton Dwelling Demand and Projected Feasibility of
DEVELOPMENT DENSITY OPTIONS IN PEACOCKE: DETACHED 1-2 BEDROOM DWELLINGS
TABLE 4-2: COMPARISON OF PROJECTED HAMILTON DWELLING DEMAND AND PROJECTED FEASIBILITY OF
DEVELOPMENT DENSITY OPTIONS IN PEACOCKE: DETACHED 3+ BEDROOM DWELLINGS
TABLE 4-3: COMPARISON OF PROJECTED ADDITIONAL HAMILTON DWELLING DEMAND AND PROJECTED FEASIBILITY OF
DEVELOPMENT DENSITY OPTIONS IN PEACOCKE: ATTACHED 1-2 BEDROOM DWELLINGS
Table 4-4: Comparison of Projected Additional Hamilton Dwelling Demand and Projected Feasibility of
DEVELOPMENT DENSITY OPTIONS IN PEACOCKE: ATTACHED 1-2 BEDROOM DWELLINGS - HIGHER DENSITY 37
TABLE 4-5: COMPARISON OF PROJECTED ADDITIONAL HAMILTON DWELLING DEMAND AND PROJECTED FEASIBILITY OF
DEVELOPMENT DENSITY OPTIONS IN PEACOCKE: ATTACHED 3+ BEDROOM DWELLINGS
Table 7-1: Definitions for housing typologies and the corresponding densities
TABLE 8-1: HOBSONVILLE PRECINCT OBJECTIVES AND POLICIES



Hamilton City Council
Te kaunihera o Kirikiriroa

TABLE 9-1 OBJECTIVES AND POLICIES RELATING TO THE IMPLEMENTATION OF NEIGHBOURHOODS	92
TABLE 9-2: CHARACTER AREAS AND THE PURPOSE OF THE AREAS FROM THE STRUCTURE PLAN	92
TABLE 9-3: OBJECTIVES AND POLICIES THAT RELATE TO THE IMPLEMENTATION OF THE CHARACTER AREAS	93
TABLE 9-4: RESIDENTIAL ACTIVITY STATUS IN MASTER PLAN APPROVAL	94
TABLE 9-5: PEACOCKE CHARACTER ZONE MINIMUM SITE AREAS	95
TABLE 9-6: BULK AND LOCATION STANDARDS FOR THE PEACOCKE CHARACTER ZONE	96
TABLE 10-1: STRENGTHS AND WEAKNESS - STRATEGIC PLANNING FRAMEWORK FOR PEACOCKE	102
TABLE 11-1: STRENGTH AND WEAKNESS ASSESSMENT OF THE PLANNING TOOLS AVAILABLE FOR MANAGING GR	REENFIELD
GROWTH IN PEACOCKE	111





#### **Executive Summary**

Hamilton City Council is looking to advance a plan change process that will enable an increased housing yield over the Peacocke growth area. To inform this plan change Market Economics and 4Sight Consulting have undertaken assessments of the commercial feasibility of development options as well as options to for promoting density and housing diversity. This report reflects the findings from the two consultancies, and are report separately.

#### Part 1: Market Economics' Assessment

Hamilton City Council seeks to understand whether more sustainable patterns of urban development can be achieved within its greenfield areas. M.E have been commissioned to assess current and future patterns of residential dwelling demand across Hamilton City, and then examine the feasibility (for commercial developers) of different development options within the greenfield areas. The assessment informs the development of planning parameters relating to density and dwelling typologies within the Peacocke greenfield area.

The demand assessment estimates the dwelling demand profile of current and future households in Hamilton City. Patterns of demand by dwelling value band and typology are generated from the underlying household demographic structures and gradual shifts in preferences through time. It considers both the total existing household base as well as the net increases in households to identify the total market size that may take up capacity within the greenfield areas.

An additional 3,500 households are projected for Hamilton City in the short-term (to 2023), and an additional 32,000 households in the long-term (to 2050). Smaller, 1-2 person, households are projected to account for over half of the growth, making up around half of the long-term household base.

Approximately 80% of the existing household base demand is for detached dwellings. The modelled changes in the demographic structure and gradual shifts in household preferences result in decreases in the share of demand for detached dwellings through time under the medium to high preference shift scenarios. The long-term projected increase in dwelling demand (+32,000 dwellings) equates to an additional demand for 18,000 to 26,000 detached dwellings, and 6,000 to 14,000 attached dwellings, with the distribution dependant upon the level of preference shift.

Approximately two-thirds of the existing dwelling demand occurs in the mid dwelling value bands (\$400k to \$800k), with 9% in the higher (\$800k+) dwelling value bands. The value band profile is projected to increase through time as a function of household income growth. Increases are smaller under the medium and higher preference shift scenarios due to an increasing share of demand for smaller, and correspondingly lower value, dwellings.

The feasibility modelling estimates the range of dwelling densities within each size and typology that are feasible to construct, at a 15%-20% and 20%+ profit margin, for a commercial developer. The current patterns of feasibility reflect past patterns of demand within Hamilton City's greenfield areas, and are dominated by detached 3+ bedroom dwellings.

Higher density dwelling typologies are projected to become feasible to construct in Peacocke through time. Larger attached dwellings are projected to become feasible within the short-term, with an increasing range of dwelling densities and options becoming feasible during the medium-term. These higher density developments are estimated to have a 15%-20% margin in the short-term (slightly below the modelled





threshold of 20% for feasibility), which reflects the small share of higher density dwellings currently being delivered in Peacocke by the market. The full range of modelled dwelling typologies and densities are projected to become feasible in Peacocke in the long-term.

Higher density apartment dwellings are also projected to become feasible within Peacocke at the end of the medium-term. These have a greater area of market overlap as demand for smaller attached dwellings is concentrated into the lower dwelling value bands. The feasibility of this higher density development option is likely to be contingent upon the establishment of a high amenity node within Peacocke, with feasibility constrained to location within and around the higher density node rather than spread across the greenfield area.

Larger detached dwellings have the greatest areas of market demand overlap, when considering the dwelling value band profile, as these reflect the dominance of this dwelling type within the existing structure of demand. There are smaller areas of projected market overlap for higher density dwelling typologies. However, the size of these segments are projected to increase through time as a function of structural changes in demand and gradual shifts in demand preferences through time as households make trade-offs between price, location and dwelling type/size.

#### Part 2: 4Sight's Assessment

4Sight's assessment has focused on an options assessment for a strategic planning framework for promoting density and housing diversity through enabling the feasible development options as identified by Market Economics. This focused on how short term demand can be met without compromising future yield, how a high quality built environment can be maintained, and what tools are available for achieving this.

Several factors are critical for delivering density and diversity, including linking subdivision and land use, walkability, mixed uses, and a consultative and collaborative design process. A case study approach was employed to assess the tools that have been employed in areas that have successfully delivered medium density greenfield residential development. All assessed examples employed at least one, detailed urban design exercise for the entire or mapped part of the greenfield area. This is used in conjunction with a high degree of prescriptiveness surrounding typologies and dwelling yields to deliver development in a comprehensive (subdivision and land use) development process.

The current strategic planning framework employs components of best practice; however, this assessment has shown, and previous development are evidence of, that it is no longer fit for purpose for achieving the desired housing outcomes for Peacocke. A number of general and specific recommendations have been made for a revised structure plan and for the plan change. The strengths and weaknesses of the different tools for implementing these recommendations were explored. A recommended approach for Hamilton City Council has then been provided that involves a revised structure plan, bespoke Peacocke Special Purposes Zone, Peacocke Design Guide, and Precinct spatial overlays that seek to promote and achieve housing outcomes that give effect to the Peacocke Structure Plan.

4Sight's analysis has identified that there is not one single planning tool for achieving density and diversity, rather it is necessary to employ a number of complementary tools that can be integrated to achieve the desired housing outcome.





# Part 1: Market Economics' Assessment

Page | 1





# 1 Introduction

Hamilton City is a high growth urban area within the upper north island. It has experienced significant population growth over the last decade, with a share of growth being met through urban expansion into the greenfield areas. Further high growth is anticipated within Hamilton City, with greenfield areas, including Peacocke, providing for a significant share of the growth. It is important to achieve development patterns in greenfield areas that contribute towards sustainable urban form and a well-functioning urban economy.

Past patterns of greenfield growth in Hamilton have been dominated by lower density outward expansion with larger standalone dwellings on relatively large sites. However, the market in Hamilton is changing, with a greater range of typologies and densities being achieved across the urban environment. Higher density dwelling typologies are increasingly being developed within existing urban areas through infill and redevelopment processes; and are beginning to emerge in small amounts within recent greenfield developments.

### 1.1 Assessment Objectives

Hamilton City Council seeks to understand whether more sustainable patterns of urban development can be achieved within Hamilton's greenfield areas. These include higher density development patterns that are more efficient spatially, as well as residential capacity that better reflects the changing needs of the market. These core aspects have important implications for the social and economic well-being of households, including through effects on housing affordability.

The Council have commissioned M.E to undertake analyses on the potential development options within the Peacocke greenfield area. The key objective is to provide economic assessment to inform the development of appropriate planning parameters to be applied by Council within the greenfield area. Council seeks to understand whether proposed planning provisions on density and dwelling typologies, to enable more sustainable urban form, are also likely to enable feasible development options for developers within the Peacocke greenfield area. The assessment has been commissioned jointly with Tauranga City Council, where the same analyses have also been undertaken within the Tauriko and Te Tumu greenfield areas.

The first part of this assessment is to understand the demand for dwellings across the Hamilton market. This includes identifying the demand for different dwelling typologies and sizes, and how these patterns may change through time as households make tradeoffs between price, size/type of dwelling and location. This is important to examine the potential size of the market that may be available to take up capacity within the greenfield areas. The second part then assesses the commercial feasibility of potential planning parameters that affect dwelling development options within the greenfield areas. These assessments are then drawn together to provide input to Council to facilitate the establishment of appropriate planning parameters for the Peacocke greenfield area.

The assessment has been undertaken over different time periods – the short-term (to 2023), medium-term (to 2030) and long-term (to 2050). This is critical as it takes into account how the market may change through time in relation to both overall size, structure and relative patterns of demand, as well as the

Page | 2





commensurate changes in development commercial feasibility through time. A time-stages approach is key to inform the potential stage implementation of greenfield planning parameters or development through time.

#### 1.2 Structure

The report is structured as follows. Section 2 provides an analysis of demand across Hamilton City. Section 3 contains an assessment of the commercial feasibility of different dwelling density development options for each dwelling typology/size within the Peacocke greenfield area. The demand and feasibility assessments are then drawn together in Section 4 which shows how the identified feasible development ranges correspond to the overall demand profile for dwellings within Hamilton City. Concluding remarks are contained in Section 5.

Page | 3





# 2 Demand for Dwellings

It is important to understand the potential future dwelling demand within Hamilton City when establishing appropriate dwelling density and type parameters within the Peacocke greenfield area. This section projects the total household demand for dwellings within the Hamilton market overall. It translates the projected household growth into demand for different types and sizes of dwellings across the short (2023), medium (2030) and long-term (2050) based on the underlying structure of household demand.

Future demand across each time period is projected by dwelling type (detached vs. attached), and within these, by dwelling size (1-2 bedroom vs. 3+ bedroom). The demand within each dwelling type/size is further projected by dwelling value bands. This is an important component to understand how the projected dwelling demand corresponds to the projected feasible development options within the Peacocke greenfield area.

Crucially, this section considers the total market demand as well as the net increases in demand. This is a critical aspect in assessing the potential market size for greenfield development options where a large share of the demand for greenfield dwellings occurs through the movement of existing households into the higher value greenfield areas.

### 2.1 Projected Household Growth

Figure 2-1 shows the projected future households in Hamilton City under different projection series. These include high, medium and low series produced by Statistics New Zealand, and medium and low series provided by Hamilton City Council. As requested by Hamilton City Council, the demand assessment uses the Council's low series projection.

The HCC low series projection generally sits between the Statistics New Zealand medium and high series projections. Under this series, household numbers are projected to increase at 1.8% per annum in the short and medium term, with net increases of around 3,500 households over the short-term (2020-2023) and 12,300 over the medium-term (2020-2030). Over the long-term, growth is projected to slow, decreasing the annual average growth rate to 1.4%. By 2050, Hamilton is projected to have an additional 32,000 households, bringing the total to 95,200 households by 2050.

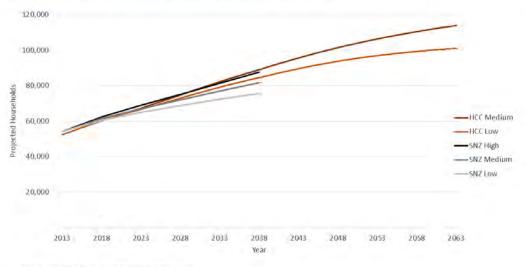
The structure of household growth is shown in Figure 2-2. Household composition is an important driver of the types, sizes and value of dwellings demanded. Over half (59%) of Hamilton's long-term household growth is projected to occur in 1-2 person households, which is likely to affect the size and types of dwellings demanded. Smaller household sizes are likely to generate greater demand for smaller dwellings, with 1-2 person households projected to account for around half (51%) of Hamilton's total household base in the long-term (2050). Family households are projected to account for over one-third (36%) of the projected long-term growth in households, with the remaining 5% in non-family households.

Page | 4



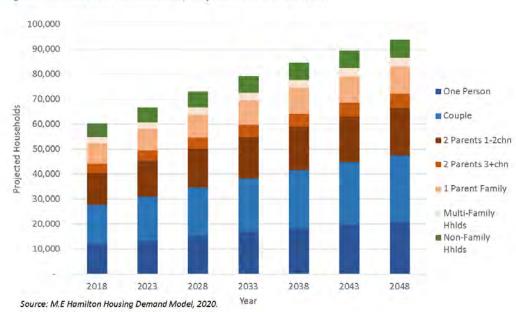


Figure 2-1: Hamilton City Projected Households by Projection Series



Source: Hamilton City Council and Statistics New Zealand.

Figure 2-2: Structure of Hamilton City Projected Household Growth



Page | 5





### 2.2 Demand for Dwellings

The M.E Hamilton Housing Demand Model translates the projected household growth in Hamilton to demand for dwellings. The model calculates the relationship between household type (from the previous section<sup>1</sup>) and dwelling type. It uses these structural relationships, within each group, as a basis for projecting forward the demand profiled based on the growth of each household type.

Dwelling demand is categorised by type into detached and attached dwellings. Within each group, it is also categorised by dwelling size as 1-2 bedroom and 3+ bedroom dwellings. As such, dwelling demand is divided into the following four groups:

- Detached 1-2 bedroom dwellings.
- II. Detached 3+ bedroom dwellings.
- iii. Attached 1-2 bedroom dwellings.
- iv. Attached 3+ bedroom dwellings.

The housing demand modelling has produced three scenarios for future dwelling demand. The first is outlined above where any changes to the structure of demand by dwelling type are a function of the growth patterns in the household type and their relation to dwelling types. The two further scenarios, in addition, incorporate a medium and high level of preference shift by dwelling type, within each household type group. These reflect the gradual shift in preference toward higher density dwelling types that typically occur gradually through time in growing urban economies.

A shift to higher density dwellings reflects the tradeoffs that households make between location, space and price. Higher density dwellings are often located in areas of higher amenity; with higher land costs (on a per m2 basis) associated with the location. These gradual shifts in dwelling typologies are reflected in Hamilton building consent data patterns through time, as well as the development patterns across other growing urban economies.

The three demand scenarios are:

- i. Nil preference shift.
- ii. Medium preference shift.
- III. High preference shift.

The projected dwelling demand by type and size in the short, medium and long-term in Hamilton is shown in Figure 2-3 and Table 2-1. The structure of the demand profile (by dwelling size and type) differs under each preference shift scenario, while the total demand for dwellings remains the same across scenarios. The total projected increase in dwellings across all scenarios equates to 3,300 in the short-term (2020-2023), 12,300 in the medium-term (2020-2030) and 31,900 in the long-term (2020-2050).

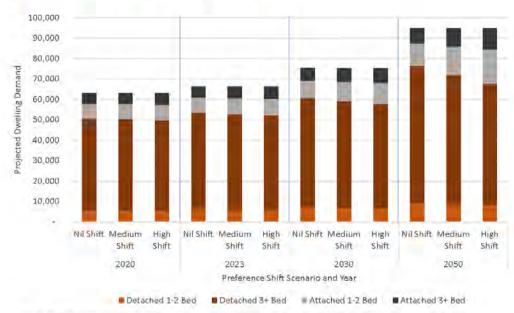
Page | 6

<sup>&</sup>lt;sup>1</sup> M.E's Housing Demand Model is driven by 210 detailed household types that are formed from combinations of household income, age and composition. Customised data has been obtained that has been used to develop a detailed concordance to dwelling type and size.





Figure 2-3: Projected Dwelling Demand by Type and Size in Hamilton, 2020-2050



Source: M.E Hamilton Housing Demand Model, 2020.

#### Nil Preference Shift Scenario

Under the nil preference shift scenario, dwelling demand is concentrated into detached dwellings. Detached dwellings are estimated to currently account for around 80% of demand. Shares of future demand for detached dwellings are similar to their current share of demand, at around 80% of additional dwellings. There is a slight decrease in the share of demand (from 82% across the short-term, to 80% across the long-term) due to changes in household composition through time. However, under this scenario, a strong preference for detached dwellings continues due to the existing patterns of dwelling demand relative to the household structure.

There is a slight corresponding increase in the share of demand through time for attached dwellings under this scenario. In the short-term, 18% of additional demand is for attached dwellings, increasing to 20% over the long-term. This increase in demand is projected to occur through the 1-2 bedroom attached dwellings, with a projected increase in demand for 4,100 additional dwellings across the long-term.

#### Medium Preference Shift Scenario

Under the medium preference shift scenario, demand becomes less concentrated into detached dwellings through time. In the short-term, 75% of additional demand is for detached dwellings (+2,500 dwellings), most of which are 3+ bedrooms. Through time, this share decreases to just over two-thirds (68%) in the long-term (+21,700 detached dwellings). The modelling projects that the decrease in the share of demand for detached dwellings occurs through 3+ bedroom dwellings, with the share of demand in 1-2 bedroom

Page | 7





detached dwellings remaining constant. This results in an overall gradual decrease in the share of total demand (existing + additional) for detached dwellings decreasing from 80% currently, to 76% by 2050.

Table 2-1: Projected Dwelling Demand by Type and Size in Hamilton

		Detached			Attached	
YEAR	1-2 Bed	3+ Bed	Detached Total	1-2 Bed	3+ Bed	Attached Total
			Nil Prefer	ence Shift		
2020	5,800	44,800	50,700	7,100	5,400	12,40
2023	6,200	47,200	53,400	7,400	5,600	13,00
2030	7,200	53,400	60,500	8,600	6,300	14,80
2050	9,400	66,900	76,300	11,100	7,600	18,70
2020-2023	400	2,300	2,700	400	200	60
2020-2030	1,300	8,600	9,900	1,500	900	2,40
2020-2050	3,600	22,100	25,600	4,100	2,200	6,20
			Medium Pref	erence Shift	t	
2020	5,800	44,500	50,200	7,300	5,600	12,90
2023	6,100	46,600	52,700	7,800	5,900	13,70
2030	7,000	52,100	59,100	9,400	6,800	16,30
2050	8,800	63,100	72,000	13,900	9,200	23,00
2020-2023	300	2,100	2,500	500	300	80
2020-2030	1,200	7,700	8,900	2,100	1,300	3,40
2020-2050	3,100	18,700	21,700	6,600	3,600	10,20
			High Prefer	ence Shift		
2020	5,700	44,100	49,800	7,500	5,800	13,30
2023	6,000	46,100	52,100	8,200	6,100	14,30
2030	6,800	50,900	57,700	10,300	7,400	17,70
2050	8,300	59,400	67,700	16,600	10,700	27,30
2020-2023	300	1,900	2,200	700	400	1,10
2020-2030	1,100	6,800	7,800	2,800	1,700	4,40
2020-2050	2,600	15,300	17,900	9,100	4,900	14,00

Source: M.E Hamilton Housing Demand Model, 2020.

The share of demand for attached dwellings correspondingly increases from 20% of total dwellings currently, to 24% of total dwellings in 2050. This equates to nearly one-third of demand for additional dwellings across the long-term for attached dwellings. Under this scenario, there is a projected demand for an additional 10,200 attached dwellings by 2050, with two-thirds (6,600 dwellings) as 1-2 bedroom dwellings. Within attached dwellings, the increase in the share of additional demand is projected to primarily occur in 1-2 bedroom dwellings, with some increase in the share of demand also in 3+ bedroom dwellings.

Page | 8





#### High Preference Shift Scenario

The high preference shift scenario sees a greater increase in the share of demand for attached dwellings. Over the long-term, 44% of the additional dwellings demanded are attached dwellings, equating to an additional 14,000 dwellings. This results in a projected increase in the share of attached dwelling demand from the current 21% to 29% in the long-term. Smaller 1-2 bedroom dwellings account for the largest share of this additional demand, accounting for an additional 9,100 dwellings over the long-term.

Despite the preference shift toward attached dwellings, the largest net increase in additional demand remains as detached dwellings. Over the long-term, there is demand for an additional 17,900 detached dwellings. Most, 15,300 of these, are for 3+ bedroom dwellings.

### 2.3 Demand by Dwelling Value Band

M.E's Hamilton Housing Demand Model also estimates the dwelling value band profile for demand for dwellings. The model assumes a real increase in the value band demand from households of 0.5% per annum. Put simply, it assumes that the dwelling value demanded by each household increases in real terms by 0.5% per year as a function of real growth in household incomes. This represents a conservative increase, below the rate of household income growth. In the short-term (3 years), this equates to a real value increase of 1.5%; in the medium-term (10 years), 5.1%; and in the long-term (30 years), 16.1%.

The current (2020) demand profile for Hamilton City dwellings by value band is shown in Figure 2-4. It shows the total number of dwellings demanded within each value band by dwelling type and size. Nearly two-thirds (62%) of the demand is for dwellings within the mid value bands of \$400,000 to \$800,000; and nearly one-third (29%) of demand is within the lower value bands (up to \$400,000). The remainder (9%) is in the higher dwelling value bands of over \$800,000.

Demand for attached dwellings is skewed toward the lower dwelling value bands. Nearly all (91%) of the demand for smaller (1-2 bedroom) attached dwellings occurs within the lowest value bands of up to \$400,000. The demand for detached dwellings is concentrated into the mid to upper dwellings value bands, with the value profile for larger dwellings (3+ bedrooms) higher than that for smaller dwellings.

The current and long-term demand profiles for dwellings by value band are shown in Figure 2-5. It shows the share of total dwelling demand within each value band. The red bars show the distribution of demand for dwellings in 2020. This reflects the distribution of demand based on household incomes in 2020. The green bars show the dwelling value band distribution of demand for 2050 under each of the nil, medium and high preference shift scenarios. They correspond to household incomes that have an assumed real annual growth rate of 0.5%. As such, the dwelling value profile correspondingly increases by the approximately the same rate.

Page | 9

Attachment 14



**Hamilton** City Council

Figure 2-4: Current (2020) Dwelling Demand by Value Band: Hamilton City

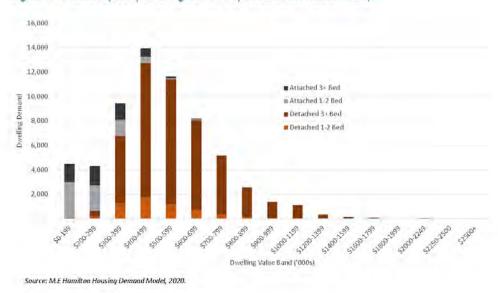
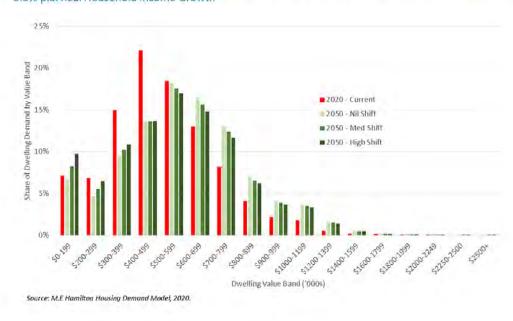


Figure 2-5: Current (2020) and Long-Term (2050) Dwelling Demand Value Band Profiles: Hamitlon City — 0.5% p.a. Real Household Income Growth



Page | 10





The current and long-term demand profiles for dwellings by value band are shown in Figure 2-5. It shows the share of total dwelling demand within each value band. The red bars show the distribution of demand for dwellings in 2020. This reflects the distribution of demand based on household incomes in 2020. The green bars show the dwelling value band distribution of demand for 2050 under each of the nil, medium and high preference shift scenarios. They correspond to household incomes that have an assumed real annual growth rate of 0.5%. As such, the dwelling value profile correspondingly increases by the approximately the same rate.

Applying a real increase in to housing value demand as a function of income growth increases the value profile of dwelling demand. However, it does not decrease housing affordability as the resulting increase in dwelling values occurs directly proportional to household income growth.

Demand for dwellings in the mid-high and higher dwelling value bands increases through time. In 2020, nearly one-third (29%) of demand is for dwellings in the lower value bands (up to \$400,000). Nearly two-thirds (62%) of demand is for dwellings in the mid value bands (\$400,000 to \$800,000), with the remainder (9%) in the mid-high and high value bands of \$800,000 or greater. In total, 70% of demand is for dwellings under \$600,000.

By 2050, the share of dwellings in the lower value bands (up to \$400,000) is projected to decrease to around 14% to 20%; and the share in the mid value bands (\$400,000 to \$800,000), to 53%-55%. Within the mid bands, the distribution becomes more evenly spread across the band, while it is more weighted toward the lower half (\$400,000-\$600,000) of the band in 2020. The share of demand in the mid-high and higher value bands (\$800,000+) is projected to increase to 27% to 31%.

Overall, this shows an increase in the dwelling value band profile through time as a function of household income growth. Under the nil preference shift scenario the value profile increases by approximately 16%, which is directly proportional to the underlying household income growth. This means there is no decrease in housing affordability from this component of the shift in the dwelling demand curve.

The value profile increases in the medium and high preference shift scenarios are smaller than under the nil preference shift scenario. This is because of the shift in demand toward attached dwellings, which have a lower dwelling value profile than detached dwellings. Under the medium preference shift scenario, the dwelling value band profile increases by approximately 13%; and under the high preference shift scenario, it increases by approximately 9%. The underlying household income is still assumed to increase by 16% under these scenarios, meaning there would be an increase in affordability with this component of the shift in the dwelling demand profile.

The total dwelling demand by value band in the current (2020) and long-term (2050) is shown in Figure 2-6. The red bars show the demand in 2020, based on current household incomes. The green bars show the demand within each dwelling value band based on 2050 household incomes (which have been assumed to have increased by 0.5% per annum). The 2050 household demand therefore includes the existing 63,000 households and the additional 32,000 households formed over that period. Existing households have moved up in value bands, accounting for some of the increase in dwelling demand across the value profile.

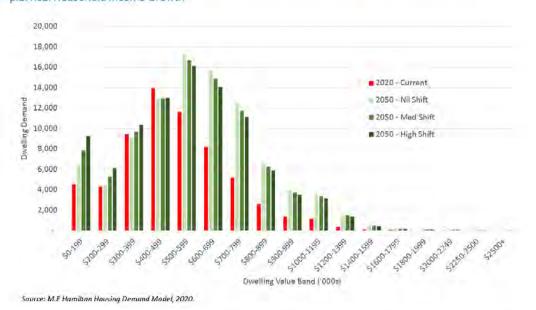
Page | 11





The long-term (2050) value bands also show increases in dwelling demand within the lower value bands, with the largest increases under the high preference shift scenario. This is a function of growth in demand for smaller, attached dwellings under this scenario.

Figure 2-6: Current (2020) and Long-Term (2050) Demand by Dwelling Value Band: Hamilton City -0.5% p.a. Real Household Income Growth



The projected net change in demand by value band in the short, medium and long-term is shown for each dwelling type and each preference shift scenario in Table 2-2. The value profile of the net increases in demand is highest for the nil preference shift scenario in comparison to the medium and high preference shift scenarios. This is because demand growth, under this scenario, is greatest in the larger detached dwellings, which have a higher value profile. Demand growth is mainly driven by 3+ bedroom detached dwellings. Over half (60%) of the demand for these dwellings in the long-term is projected to occur in the mid to high value bands (\$600,000+), with 23% occurring in value bands of \$800,000 or greater. There is still a large share of the net increase in demand for detached 3+ bedroom dwellings in the lower value bands, particularly in the short-term. Demand growth for attached and smaller dwellings is mainly concentrated into the lower dwelling value bands.

Net increases in demand in the medium to high preference shift scenarios have a greater share of demand increases in the lower value bands. This is due to the increased shares of demand for attached and smaller dwellings. The share of net increases in demand within the lower and low-mid value bands (up to \$600,000) increases to 66% in under the high preference shift scenario. Yet, demand growth for detached 3+ bedroom dwellings still accounts for the largest share of demand increase under these scenarios.

Page | 12





Table 2-2: Projected Net Change in Demand by Dwelling Value Band and Dwelling Type: Hamilton City, Short, Medium and Long-Term – 0.5% p.a. Real Household Income Growth

ime Period	Dwelling Type	Un to Carrol	CADOL CEDAL	\$600k-\$800k	velling Value Ban \$800k-\$1m \$		\$1.6m+	TOTAL	
ime Period	Dwelling Type	Up to \$400K	\$400K-\$600K		ference Shift Sce		\$1.6m+	TOTAL	
	Detached 1-2 Bed	80	200	80	Control of the Contro	-		400	
	Detached 3+ Bed	300	1,100	600	7.0	90	10	2,300	
Short-Term	Attached 1-2 Bed	300	30	-	-	-	-	400	
2020-2023	Attached 3+ Bed	200	30	12	9	- 12	- 6	200	
	TOTAL	900	1,300	700		90	10	3,300	
	Detached 1-2 Bed	300	700	300		20	-	1,300	
Medium-	Detached 3+ Bed	1,000	3,700	2,500		400	50	8,60	
Term 2020-	Attached 1-2 Bed	1,300	200	2,300				1,50	
2030	Attached 1-2 Bed Attached 3+ Bed	700	200	20			7:	90	
2030							ro.		
	TOTAL	3,300	4,700	2,800		100	50	12,30	
	Detached 1-2 Bed	500	1,500	1,200		20071		3,60	
Long-Term	Detached 3+ Bed	1,500	7,400	8,100		1,700	200	22,10	
2020-2050	Attached 1-2 Bed	3,300	700	70		-	-	4,10	
	Attached 3+ Bed	1,400	600	90	23	10		2,20	
	TOTAL	6,700	10,100	9,400		1,900	200	31,90	
	2 1 1 1 2 2 1	70	200		Preference Shift			20	
	Detached 1-2 Bed	70	200	70		4	1	30	
Short-Term	Detached 3+ Bed	300	1,000	600		80	10	2,10	
2020-2023	Attached 1-2 Bed	500	40			-	-	50	
	Attached 3+ Bed	300	50	10		-	-	30	
	TOTAL	1,100	1,200	700		90	10	3,30	
	Detached 1-2 Bed	200	600	300		20		1,20	
Medium-	Detached 3+ Bed	900	3,300	2,200	800	400	40	7,70	
Term 2020-	Attached 1-2 Bed	1,900	200	20	-		-	2,10	
2030	Attached 3+ Bed	1,000	200	30	10		- Y.	1,30	
	TOTAL	4,000	4,400	2,600	900	400	40	12,30	
	Detached 1-2 Bed	400	1,300	1,000	300	100	100	3,10	
Long-Term	Detached 3+ Bed	1,300	6,200	6,800	2,700	1,500	100	18,60	
2020-2050	Attached 1-2 Bed	5,300	1,100	100	10	10	9:	6,60	
2020-2030	Attached 3+ Bed	2,400	1,000	100	20	20		3,60	
	TOTAL	9,400	9,600	8,100	3,000	1,600	100	31,90	
				High Pr	eference Shift Sc	enario			
	Detached 1-2 Bed	70	200	70	10	9	12	30	
Short-Term	Detached 3+ Bed	300	900	500	200	70	10	1,90	
	Attached 1-2 Bed	600	60	10	-	- 4	-	70	
2020-2023	Attached 3+ Bed	300	60	10	-		-	40	
	TOTAL	1,300	1,200	600	200	80	10	3,30	
	Detached 1-2 Bed	200	500	200	60	20	12	1,10	
Medium-	Detached 3+ Bed	800	2,900	2,000	700	300	40	6,80	
Term 2020-	Attached 1-2 Bed	2,400	300	30	) -	4		2,80	
2030	Attached 3+ Bed	1,300	300	40	10	10	_	1,70	
	TOTAL	4,700	4,100	2,300	800	300	40	12,30	
	Detached 1-2 Bed	300	1,100	800		90	-	2,60	
	Detached 3+ Bed	1,100	5,100	5,600		1,200	100	15,30	
Long-Term	Attached 1-2 Bed	7,300	1,500	200		10	- 100	9,10	
2020-2050	Attached 3+ Bed	3,300	1,400	200		30	1.	4,90	
	Traciled of ped	3,300	1/400	200	- 00			4,50	

Source: M.E Hamilton Housing Demand Model, 2020.

Page | 13

Attachment 14



It is also important to understand the total market size for dwelling demand in Hamilton. This is because there is typically a large amount of churn in any housing market where households move from one dwelling to another. Demand for new dwellings is a function of both the formation of additional households together the movement of existing households into new dwellings. It is likely that the demand for new dwellings within greenfield areas occurs from existing households currently occupying dwellings within other parts of the market.

The total projected market demand for dwellings by value band within the short, medium and long-term in Hamilton is shown in Table 2-3 for each of the scenarios. This shows the demand as a function of household incomes. It assumes a real increase of 0.5% per annum in household income growth, but does not assume any increase in dwelling value demand as a result in changes in existing dwelling equity. These reflect the total long-term profiles shown in Figure 2-6, but provide additional breakdowns by time period and dwelling type.

Over the long-term, the share of dwelling demand within the mid-upper to upper (\$600,000+) dwelling value bands increases from 31% to 42%-47%. The share of detached 3+ bedroom dwellings within these value bands in the long-term, is highest at 60%. The value profiles under the medium and high preference shift scenarios show smaller value increases due to gradually increasing proportions of demand within the attached dwellings, which have a lower value profile.

The analysis estimates the dwelling demand in Hamilton through time as a function of real increases in household income. It does not take into account the movement of existing households within the market that occurs due to increases in existing dwelling equity through time. Inflation in dwelling prices through time means that existing dwelling owners are able to move into higher value dwellings through building up equity<sup>2</sup> in their existing dwellings through time. This is an important component of the demand for new dwellings within greenfield areas. These dwellings are typically higher in value than the existing market average, with a high proportion of their demand arising through existing households moving up the dwelling value profile through a combination of real income and equity growth.

A further scenario of dwelling demand growth has been generated to reflect these components of demand. An increase of 1% per annum has been applied to the dwelling demand profile through time to produce a conservative estimate of the size of demand within the higher dwelling value bands. This is below the likely rate of dwelling price inflation, however, it has been applied to reflect the smaller prortion of the timeframe across which a number of dwellings would have experienced price growth (where a number of dwellings would be constructed within the period). As such, it provides a conservative scenario of the dwelling demand by value band taking into account some demand growth from increases in equity through time.

Table 2-4 shows the net change in demand by value band, while Table 2-5 shows the total market picture through the total demand within each value band from new and existing households. The same approach has been applied as Table 2-2 and Table 2-3, albeit with a 1% annual growth in the dwelling value band profile.

Under this scenario, the net changes in dwelling demand and total market sizes increase under the midhigh and high dwelling value bands. The share of long-term dwelling demand growth above \$600,000 increases from 34%-47% (under the 0.5% growth scenario), to 45%-61%, equating to 14,000 to 19,000

Page | 14

<sup>&</sup>lt;sup>2</sup> Equity in existing dwellings also occurs through paying off mortgages through time:





additional dwellings. Under this scenario, around 40% of long-term detached 3+ bedroom dwelling demand growth occurs in value bands of \$800,000 or greater (6,000 to 9,000 dwellings).

The shares of total dwelling demand within the total market (Table 2-5) also correspondingly increase in the higher dwelling value bands under this scenario. In the long-term, there is a projected total demand for 26,000 to 29,000 dwellings in the higher value bands (\$800,000+). Most (23,000-26,000) of these are in the detached 3+ bedroom dwellings.

Table 2-3: Total Market Demand for Dwellings by Dwelling Value Band and Dwelling Type: Hamilton City, Short, Medium and Long-Term – 0.5% p.a. Real Household Income Growth

Time Period	Dwelling Type	Up to \$400k	\$400k-\$600k	5600k-5800k	elling Value Ban \$800k-\$1m S	d 1m-\$1.6m	S1.6m+	TOTAL
mic i chea	Succession Management	op to y to an	P. Indiana	LA POPOSITION CONTRACTOR	Nil Preference Shift Scenario			100,014
	Detached 1-2 Bed	1,400	3,200	1,300	300	80		6,20
	Detached 3+Bed	6,500	21,600	13,000	4,000	1,800	200	47,20
Short-Term 2020-2023	Attached 1-2 Bed	6,700	600	60	10	-	2	7,40
	Attached 3+ Bed	4,600	900	100	20	20		5,60
	TOTAL	19,200	26,300	14,500	4,300	1,900	200	66,40
	Detached 1-2 Bed	1,400	3,500	1,700	400	100	10	7,20
Medium- Jerm 2020- 2030	Detached 3+Bed	6,300	23,000	15,500	5,800	2,500	300	
	Attached 1-2 Bed	7,500	900	90	10	10	-	8,60
	Attached 3+ Bed	4,800	1,200	200	30	20		6,30
	TOTAL	20,000	28,700	17,400	6,300	2,700	300	75,40
	Detached 1-2 Bed	1,200	3,900	3,100	900	300		
	Detached 3+ Bed	4,600	22,300	24,600	9.600	5,300	500	66,90
Long Term	Attached 1 2 Bed	9.100	1,900	200	20	10	0 7	11,10
2020 2050	Attached 3+ Bed	5,000	2,100	300	50	40		7,50
	TOTAL	19,900	30,200	28,100	10,600	5,600	500	95,00
				Medium P	reference Shift	Scenario		
	Detached 1-2 Bed	1,300	3,100	1,300	300	80	-	6,10
	Detached 3+ Bed	6,500	21,400	12,800	4,000	1,700	500	46,60
Short-Term	Attached 1-2 Bed	7,100	700	60	10		1	7,80
2020-2023	Attached 3+Bed	4,800	900	100	20	20		5,90
	TOTAL	19,700	26,100	14,300	4,300	1,800	200	66,40
	Detached 1-2 Bed	1,400	3,500	1,600	400	100	10	7,00
Medium-	Detached 3+ Bed	6,100	22,400	15,100	5,700	2,500	300	52,10
Term 2020-	Attached 1 2 Bed	8,300	1,000	90	10	10		9,40
2030	Attached 3+ Bed	5,300	1,300	200	30	20	_	6,80
	TOTAL	21,000	28,300	17,000	6,100	2,600	300	75,40
	Detached 1-2 Bed	1,200	3,700	2,900	800	300	10	8,90
	Detached 3+Bed	4,400	21,100	23,100	9,100	5,000	500	63,10
Long-Term	Attached 1-2 Bed	11,300	2,300	200	36	20		13,90
2020-2050	Attached 3+ Bed	6,100	2,600	400	60	50		9,20
	TOTAL	22,900	29,700	26,600	10,000	5,300	500	95,00
	11111		-	High Pre	ference Shift Sci	enario		
	Detached 1-2 Bed	1,300	3,100	1,300	300	80	-	6,00
	Detached 3+ Bed	6,400	21,100	12,700	3,900	1,700	200	46,00
Short-Term	Attached 1 2 Bed	7,400	700	70	10	10		8,20
2020 2023	Attached 3+ Bed	5,000	1,000	100	20	20	-	6,10
	TOTAL	20,100	25,900	14,100	4,200	1,800	200	66,40
	Detached 1-2 Bed	1,300	3,400	1,600	400	100	10	6,80
Medium- Term 2020 2030	Detached 3+Bed	6,000	21,900	14,800	5,500	2,400	300	50,90
	Attached 1-2 Bed	9.100	1,100	100	20	10		10,30
	Attached 3+ Bed	5,700	1,500	200	40	30		7,40
	TOTAL	22,000	27,900	16,600	6,000	2,600	300	75,40
	Detached 1-2 Bed	1,100	3,500	2,700	800	300		
	Detached 3+Bed	4,100	19,900	21,800	8,500	4,700		59,40
Long Term	Attached 1 2 Bed	13,400	2,800	300	40	20		16,60
2020-2050	Attached 3+Bed	7,100	3,000	400	70	60		10,70
	TOTAL	25,700	29,200	25,200	9,400	5,000	500	95,00

Source: M.E Hamilton Housing Demand Model, 2020.

Page | 15





Table 2-4: Projected Net Change in Demand by Dwelling Value Band and Dwelling Type: Hamilton City, Short, Medium and Long-Term – 1% p.a. Real Household Income Growth

Time Period	Dwelling Type	Up to \$400k	\$400k-\$600k	\$600k-\$800k \$8			\$1.6m+	TOTAL	
				Nil Preference Shift Scenario					
	Detached 1-2 Bed	80	200	80	20	10	•	400	
Short-Term	Detached 3+ Bed	300	1,100	600	200	100	10	2,30	
2020-2023	Attached 1-2 Bed	300	40	1	-	5	•	40	
	Attached 3+ Bed	200	40	4	9-	-	-	20	
	TOTAL	900	1,300	700	200	100	10	3,30	
	Detached 1-2 Bed	200	600	400	100	30	-	1,30	
Medium-	Detached 3+ Bed	800	3,200	2,700	1,200	500	60	8,60	
Term 2020- 2030	Attached 1-2 Bed	1,300	200	20	-	-		1,50	
	Attached 3+ Bed	600	200	30	10		•	90	
	TOTAL	3,000	4,200	3,100	1,300	600	60	12,30	
	Detached 1-2 Bed	100	1,300	1,300	600	300	10	3,60	
Long-Term	Detached 3+ Bed	300	5,200	7,900	4,600	3,800	300	22,10	
2020-2050	Attached 1-2 Bed	2,900	900	200	20	10		4,10	
2020-2030	Attached 3+ Bed	1,200	700	200	40	20		2,20	
	TOTAL	4,500	8,100	9,600	5,300	4,100	300	31,90	
				Medium Prefe					
	Detached 1-2 Bed	70	200	70	20	10		30	
Short-Term 2020-2023	Detached 3+ Bed	300	1,000	600	200	90	10	2,10	
	Attached 1-2 Bed	500	50	-		6	LA.	50	
2020-2025	Attached 3+ Bed	300	50	10		- 5	, é	30	
	TOTAL	1,100	1,200	700	200	100	10	3,30	
	Detached 1-2 Bed	200	500	300	100	30	-	1,20	
Medium-	Detached 3+ Bed	700	2,900	2,400	1,100	500	50	7,70	
Term 2020-	Attached 1-2 Bed	1,800	300	30	,	-		2,10	
2030	Attached 3+ Bed	900	300	40	10	10		1,30	
	TOTAL	3,700	4,000	2,800	1,200	500	50	12,30	
	Detached 1-2 Bed	90	1,100	1,100	500	300	10	3,10	
0.52	Detached 3+ Bed	200	4,400	6,600	3,900	3,200	300	18,60	
Long-Term	Attached 1-2 Bed	4,700	1,500	300	40	20	-	6,60	
2020-2050	Attached 3+ Bed	2,000	1,200	400	70	40	-	3,60	
	TOTAL	7,000	8,100	8,400	4,500	3,500	300	31,90	
					ence Shift Scena				
	Detached 1-2 Bed	60	200	70	20	-	- 4	30	
w 0.400	Detached 3+ Bed	300	900	500	200	80	10	1,90	
Short-Term	Attached 1-2 Bed	600	50	10				70	
2020-2023	Attached 3+ Bed	300	70	10				40	
	TOTAL	1,200	1,200	600	200	90	10	3,30	
	Detached 1-2 Bed	200	500	300	90	30		1,10	
Medium- Term 2020-	Detached 3+ Bed	700	2,600	2,100	900	400	50	6,80	
	Attached 1-2 Bed	2,400	400	40	10		(4)	2,80	
2030	Attached 3+ Bed	1,200	400	50	10	10		1,70	
	TOTAL	4,400	3,800	2,500	1,000	500	50	12,30	
	Detached 1-2 Bed	80	900	1,000	400	200	10	2,60	
	Detached 3+ Bed	200	3,600	5,400	3,200	2,600	200	15,30	
Long-Term	Attached 1-2 Bed	6,500	2,000	400	60	20	-	9,10	
2020-2050	Attached 3+ Bed	2,700	1,600	500	90	50		4,90	
2020 2030	TOTAL	9,500	8,200	7,300	3,800	2,900	200	31,90	

Source: M.E Hamilton Housing Demand Model, 2020.

Page | 16





Table 2-5: Total Market Demand for Dwellings by Dwelling Value Band and Dwelling Type: Hamilton City, Short, Medium and Long-Term – 1% p.a. Real Household Income Growth

Time Period	Dwelling Type	Up to \$400k	\$400k-\$500k		ling Value Band 800k-\$1m \$1	m-\$1.6m	\$1.6m+	TOTAL
				Nil Prefer	ence Shift Scena	ario		
	Detached 1-2 Bed	1,300	3,200	1,300	300	90	1.0	6,200
Short-Term	Detached 3+ Bed	6,200	21,400	12,800	4,600	2,000	200	47,200
2020-2023	Attached 1-2 Bed	6,700	700	60	10	2.		7,400
	Attached 3+ Bed	4,500	1,000	100	20	20		5,600
	TOTAL	18,700	26,200	14,300	5,000	2,100	200	66,400
	Detached 1-2 Bed	1,200	3,300	1,900	600	200	10	7,200
Medium-	Detached 3+ Bed	5,200	20,200	17,000	7,400	3,300	400	53,400
Term 2020-	Attached 1-2 Bed	7,300	1,100	100	20	10	4	8,600
2030	Attached 3+ Bed	4,500	1,400	200	40	30		6,300
	TOTAL	18,200	26,100	19,200	8,000	3,500	400	75,400
	Detached 1-2 Bed	300	3,300	3,400	1,500	800	30	9,400
Long-Term	Detached 3+ Bed	800	15,800	23,800	14,000	11,400	1,000	66,900
2020-2050	Attached 1-2 Bed	8,100	2,500	500	70	30	9477	11,100
2020-2030	Attached 3+ Bed	4,100	2,400	800	100	70		7,500
	TOTAL	13,200	24,000	28,600	15,700	12,400	1,100	95,000
	7.00			Medium Pre	ference Shift So	enarlo	-	
	Detached 1-2 Bed	1,300	3,100	1,300	300	90		6,100
Short-Term 2020-2023	Detached 3+ Bed	6,100	21,100	12,600	4,500	1,900	200	46,600
	Attached 1-2 Bed	7,000	700	70	10	10	- 4	7,800
	Attached 3+ Bed	4,700	1,000	100	30	20		5,900
	TOTAL	19,100	26,000	14,100	4,900	2,100	200	66,400
	Detached 1-2 Bed	1,200	3,200	1,900	600	200	10	7,000
Medium-	Detached 3+ Bed	5,000	19,700	16,600	7,200	3,200	300	52,100
Term 2020-	Attached 1-2 Bed	8,000	1,200	100	20	10		9,400
2030	Attached 3+ Bed	5,000	1,600	200	40	30	-	6,800
	TOTAL	19,200	25,800	18,800	7,800	3,400	400	75,400
	Detached 1-2 Bed	300	3,100	3,200	1,400	800	30	8,900
Long-Term	Detached 3+ Bed	700	14,900	22,500	13,200	10,800	1,000	63,100
2020-2050	Attached 1-2 Bed	10,000	3,100	700	90	30	-	13,900
2020-2030	Attached 3+ Bed	5,000	2,900	1,000	200	90	10	9,200
	TOTAL	16,000	24,100	27,300	14,900	11,700	1,000	95,000
			100	High Prefe	rence Shift Scen	ario		
	Detached 1-2 Bed	1,300	3,100	1,300	300	90		6,000
Short-Term	Detached 3+ Bed	6,100	20,900	12,400	4,500	1,900	200	46,000
2020-2023	Attached 1-2 Bed	7,300	800	70	10	10		8,200
2020-2023	Attached 3+ Bed	4,900	1,000	100	30	20	-	6,100
	TOTAL	19,600	25,800	13,900	4,900	2,000	200	66,400
	Detached 1-2 Bed	1,200	3,100	1,800	600	200	10	6,800
Medium-	Detached 3+ Bed	4,900	19,300	16,200	7,000	3,100	300	50,900
Term 2020-	Attached 1-2 Bed	8,800	1,400	100	20	10	(1	10,300
2030	Attached 3+ Bed	5,400	1,700	200	50	30		7,400
	TOTAL	20,200	25,500	18,300	7,600	3,300	300	75,400
	Detached 1-2 Bed	300	3,000	3,000	1,300	700	30	8,300
Long-Term	Detached 3+ Bed	700	14,100	21,100	12,400	10,100	900	59,400
2020-2050	Attached 1-2 Bed	12,000	3,700	800	100	40		16,600
2020-2030	Attached 3+ Bed	5,800	3,400	1,100	200	100	10	10,700
	TOTAL	18,700	24,200	26,100	14,100	11,000	900	95,000

Source: M.E Hamilton Housing Demand Model, 2020.

Page | 17

Attachment 14



**Hamilton** City Council

# 3 Commercial Feasibility of Development **Options**

It is important to understand the commercial feasibility for developers of different development options when establishing planning provisions that affect the density and type of dwellings enabled within the greenfield areas. The feasibility of development is determined by whether a commercial developer is able to make a sufficient profit margin on a dwelling development. This section assesses the commercial feasibility of different development options to guide the development of planning parameters within each greenfield area. Planning parameters to be informed by the analysis relate to the minimum density provisions within greenfield areas and any provisions that specify the required dwelling type mix.

The following sub-sections provide an overview of the approach to commercial feasibility modelling (Section 3.1) and the calculation of dwelling densities (Section 3.1.1). The next sections (Section 3.2 to Section 3.5) then outline the key findings from the modelling. They estimate the current feasibility of development options and densities. They then examine how this may change through time, to provide estimated pictures of feasibility in the short, medium and long-term, Section 3,6 then considers the feasibility of different development densities for each dwelling type/size and how this is projected to change through time. The key findings of the commercial feasibility assessment are then brought together in Section 3.7 to identify the feasible development densities by each dwelling size/type combination in the current, short, medium and long-terms.

### 3.1 Approach to Commercial Feasibility

This assessment models the feasibility of development for a profit-driven commercial developer. It models the commercial feasibility of house and land package options where a developer sells a dwelling on a piece of land to a private buyer.

It is important to note that the private profit-driven commercial developer represents one component of the wider market that is likely to deliver housing capacity. There are other components of the market that may also deliver capacity, that may have different development models. These include central government social housing, other social housing/community-based providers, and any local government supplied housing. In addition, a small share of the dwelling development also occurs through households purchasing a section and then commissioning a builder to construct a house on it.

The modelling approach takes into account the costs3 of development to bring a house to market. It compares these costs to the estimated sales price of the constructed dwelling to determine the profit margin that may occur.

Page | 18

<sup>3</sup> Costs include the land cost, site preparation, construction costs (including landscaping), ancillary costs (resource consents. building consents, development contributions, utilities connections, technical specialist input, project management, sales and





In accordance with the NPS-UDC technical guidance, this assessment has assumed that developments with a margin of 20% or greater<sup>4</sup> are commercially feasible to construct for a commercial developer. Dwelling typology/sie and density combinations are deemed to be commercially feasible if they achive at least this margin in the assessment.

This assessment also identifies development options within an estimated profit margin of 15-20%. It is important to recognise that costs, prices and developer accepted margins are likely to vary across different developers as a function of the unique set of conditions to each development. The modelling approach triangulates multiple data sources to estimate average and generate the best estimates of costs and prices, however, it is not possible to reflect every possibility that may be available to individual developers.

Given the unique individualised circumstances of different developers, it is likely that developments will still occur that are outside of the ranges predicted by the modelling. It is therefore important to also consider development options that result in a margin outside of the 20% margin threshold. On this basis, we consider that developers within the 15-20% margin range are those that are next most likely to be delivered by the market. The results tables within this section therefore identify the density ranges within each dwelling typology/size combination that are estimated to fall within this additional range.

The feasibility modelling tests the commercial feasibility of different densities of each dwelling typology and size combination. Dwelling typologies are set as either attached or detached dwellings. Dwellings are then further divided by size into 1-2 bedroom dwellings and 3+ bedroom dwellings, with these combinations corresponding to the dwelling demand assessment. These typology/size combinations have not been specified beyond this level in order to not unnecessarily constrain the assessment for the development of planning provisions.

Importantly, in testing the feasibility of different densities, the modelling takes account of the relationships between the number of dwellings per hectare (density), site size, and the nature and size of dwellings constructed on each site<sup>5</sup>. There are corresponding changes in the structure of costs and prices, that align with dwellings at different densities, that drive the feasibility modelling. The modelling does not include any zoning minimum site size constraints as the intent is to inform the development of these parameters.

The model projects the feasibility of development options and densities through time. It provides a picture of the feasible development ranges in the current market, as well as in the short, medium and long-term. Understanding the feasibility through time is important as feasibility changes through time as demand and the scarcity of location increase. A greater range of development options and increased densities typically gradually increase in feasibility through time in growing urban economies.

Page | 19

marketing, and legal costs). Finance costs are applied to all of the costs in line with their project timing. GST and corporate taxes are also removed from the developer margin.

<sup>&</sup>lt;sup>4</sup> The margin refers to the profit margin made by a commercial developer through selling a house and land package. It is the margin, after tax, between the sales price and the total costs of development.

<sup>&</sup>lt;sup>5</sup> The modelled combinations are generated by assessment of the relationships between dwelling and site size for each typology, expressed as floor area ratios (FARs) – i.e. the dwelling floorspace / land parcel area. The FARs have been developed through assessment of other urban economies that contain a greater range of dwelling typologies and densities, and then calibrated to the Tauranga and Hamilton markets based on M.E's localised floorspace and land area parcel assessment models. The modelling also applies the ratios of parcelled land area to total subdivision developable area by dwelling typologies and densities, generated through the same assessment process in other urban economies.





#### 3.1.1 Calculation of Dwelling Densities

Dwelling densities within the modelling are expressed in terms of the number of dwellings per hectare. Specifically, they are the number of dwellings per hectare of developable area within a subdivision. The developable area includes roads and reserves, but excludes undevelopable areas (e.g. wetlands or geotechnically/topographically constrained areas) or major infrastructure corridors.

For modelling purposes, it is important that the densities are calculated based on the *total developable* area (as outlined above) rather than the area net of roads and reserves (i.e. the final saleable land parcel area). This is because of the share of land that is removed for roads and reserves is not constant and instead differs by the development density. Broadly, areas of higher density have a greater share of land removed for roads and reserves, with correspondingly lower shares removed within lower density developments.

As an example, a modelled density of 17 dwellings per hectare for 3+ bedroom detached dwellings would equate to a site size of around 400m2 per dwelling. At this density, 33% of the developable land would be removed for roads and reserves for this dwelling type. This leaves around 6,750m2 of land per hectare upon which to divide into saleable lots. At 17 dwellings per hectare, this equates to 400m2 per site (i.e. 6,750m2 / 17 = 397m2).

The modelled dwelling density ranges for each dwelling type/size combination and their resulting per dwelling site sizes are displayed in Table 3-1.

Table 3-1: Modelled Average Land Parcel Site Size per Dwelling by Dwelling

Density (Dwellings per Hectare)	Average Site Size per Dwelling (m2)			
	Detached 1-2 Bed	Detached 3+ Bed	Attached 1-2 Bed	Attached 3+ Bed
10		730	+	
11		650		
12		590		
13		540	h	530
14		490	1	49
15		460		450
16	420	420		42
17	400	400		39
18	370	370		37
19	350	350	340	34
20	330	330	320	33
21	310	310	300	31
22	300	300	290	29
23	280	280	270	28
24	270	270	260	26
25	250	250	250	25
26	240	1 6 7	230	24
27	230		230	23
28			220	22
29			210	210
30			200	21
31			200	20
32			190	19
33			180	19
34			180	18
35			170	18
36			170	17
37			160	17
38			160	16
39			160	16
40			150	16

Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

Page | 20





### 3.2 Current (2020) Situation

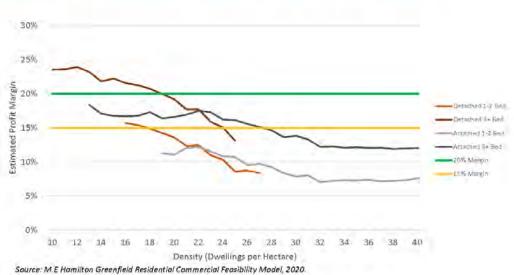
This section describes the current (2020) market situation within Hamilton's greenfield areas. It estimates the dwelling densities that are commercially feasible to construct within each dwelling typology/size combination, as well as the range of densities that have an estimated 15-20% margin.

Figure 3-1 displays the estimated feasibility within the current commercial development market. Each line on the graph represents and dwelling typology/size combination. The value at each point of the line shows the estimated profit margin of the dwelling typology/size combination at each dwelling density. Dwelling densities are expressed in terms of the number of dwellings per hectare<sup>6</sup>, with density increasing with the number of dwellings.

The graph also contains lines to show the 15% and 20% profit margins, which correspond to the assumed categories of feasibility within the model. Overall, it can be seen in the graph that feasibility generally decreases with density for each dwelling typology. The points at which the dwelling typology/size lines intersect the feasibility margin lines show the extent of the density range which is estimated to be currently commercially feasibily, or have marginal feasibility (15-20% margin).

Figure 3-1 shows that, in Peacocke, that detached 3+ bedroom dwellings have the highest levels of feasibility, with the market delivering the greatest margins in the lower density ranges.

Figure 3-1: Current (2020) Development Feasibility by Dwelling Type and Size: Peacocke



<sup>&</sup>lt;sup>6</sup> The number of dwellings per hectare also includes provision for roads, reserves, etc, where the non-parcelled (roads/reserves) area differs by dwelling typology and density. For example, at a yield of 20 detached 3+ bedroom dwellings per hectare, the model allocates 34% of the developable land area to roads, reserves, etc. The remaining area (6,600m2 per ha) is divided by 20 dwellings to equate to an average section size of 330m2 per dwelling.

Page | 21

Attachment 14



**Hamilton** City Council

In Peacocke, the model estimates that it is currently commercially feasible to develop detached 3+ bedroom dwellings at densities up to 18 dwellings per ha. At the highest density, this equates to a 372m2 section size. It estimates that densities of up to 24 dwellings per hectare (270-350m2 sections) fall within a 15-20% margin.

The model does not show any other dwelling typology/size combinations that are currently commercially feasible (with a margin of at least 20%) within Peacocke. However, it shows that attached 3+ bedroom dwellings of 13 to 25 dwellings per hectare (250-530m2 sections per dwelling unit) have an estimated margin of 15-20%. The modelling parameters assume that 3+ bedroom detached dwellings require a minimum site size of at least 250m27. The graph also shows that 1-2 bedroom detached dwellings at site sizes around the General Residential Zone 400m2 minimum (16 to 17 dwellings per hectare) also fall within this marginal range.

The estimated margins for smaller 1-2 bedroom dwellings are currently significantly lower than for larger dwellings. This reflects the current prices and demand for these types of dwellings within the market.

These modelled outputs reflect the current development patterns within Peacocke in Hamilton where the predominant patterns are for larger, detached houses. Previous development patterns within the last decade across Hamilton's greenfield areas have typically occurred on larger section sizes (600-800m2), particularly in the northern part of the city. Development patterns of standalone houses on smaller sites are starting to emerge, although the density of these are somewhat limited by the 400m2 per dwelling minimum site size requirement of single dwellings within the General Residential Zone that applies across most of Hamilton's residential area. A small share of development of attached dwellings on smaller sites is currently being constructed, including within the northern part of Peacocke.

The modelling suggests that attached 3+ bedroom dwellings have a higher estimated margin than detached 3+ bedroom dwellings at higher densities. This is because it becomes easier to construct attached dwellings, than detached dwellings, on smaller site sizes. The potential size of detached dwellings on smaller sites decreases at a greater rate than for attached dwellings due to the reduced constraint of bulk and location parameters for attached dwellings (due to attached walls across site boundaries). The feasibility of smaller dwellings is also reduced by the combination of lower sales prices and increased construction cost per m2 of smaller dwellings.

### 3.3 Short-Term (2020-2023) Projection

The estimated picture of feasibility in the short-term is shown in Figure 3-2. The short-term refers to the next three years (2020-2023) and somewhat aligns with the development planning pipelines.

The projected ranges of feasible and marginal development densities within each dwelling typology/size have increased slightly from the current feasibility estimates. The model estimates that it will be feasible to construct detached dwellings up to 20 dwellings per hectare in the short-term. This equates to an average section size of around 330m2 per dwelling, which is similar to the smaller site sizes currently being

Page | 22

<sup>\*</sup> Hamilton City Council planners advise that a minimum site size of 250m2 per standalone dwelling should be applied as an assumption in the model for Peacocke. We have applied this assumption for 3+ bedroom detached dwellings, and used an assumption of a 230m2 minimum site size for smaller 1-2 bedroom detached dwellings to reflect the smaller size of these dwellings.





delivered for standalone dwellings in other similar urban economies in New Zealand. It also shows that larger attached dwellings at lower densities also become feasible within the short-term.

Figure 3-2 also shows that the density ranges of dwellings within the marginal (15-20%) range also increase in the short-term. The marginal feasibility density of detached 3+ bedroom dwellings remains at 24 dwellings per hectare, and the attached 3+ bedroom dwellings, increases up to 31 dwellings per hectare. This reaches site sizes of down to nearly 200m2 per dwelling, which is similar to the current duplex dwelling per unit size site requirement of the General Residential Zone, which is experiencing duplex development at these higher densities across many parts of Hamilton. The range of smaller (1-2 bedroom) detached dwellings within the marginal range increases up to 20 dwellings per hectare.

Figure 3-2: Short-Term (2020-2023) Development Feasibility by Dwelling Type and Size: Peacocke



# 3.4 Medium-Term (2020-2030) Projection

The estimated picture of feasibility in the medium-term is shown in Figure 3-3. The short-term refers to the next ten years (2020-2030) with the development planning pipelines extending into this period.

The projected ranges of feasible and marginal development densities within each dwelling typology/size have increased again from the short-term feasibility estimates. The model estimates that it will become feasible to construct 3+ bedroom detached dwellings at up to 24 dwellings per hectare. At the highest density end of this range, this equates to an average site size of around 270m2 per dwelling, close to the highest density modelled.

The model projects that, in the medium-term, a greater range of attached 3+ bedroom dwellings will become commercially feasible to construct. It estimates that it will be feasible to construct these dwellings at densities up to 30 dwellings per hectare, which equates to site sizes of around 200m2 per dwelling unit.

Page | 23

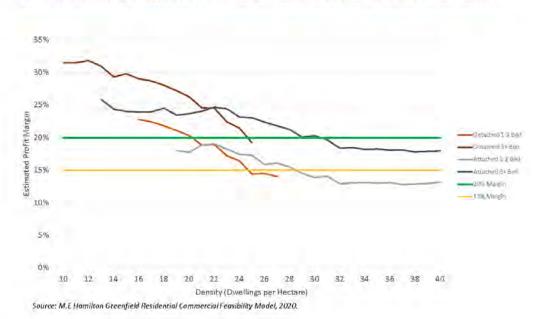
Attachment 14



This exceeds the estimated feasible range of detached 3+ bedroom dwellings due to ability to construct larger attached dwellings on smaller sites together with the constrained ability to construct detached dwellings on smaller sites.

In the medium-term, the model projects that it will become feasible to construct 1-2 bedroom detached dwellings. These are projected to become feasible at a dwelling density of up to 20 dwellings per hectare. The feasibility of smaller dwellings is likely to increase into the future, reflecting growth in the relative proportion of smaller households. Growth in demand for smaller dwellings is also seen in the range of 1-2 bedroom attached dwellings that are projected to occur in the marginal feasibility (15-20%) range in the medium-term. At the higher densities, these also have site sizes of around 200m2 per dwelling unit.

Figure 3-3: Medium-Term (2020-2030) Development Feasibility by Dwelling Type and Size: Peacocke



# 3.5 Long-Term (2020-2050) Projection

In the long-term (2020-2050), all of the modelled development options and densities are projected to become feasible in Peacocke (see Figure 3-4). Three or more bedroom dwellings have higher modelled margins than smaller dwellings, reflecting historic patterns of higher demand for dwellings with a greater number of bedrooms.

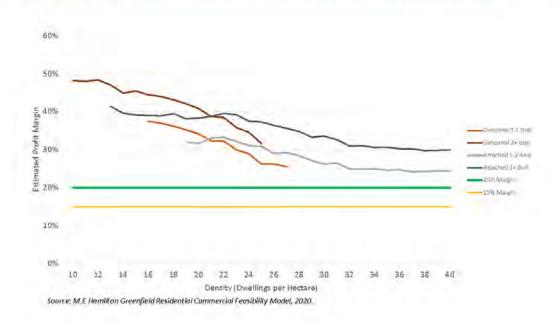
As sites become smaller, the modelling suggests that it becomes relatively more feasible to construct attached dwellings than detached dwellings. Within each dwelling size group (1-2 bedrooms vs. 3+ bedrooms), the modelled margins of attached dwellings begin to exceed those of detached dwellings at densities of 22 dwellings per hectare or greater. This equates to a site size of around 300m2 or smaller.

Page | 24





Figure 3-4: Long-Term (2020-2050) Development Feasibility by Dwelling Type and Size: Peacocke



### 3.6 Feasibility by Dwelling Typology and Size

The following sub-sections provide greater detail on the timing of feasibility of different densities within each dwelling typology/size combination. The chart in each sub-section shows the full crosstabulation between the modelled density range (dwellings per hectare) and the years within the modelling time period (2020-2050).

The green sections on each graph show the range of dwelling densities that are feasible within each year with a margin of 20% of greater. The vertical height of the green section, at each yearly interval, corresponds with the maximum density that is modelled to be feasible at the point in time. The range of feasible density generally increases through time. The yellow sections of the graph show the range of densities that are modelled to have a margin of 15-20%; and the grey areas, the range of densities that are deemed to be infeasible with a margin of less than 15%.

#### 3.6.1 Detached 1-2 Bedroom Dwellings

Figure 3-5 shows the modelled feasibility for 1-2 bedroom detached dwellings in Peacocke. The modelling suggests that this development option is projected to become feasible with a 20% or greater margin midway through the medium-term. In the short and medium-terms, a range of density is projected to be within the 15-20% margin for this development option. These equate a range of smaller site sizes (around 270-400m2).

The feasible density of this development option increases through time. The maximum modelled densities are projected to become feasible with a 20% or greater margin midway through the long-term. These are modelled at 27 dwellings per hectare, which equates to a small standalone dwelling (around 100-110m2).

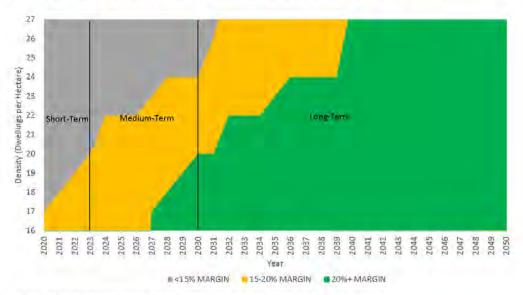
Page | 25





floorspace) on a small site area (around 230m2). While this density may be projected to become feasible, the market may deliver dwellings at a different density within the feasible range, depending upon the scale of demand and market preferences that emerge in the long-term.

Figure 3-5: Feasibility by Density and Time for Detached 1-2 Bedroom Dwellings: Peacocke



Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

#### 3.6.2 Detached 3+ Bedroom Dwellings

Figure 3-6 shows the modelled feasibility for for 3+ bedroom detached dwellings in Peacocke, It estimates that much of the modelled range is currently feasible to construct with a 20% or greater margin. It is estimated that it is currently feasible to construct dwellings on minimum site sizes similar to those in the General Residential Zone (400m2) that is applied across much of Hamilton's residential area.

In the short-term the feasible density is projected to increase to around 20 dwellings per hectare, equating to site sizes of around 330m2 per dwelling. These site sizes are not currently seen in the Hamilton market within the outer areas of greenfield growth. However, this is likely to be influenced by the existing General Residential Zone 400m2 minimum site size requirement for single dwellings. We note that 3+ bedroom detached dwellings are currently being delivered at these smaller site sizes in the greenfield growth areas of other similar urban economies.

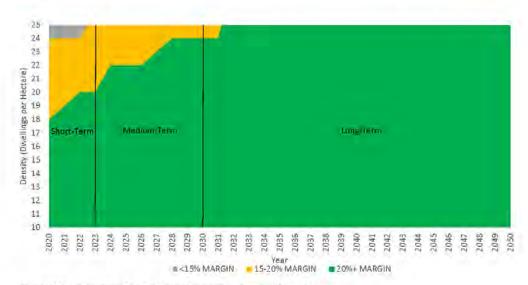
The full modelled range of densities for this development option is projected to become feasible (at a 20% or greater margin) shortly into the long-term (around 2031-2032). This equates to a density of 25 dwellings per hectare, with a site size of around 250m2 per dwelling.

Page | 26





Figure 3-6: Feasibility by Density and Time for Detached 3+ Bedroom Dwellings: Peacocke



Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

#### 3.6.3 Attached 1-2 Bedroom Dwellings

The modelled feasibility through time of attached 1-2 bedroom dwellings is shown in Figure 3-7. The modelled range of density is from 19 dwellings per hectare up to 40 dwellings per hectare, equating to a site size range of around 150m2 to 350m2.

The modelling projects that this type of development is more likely to become feasible at a margin of 20% or greater in Peacocke during the long-term. It is not projected to achieve a 15-20% margin till the medium-term. Long-term demand for these types of smaller dwellings are likely to correspond to patterns of greater growth in smaller household types seen in the demand assessment.

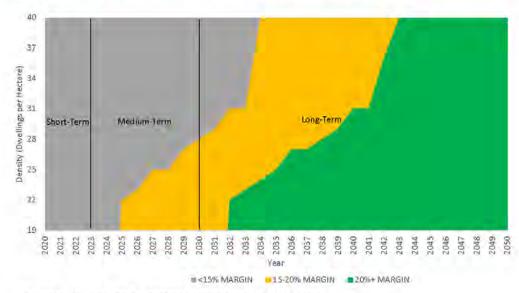
Current market analysis suggests that these types of smaller, attached dwellings are currently being delivered within Hamilton. Although, these are typically occurring within more central areas of higher amenity, while outer greenfield areas have a greater propensity to develop as larger detached dwellings on larger sites. However, the establishment of a centralised node of higher amenity within the Peacocke area may increase the viability of these types of smaller higher density dwellings. While there are currently some attached dwellings being developed within Peacocke, these are generally 3+ bedroom dwellings, which are reflected in the following section.

Page | 27





Figure 3-7: Feasibility by Density and Time for Attached 1-2 Bedroom Dwellings: Peacocke



Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

### 3.6.4 Attached 3+ Bedroom Dwellings

The modelled feasibility by density for attached 3+ bedroom dwellings is shown in Figure 3-8. This development option is projected to become feasible at a 20% or greater margin in the medium-term, with the full range of modelled densities becoming feasible at this margin part way through the long-term.

In the current market and short-term, a range of this development option is estimated to have a margin of 15-20%. It is estimated that the density range at this margin currently equates to 13 to 27 dwellings per hectare, increasing up to 31 dwellings per hectare in the short-term. At the highest density, this corresponds to a site size of 230m2 currently, decreasing to 200m2 in the short-term. This development option at this higher density (230m2 site size) reflects a small share of the development that is currently occurring within Peacocke.

While the modelling estimates that this development option is likely to be feasible at lower densities in the medium-term, it is less likely that attached dwellings will be delivered by the market at this density range. The reason is twofold. Firstly, at these larger site sizes (13 to 15 dwellings per hectare – 450m2 to 530m2 site sizes), the market is easily able to deliver standalone dwellings, which typically have a higher level of demand as their size is not generally constrained at this site size. Secondly, if attached dwellings are constructed, then they are more likely to be constructed at a higher density to increase the total dwelling yield, and therefore, net profit, of the subdivision.

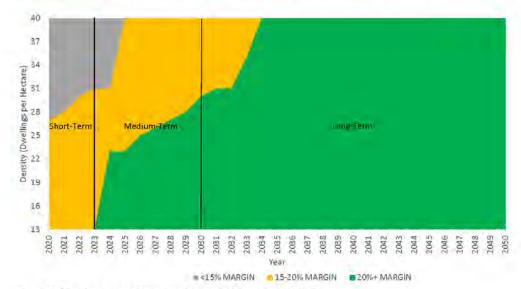
The full range of modelled densities is projected to become feasible, at a margin of 20% or greater, for this development option in the long-term.

Page | 28





Figure 3-8: Feasibility by Density and Time for Attached 3+ Bedroom Dwellings: Peacocke



Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

## 3.7 Summary to Inform the Development of Planning Density Parameters

The estimated and projected feasibility of density ranges for each development option is summarised in Table 3-2 for the current situation and the short, medium and long-term. The first column in the table shows the range of dwelling densities, for each development option, that are projected to be feasible at a margin of 20% of greater within each time period. The final column also shows the corresponding range of densities that are projected to have a margin of 15-20%, which provides an indication of density ranges that may be feasible for individual developer circumstances.

These density ranges reflect those discussed in the previous sections for each development option and time period. They are collated here to assist planners in establishing appropriate density and dwelling typology/size requirements for the Peacocke greenfield area.

In addition, Table 3-2 also estimates the feasibility of apartment dwellings. These reflect apartments that are constructed in buildings that are three storeys or greater. These are not projected to be feasible currently or in the short-term, but are projected to begin to become feasible within the medium and long-term.

The middle column of Table 3-2 also contains an estimated projected dwelling price range associated with each of the density ranges projected for the 20% or greater margin. The prices are the estimated sales prices within the model associated with these feasible density ranges. The prices modelled are expressed

Page | 29





in 2020 values. However, they assume a real increase in dwelling prices (within each dwelling typology/size combination) of 2% per annum through time.

Table 3-2: Estimated Commercially Feasible Development Densities and Dwelling Value Bands in Peacocke by Time Period and Dwelling Size/Type

TIME PERIOD	Feasible Density Range (>= 20% margin)	Feasible Dwelling Price Range	Marginal Density Range (15% - 20% margin)						
	DE	DETACHED 1-2 Bedroom Dwellings							
Current: 2020	Not Feasible	Not Feasible	16 to 17 dwellings per ha						
Short-Term: 2020-2023	Not Feasible	Not Feasible	16 to 20 dwellings per ha						
Medium-Term: 2020-2030	16 to 20 dwellings per ha	\$930k to \$1.08m	21 to 24 dwellings per ha						
Long-Term: 2020-2050	16 to 27 dwellings per ha	\$870k to \$1.60m	The same of the same of						
	DI	ETACHED 3+ Bedroom Dwell	ings						
Current: 2020	10 to 18 dwellings per ha	\$870k to \$1.23m	19 to 24 dwellings per ha						
Short-Term: 2020-2023	10 to 20 dwellings per ha	\$840k to \$1.31m	21 to 25 dwellings per ha						
Medium-Term: 2020-2030	10 to 24 dwellings per ha	\$790k to \$1.50m	25 dwellings per ha						
Long-Term: 2020-2050	10 to 25 dwellings per ha	\$800k to \$2.22m							
	AT	TACHED 1-2 Bedroom Dwel	lings						
Current: 2020	Not Feasible	Not Feasible	Not Marginal						
Short-Term: 2020-2023	Not Feasible	Not Feasible	Not Marginal						
Medium-Term: 2020-2030	Not Feasible	Not Feasible	19 to 28 dwellings per ha						
Long-Term: 2020-2050	19 to 40 dwellings per ha	\$850k to \$1.43m							
	A	TTACHED 3+ Bedroom Dwell	ings						
Current: 2020	Not Feasible	Not Feasible	13 to 27 dwellings per ha						
Short-Term: 2020-2023	13 dwellings per ha	\$1.05m to \$1.1m	14 to 31 dwellings per h						
Medium-Term: 2020-2030	13 to 30 dwellings per ha	\$820k to \$1.26m	31 to 40 dwellings per ha						
Long-Term: 2020-2050	13 to 40 dwellings per ha	\$770k to \$1.87m							
	ATTACHE	D 1-2 Bedroom Dwellings (A	partments)						
Current: 2020	Not Feasible	Not Feasible	Not Marginal						
Short-Term: 2020-2023	Not Feasible	Not Feasible	Not Marginal						
Medium-Term: 2020-2030	Feasible	\$530k to \$540k	Marginal						
Long-Term: 2020-2050	Feasible	\$540k to \$780k							

Source: M.E Hamilton City Greenfield Commercial Feasibility Model, 2020.

Generally, the lower prices correspond to the higher end of the density range as they reflect the provision of smaller dwellings and land areas. In addition, the price ranges can occur at a particular point in the time period, with the price of their corresponding development option changing through time. For instance, the modelling projects that the price range for feasible 3+ bedroom dwellings is modelled at \$800,000 to \$1.53 million in the long-term. The lower end (\$800,000) of this price bracket corresponds to a dwelling constructed at a density of 25 dwellings per hectare toward the start of the long-term (when this higher density becomes feasible). Using the growth assumptions within the model, this dwelling is projected to increase in price to \$1.14m by the end of the modelling period (2050). Conversely, the maximum price of \$2.22m in this range corresponds to the construction of a large dwelling (250m2) on a large site (around 730m2) in 2050.

It is important to note that the highest prices in these ranges are likely to reflect the construction of the largest dwellings and site size combinations within each development option. Part of this increase would

Page | 30





reflect the price premium paid due to the scarcity of space at these lower densities where the overall average densities of urban economies typically gradually increase through time due to the scarcity of location. Development patterns through time suggest that the market is instead more likely to gradually develop to greater densities, which therefore has the effect of slowing the real increase in dwelling prices (on an average per dwelling basis) through time.

The differences in prices between different dwelling typology/size development options are also a function of the timining of the feasibility of the density range. This is particularly the case within the long-term, where prices for similar sized dwellings may be higher for one development option relative to another as a function of the time at which the density becomes feasible within the time period. For example, at the upper end of the feasible density for 3+ bedroom detached dwellings (25 dwellings per hectare), the typology is projected to become feasible in 2032 at a price of \$800,000. However, the 1-2 bedroom detached dwelling, at the same density, has a higher price of \$890,000 because it is projected to become feasible significantly later (in 2040) than the 3+ bedroom dwelling.





# 4 Development Options & Demand

The final assessment draws together the projected dwelling demand for Hamilton and the dwelling density ranges estimated to be feasible in the Peacocke greenfield area in the short, medium and long-term. These demand and feasibility outputs are presented by dwelling type/size combination and dwelling value band.

The value band information relates to the value band of demand within each category (on the demand side) and then the estimated price at which capacity is modelled to be feasible. This comparison identifies the broad areas of market overlap between overall Hamilton housing demand and what is estimated to be feasible to potentially supply in Peacocke. Importantly, the analysis also identifies the number of additional and total dwellings demanded to show the estimates projected scale of the market within each area of overlap.

The following tables (Table 4-1 to Table 4-5) provide the comparison between the demand and feasibility assessments for each dwelling type/size combination. The upper parts of the table contains the total and additional market demand within each dwelling value band. The top section contains the demand outputs for the scenario where the dwelling value profile is increased by 0.5% per annum to reflect real increases in household income; and the next section, where the value profile is increased by 1% per annum to allow for a level of demand growth through increases in equity within existing dwellings. It is important to consider both the additional and total demand aspects of the market as much for the greenfield supply is taken up by existing households. The total market shows the total potential size of the market that could purchase from the supplied greenfield dwellings.

The lower section of each table contains the dwelling density ranges that are projected to be feasible within the Peacocke greenfield area within the short, medium and long-term. These are correlated with dwelling value bands based on the estimated price at which they are projected to be feasible. The table contains both the ranges which are feasible with a margin of 20% or greater, as well as the density ranges that are projected to have a margin of between 15% and 20%.

Finally, the shading within the upper sections of the tables shows the broad areas of potential overlap between the dwelling demand and feasible development options in Peacocke. The areas of darker shading show value bands within each timeframe that contain development options that are projected to be feasible in Peacocke at a 20% or greater margin. The lighter shaded parts of the table correspond to areas that are estimated to contain potential development options with an estimated 15%-20% margin. As such. The table can be read by observing the scale of the demand in the upper sections, and the extent of demand which falls within a feasible range. The lower part of the table then shows the corresponding densities for each dwelling value band/timeframe combination.

The demand and potential feasible capacity should be compared at a broad level. The dwelling value band profile of new dwellings does not necessarily need to closely align with the value profile of demand for a couple of reasons. Firstly, part of the demand within a value band may be met through supply within other adjacent dwelling value bands. While part of this effect is already captured within the 1% scenario through the accumulation of equity, potential still exists for households to move up within the value profile, albeit with a lower level of affordability.

Page | 32





Secondly, the demand analysis reflects the underlying patterns of household dwelling demand by value band and dwelling type. Some of the demand for dwellings within a value band can be met with similar value bands across other dwelling types. As such, part of the demand for a given dwelling type and price point may also occur in the segments of market demand for other types of dwellings. This often occurs where households make tradeoffs between location, space and price of dwellings.

### Detached 1-2 Bedroom Dwellings

The assessment for 1-2 bedroom detached dwellings is contained in Table 4-1. This development option is projected to become feasible in Peacocke during the medium-term. The total estimated market for this dwelling type is relatively small, with a total market size of 500-800 dwellings (including around 100 additional dwellings) in the medium-term and 600-1,200 dwellings (including around 300 to 900 additional dwellings) in the long-term estimated to overlap with development options with a projected market of 20% of greater.

Table 4-1: Comparison of Projected Hamilton Dwelling Demand and Projected Feasibility of Development Density Options in Peacocke: Detached 1-2 Bedroom Dwellings

			TOTAL	MARKET DEMAI	ND (0.5% p.s. de	mand profile	growth)	0.4	
	Nill	Preference Shift		Medi	um Preference	Shift	High	Preference Shift	t
Dwelling Value Band	Short-Term M	ledium-Term Lo	ng-Term	Short-Term 1	Medium-Term	Long-Term	Short-Term I	Medium-Term Lo	ng-Term
Up to \$400k	1,400	1,400	1,200	1,300	1,400	1,200	1,300	1,300	1,100
\$400k to \$600k	3,200	3,500	3,900	3,100	3,500	3,700	3,100	3,400	8,500
\$600k to \$800k	1,300	1,700	3,100	1,300	1,600	2,900	1,300	1,600	2,700
\$800k \$1m	300	-400	900	300	400	800	300	400	800
\$1m-\$1.6m	80	100	300	80	100	300	80	100	300
\$1,600+		10	10	1	10	10		10	10
TOTAL	6,200	7,200	9,400	6,100	7,000	8,900	6,000	6,800	8,300
			DDITIONA		MAND (0.5% p.		ofile growth)		
	Nil Preference Shift				um Preference			Preference Shift	
Dwelling Value Band	100	ledium-Term Lo		1	Medium-Term		The second second	Wedium-Term Lo	
Up to \$400kg	80	300	500	70	200	400	70	200	300
\$400k to \$600k	200	700	1,500	200	600	1,300	200	500	1,100
\$600k to \$800k	80	300	1,700	70	300	1,000	70	200	800
\$800k-\$1m	20	80	300	10	70	300	10	60	200
\$1m-\$1.6m	20	20	100	20	20	100	10	70	90
\$1.6m+	9	- X31	-100	-	Agr	100		- 24	90
TOTAL	400	1,300	3,600	300	1,200	3,100	300	1,100	2,600
TOTAL	400	1,500	4			197		1,100	2,000
	****	n. d			WD (1% p.a. de			David and Chief	_
	The second second	Preference Shift		Medium Preference Shift Short-Term Medium-Term Long-Term			High Preference Shift		
Dwelling Value Band		ledium-Term Lo	- 5					Medium-Term Lo	
Lip to \$400k	1,300	1,200	300	1,300	1,200	300	1,300	1,200	300
\$400k to \$600k	3,200	3,300	3,300	3,100	3,200	3,100	3,100	3,100	3,000
\$600k to \$800k	3,300	1,990	3,400	1,300	1/900	3,200	1,300	1,800	3,000
\$800k-\$1m	300	600	1,500	300	600	1,400	300	600	1,300
\$1m-\$1.6m	.90	200	870	90	700	800	90	201	700
\$1.6m+	-	10	30	7	10	30	7	10	30
TOTAL	6,200	7,200	9,400	4	7,000	8,900	6,000	5,800	8,300
		-	ADDITION,	AL DWELLING D	EMAND (1% p.a	. dumand pro		-	
	NIII	Preference Shift		Medium Preference Shift			High	Preference Shift	t
Dwelling Value Band	Short-Term M	ledium-Term Lo	ng-Term	Short-Term 1	Medium-Term	Long-Term	Short-Term !	Medium-Term Lo	ng-Term
Up to \$400k	80	200	100	70	200	90	60	200	30
\$400k to \$600k	200	600	1,300	200	500	1,100	200	500	900
\$600k to \$800k	.80	400	1,300	70	300	1,100	70	300	1,000
\$800k-\$1m	20	100	600	20	100	500	20	90	400
\$1m-\$1.6m	10	30	300	10	30	3/00	-15	30	200
\$1,6m+	100	-	10	1 Acr	-	10	91		10
TOTAL	400	1,300	3,600	300	1,200	3,100	300	1,100	2,600
	D	EVELOPMENT D	ENSITY OF	TIONS (Owelling	gs per Hectare)				
		of 20% or Grea			argin of 15%-20	%	1		
Dwelling Value Band		ledium-Term Lo		The second second	Medium-Term				
Up to \$400k	1						1		
\$400k to \$600k									
\$600k to \$800k					21 to 24	25 to 27			
\$800k-\$1m		17 to 20	19 to 27	16 to 20	16 to 23	21 to 27			
\$1m-\$1.6m		16 to 19.	16 to 27	101020	10 10 25	21.002/			
\$1.6m+		AN IO. IN.	TOTOLS						
2 8 11 11 11	Housing Deman						The same of		

Source: M.E. Hamilton Housing Demand Model, 2020 and M.E. Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

Page | 33

Attachment 14





The market size becomes significantly larger when considering demand within the lower adjacent value band (\$600,000-\$800,000), where development options are estimated to have a 15%-20% margin in the medium and long-term. There are is a projected further 1,600 to 1,900 dwelling demand (including 200 to 400 additional dwellings) within this value band in the medium-term, and a further 2,700 to 3,400 dwelling demand (including 800 to 1,300 additional dwellings) in the long-term.

### Detached 3+ Bedroom Dwellings

The assessment for 3+ bedroom detached dwellings is contained in Table 4-2. This development option is estimated to be currently feasible in Peacocke with a margin of 20% or greater, with an increasing range of development densities projected to become feasible in Peacocke through time.

Table 4-2: Comparison of Projected Hamilton Dwelling Demand and Projected Feasibility of Development Density Options in Peacocke: Detached 3+ Bedroom Dwellings.

		Carlo Carlo			AND (0.5% p.a. d				
	1	il Preference Sh		77.00	dium Preference			h Preference Shif	
Dwelling Value Band	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term Le	ong-Term
Up to \$400k	6,500	6,300	4,600	6,500	6,100	4,400	6,400	6,000	4,100
\$400k to \$600k	21,600	23,000	22,300	21,400	22,400	21,100	21,100	21,900	19,900
\$600k to \$800k	13,000	15,500	24,600	12,800	15,100	23,100	12,700	14,800	21,800
\$800k-\$1m	4,000	:5,800	9,600	4,000	5,700	9,100	3,900	5,500	8,500
\$1m-\$1.6m	1,900	2,500	5,300	1,700	2,500	5,000	1,700	2,400	4,700
\$1.6m+	200	300	500	200	300	500	200	300	500
TOTAL	47,200	53,400	66,900	46,600	52,100	63,100	46,000	50,900	59,400
		-	ADDITIONA	L DWELLING	DEMAND (0.5% p	a. demand pr	ofile growth)		
	N	il Preference Sh	ift	Me	dium Preference	Shift	Hig	h Preference Shill	t
Dwelling Value Band	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L	ong-Term
Up to \$400k	300	1,000	1,500	300	900	1,300	300	800	1,100
\$400k to \$600k	1,100	3,700	7,400	1,000	3,300	6,200	900	2,900	5,100
\$600k to \$800k	600	2,500	8,100	600	2,200	6,800	500	2,000	5,600
\$800k-\$1m	200	900	3,200	200	800	2,700	200	/00	2,200
\$1m \$1.6m	90	400	1,700	80	400	1,500	70	300	1,200
\$1.6m+	10	50	200	10	40	100	10	40	100
TOTAL	2,300	8,600	22,100	2,100	7,700	18,600	1,900	6,800	15,300
10.0	7				IAND (1% p.a. de			3,232	
	N	il Preference Sh		Medium Preference Shift			High Preference Shift		
Dwelling Value Band	The second secon	Medium-Term			Medium-Term		The second second	Medium-Term L	
Up to S400k	6,200	5,200	800	6,100	5.000	700	6,100	4,900	700
\$400k to \$600k	21,400	20,200	15,800	21,100	19,700	14,900	20,900	19,300	14,100
S600k to S800k	12,800	17,000	23,800	12,600	16,600	22,500	12,400	16,200	21,100
\$800k-\$1m	4,600	7,400	14,000	4,500	7,200	13,200	4,500	7,000	12,400
S1m-S1.6m	2,000	3,300	11,400	1,900	3,200	10,800	1,900	3,100	10,100
\$1.6m+	200	400	1,000	200	300	1,000	200	300	900
TOTAL	47,200	53,400	66,900	46,600	52,100	63,100	46,000	50,900	59,400
TOTAL	47,200	33,400						30,300	33,400
	- 61	il Preference Sh			DEMAND (1% p.:			h Desfarance Child	
0				The second second			High Preference Shift Short-Term Medium-Term Long-Term		
Dwelling Value Band		Medium-Term		Short-Term	Medium-Term				
Up to \$400k	300	800	300		700	200	300	700	200
\$400k to \$600k	1,100	3,200	5,200	1,000	2,900	4,400	900	2,600	3,600
\$600k to \$800k	600	2,700	7,900	600	2,400	6,600	500	2,100	5,400
\$800k-\$1m	200	1,200	4,600	200	1,100	3,900	200	900	3,200
\$1m-\$1.6m	100	500_	3,800	90	500	3,200	80	400	2,600
\$1.6m+	10	60	300	10	50	300	10	50	200
TOTAL	2,300	8,600	22,100	2,100	7,700	18,600	1,900	6,800	15,300
				1	ngs per Hectare)	~			
		gin of 20% or Gr		1	Margin of 15%-20				
Dwelling Value Band	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term	Long-Term			
Up to \$400k									
\$400k to \$600k				7					
\$600k to \$800k		24		21 to 24	23 to 25	25			
\$800k-\$1m	14 to 20	17 to 24	20 to 25	19 to 21					
S1m S1.6m	10 to 15	10 to 19	101025						
\$1.6m+			10 to 17				100		

Source: M.E. Hamilton Housing Demand Model, 2020 and M.E. Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

Page | 34





Larger (3+ bedroom) detached dwellings are currently the predominant development type within Hamilton's greenfield areas, and correspondingly have the largest total market size across Hamilton overall. The analysis suggests there is also significant overlap of the feasible development options in Peacocke with total Hamilton market demand for this dwelling type. It is estimated that around 40% of the short-term total market is either feasible at 20% or greater, or has an estimated margin between 15% and 20%. The existing strong market preferences for larger detached dwellings means that it is more likely that the market will also deliver dwellings within the estimated 15%-20% margin densities. In the long-term it is projected to become feasible to construct this dwelling type at densities with associated price points that correspond to up to 75% of the total market value band profile.

In total, it is projected that the feasible development options, with a 20% or greater margin, correspond to a short-term total dwelling demand for 5,600 to 6,600 dwellings (including around 300 additional dwellings). In the medium-term, the estimated feasible development options correspond to a total dwelling demand of 23,000 to 28,000 dwellings (including 3,000 to 4,400 additional dwellings). In the long-term, the total demand overlap is estimated to be 14,000 to 26,000 dwellings (including 3,500 to 9,000 additional dwellings). The total market size becomes substantially larger when considering demand within the 15%-20% estimated range.

Most of the estimated feasible (at a 20% or greater margin) development ranges for 3+ bedroom detached dwellings correspond to dwellings in value bands of \$800,000 or more. Dwellings in the \$600,000 to \$800,000 value bands are projected to have a 15% to 20% margin.

### Attached 1-2 Bedroom Dwellings

The assessment for 1-2 bedroom attached dwellings is contained in Table 4-3. This development option is projected to only become feasible in Peacocke in the long-term, with no development options estimated to occur within the 15%-20% margin range either within the short-term.

The total market size for this dwelling option within the projected feasible range is very small, with around 100 dwellings demanded within the upper price bands within the long-term, and projected demand for less than 1,000 dwellings within the 15%-20% margin range. Total market demand for the smaller attached dwellings is instead concentrated into the lower dwelling value bands within the market.

It is important to note that dwelling demand within this category is very low within the mid to upper price brackets (those that are feasible in the long-term with a 20% or greater margin), which is partly due to the very small share of the existing dwelling stock within these parts of the market. The analysis here relates to smaller dwellings that are on land areas of around 150m2 to 340m2 per dwelling (at 19 to 40 dwellings per hectare). In contrast, many of the smaller (1-2 bedroom) attached dwellings within the existing dwelling stock are likely to be either older dwellings in lower value locations, or have smaller land areas per dwelling, placing them into the lower dwelling value bands. At the densities modelled here (150m2 to 340m2 site sizes), it is likely to be a more feasible option, due to higher demand, to construct either a detached or larger (3+ bedroom) dwelling.

The following section further examines the smaller attached dwellings at higher densities that instead reflect apartment developments.

Page | 35





Table 4-3: Comparison of Projected Additional Hamilton Dwelling Demand and Projected Feasibility of Development Density Options in Peacocke: Attached 1-2 Bedroom Dwellings

			TOTAL !	MARKET DEM	AND (0.5% p.a. d	emand profile	growth)			
	1	III Preference Shif	t	Me	dium Preference	Shift	High Preference Shift			
Dwelling Value Band	Short-Term	Medium-Term L	ong-Term	Short-Term	Medium-Term	Long-Term	erm Short-Term Medium-Term Long-Ter			
Up to \$400k	6,700	7,500	9,100	7,100	8,300	11,300	7,400	9,100	13,400	
5400k to \$600k	600	900	1,900	700		2,300	700	1,100	2,800	
\$600k to \$800k	60	90	200	60		200	70	100	300	
\$800k-\$1m	10	10	20	10		30	10	20	-40	
\$1m-\$1.6m	1.2	10	10		10	20	10	10	20	
\$1.6m+				- 5	-			-		
TOTAL	7,400	8,600	11,100	7,800	9,400	13,900	8,200	10,300	16,600	
TOTAL	17,100				DEMAND (0.5% p		-	10,500	10,000	
		III Preference Shif			dium Preference			gh Preference Shi		
Dwelling Value Band	I amount of the same of the sa	Medium-Term L			Medium-Term		Short-Term	Medium-Term L		
Up to \$400k	300	1,300	3,300	500	1,900	5,300	600	2,400	7,300	
\$400k to \$600k	30	200	700	40	200	1,100	60	300	1,500	
	30	20		40			10			
\$600k to \$800k		20	70	-	20	100	10	30	200	
\$800k \$1m			10			10	-		20	
\$1m-\$1.6m		7	8		7	10	7		10	
\$1.6m+	200			1			-	7000	-	
TOTAL	400	1,500	4,100	500		6,600	700	2,800	9,100	
					1AND (1% p.a. de					
	The second secon	III Preference Shif		Medium Preference Shift			High Preference Shift			
Dwelling Value Band	Short-Term	Medium-Term L	ong-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L	ong-Term	
Up to \$400k	6,700	7,300	8,100	7,000	8,000	10,000	7,300	8,800	12,000	
\$400k to \$600k	700	1,100	2,500	700	1,200	3,100	800	1,400	3,700	
\$600k to \$800k	60	100	500	70	100	700	70	100	800	
\$800k-\$1m	10	20	70	10	20	90	10	20	100	
\$1m-\$1.6m	_	10	30	10	10	30	10	10	40	
\$1.6m+	100	-	-	-				-	-	
TOTAL	7,400	8,600	11,100	7,800	9,400	13,900	8,200	10,300	16,600	
			ADDITIONA	L DWELLING	DEMAND (1% p.	a. demand pro	file growth)			
	N.	III Preference Shif			dium Preference			gh Preference Shi	ft	
Dwelling Value Band		Medium-Term L		Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L		
Up to \$400k	300	1,300	2,900	500		4,700	600	2,400	6,500	
\$400k to \$600k	40	200	900	50		1,500	60	400	2,000	
\$600k to \$800k	1	20	200		30	300	10	40	400	
\$800k-\$1m		20	200		30	40	10	10	60	
S1m S1.6m			10			20	3.	10	26	
\$1.6m+	-	-	10			20			-20	
	400	2 500		500	2.100	5.500	700			
TOTAL	400	1,500	4,100			6,600	700	2,800	9,100	
		DEVELOPMENTE					-			
and the second second	Margin of 20% or Greater			The second second	Margin of 15%-20%					
Dwelling Value Band	Short-Term	Medium-Term L	ong-Term	Short-Term	Medium-Term	Long-Term				
Up to \$400k										
\$400k to \$600k										
\$600k to \$800k						29 to 40				
\$800k-\$1m			21 to 40		19 to 28	19 to 40				
\$1m-\$1.6m			19 to 36							
\$1.6m+										

Source: M.E Hamilton Housing Demand Model, 2020 and M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

Page | 36





### Attached 1-2 Bedroom Dwellings - Higher Density

The assessment for higher density 1-2 bedroom detached dwellings is contained in Table 4-4. These relate to higher density apartment dwellings at around 80 to 120 dwellings per hectare. They have a 50m2 floorspace with an average land area of around 50m2 to 80m2 per dwelling, and differ to the lower density 1-2 bedroom attached dwellings examined in the previous section. This development option is projected to become feasible within Peacocke at the end of the medium-term.

Table 4-4: Comparison of Projected Additional Hamilton Dwelling Demand and Projected Feasibility of Development Density Options in Peacocke: Attached 1-2 Bedroom Dwellings — Higher Density

	TOTAL MARKET DEMAND (0.5% p.a. demand profile growth)										
	N	Il Preference Shift	r.	Me	dlum Preference	Shift	Hi	gh Preference Shi	ft		
Dwelling Value Band	Short-Term	Medium-Term Lo	ong-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L	ong-Term		
Up to \$400k	6,700	7,500	9,100	7,100	8,300	11,300	7,400	9,100	13,400		
\$400k to \$600k	600	900	1,900	700	1,000	2,300	700	1,100	2,800		
\$600k to \$800k	60	90	200	.60	90	200	70	100	300		
\$800k-\$1m	10	10	20	10	10	30	10	20	40		
\$1m-\$1.6m	-	10	10	-	10	20	10	10	20		
\$1.6m+			-				-	-	÷		
TOTAL	7,400	8,600	11,100	7,800	9,400	13,900	8,200	10,300	16,600		
			ADDITIONA	L DWELLING	DEMAND (0.5% p.	a. demand pr	ofile growth)				
	N	Il Preference Shift		Me	dium Preference	Shift	HI	gh Preference Shi	ft		
Dwelling Value Band	Short-Term	Medium-Term Lo	ong-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L	ong-Term		
Up to \$400k	300	1,300	3,300	500	1,900	5,300	600	2,400	7,300		
\$400k to \$600k	30	500	700	40	200	1,100	60	300	1,500		
\$600k to \$800k	-	20	70	-	50	100	10	30	200		
\$800k-\$1m	_		10			10			20		
\$1m-\$1.6m	140	11.5	-	- 6	9	10	100	100	10		
\$1.6m+	×	-	~	-	-		-		-		
TOTAL	400	1,500	4,100	500	2,100	6,600	700	2,800	9,100		
			TOTAL	MARKET DEN	1AND (1% p.a. de	mand profile	growth)				
	Nil Preference Shift		Medium Preference Shift			High Preference Shift					
Dwelling Value Band	Short-Term	Medium-Term Lo	ong-Term	Short-Term Medium-Term Long-Term		Long-Term	Short-Term Medium-Term Long-Te		ong-Term		
Up to \$400k	6,700	7,300	8,100	7,000	8,000	10,000	7,300	8,800	12,000		
\$400k to \$600k	700	1.100	2,500	700	1,200	3,100	800	1.400	3,700		
\$600k to \$800k	60	100	500	70	100	700	70	100	800		
\$800k-\$1m	10	20	70	10	20	90	10	20	100		
\$1m-\$1.6m	les."	10	30	10	10	30	10	10	40		
\$1.6m+								-			
TOTAL	7,400	8,600	11,100	7,800	9,400	13,900	8,200	10,300	16,600		
			ADDITIONA	AL DWELLING	DEMAND (1% p.:	a. demand pro	file growth)				
	N	il Preference Shift	t	Me	dium Preference	Shift	Hi	gh Preference Shi	ft		
Dwelling Value Band	Short-Term	Medium-Term Lo	ong-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L			
Up to \$400k	300	1,300	2,900	500	1,800	4,700	600	2,400	6,500		
5400k to \$600k	40	200	900	50	300	1,500	60	400	7,000		
\$600k to \$800k		20	200		30	300	10	40	400		
\$800k-\$1m			20	_	_	40	J 10 500	10	.60		
S1m-S1.6m	_		10	-	- 2	20			20		
\$1.6m+			-		- 9		9.		- 0		
TOTAL	400	1,500	4,100	500	2,100	6,600	700	2,800	9,100		
		DEVELOPMENTO	ENSITY OF	TIONS (Dwell	ngs per Hectare)						
	Margin of 20% or Greater		Margin of 15%-20%			1					
Dwelling Value Band	The second second	Medium-Term Lo		A CONTRACTOR OF THE PARTY OF TH	Medium-Term						
Up to \$400k							1				
SE 37 BOOKS		ves	ves		yes.	ves					
\$400k to \$600k		1	yes		1	yes					
\$400k to \$600k \$600k to \$800k											
\$600k to \$800k			.res			1/63					
			, res			160					

Source: M.E. Hamilton Housing Demand Model, 2020 and M.E. Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

Page | 37

Attachment 14



These higher density apartment dwellings are smaller in both floorspace and pwer dwelling land area, placing them into the mid dwelling value bands. They have a greater overlap with the projected smaller attached dwelling demand as the market is more concentrated into the lower to low-mid value bands. There is a projected total market size of around 2,000 to 4,500 dwellings (including 800 to 2,500 additional dwellings) in the long-term within the value bands at which these are projected to have a 20% or greater margin.

It is important to note that these higher density apartment dwellings are typically only feasible in higher amenity locations. They are currently concentrated into Hamilton's city centre, with some development as cheaper student accommodation around the university. The feasibility modelling for Peacocke is contingent on the establishment of a high amenity node within a quality urban environment within the Peacocke greenfield area. This development option is only likely to be feasible within a higher density node and is unlikely to be feasible across all parts of the Peacocke greenfield area.

### Attached 3+ Bedroom Dwellings

The assessment for 3+ bedroom attached dwellings is contained in Table 4-5. This development option is estimated to be feasible, with a margin of 20% or greater, across a narrow density range in Peacocke in the short-term, with an increasing range of development densities projected to become feasible in Peacocke through time.

The feasible (20%+ margin) development densities for this dwelling type correspond to only a small total market size (400 to 1,400 total dwellings) in the long-term. However, these dwellings are projected to be feasible in Peacocke in the lower-mid value bands in the long-term. In comparison, detached 3+ bedroom dwellings are projected to be feasible at the \$800,000+ value bands in the long-term, reflecting their price premium over attached dwellings. However, this may create a potential area of market overlap with the 3+ bedroom detached dwellings, where attached dwellings may meet some of the detached dwelling demand where households make trade-offs between price and dwelling type.

Page | 38





Table 4-5: Comparison of Projected Additional Hamilton Dwelling Demand and Projected Feasibility of Development Density Options in Peacocke: Attached 3+ Bedroom Dwellings

			TOTAL	MARKET DEM	AND (0.5% p.a. d	emand profile	growth)		
	N	lil Preference Sh	ift	Me	dium Preference	Shift	Hi	gh Preference Shi	ft
Dwelling Value Band	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L	ong-Term
Up to \$400k	4,600	4,800	5,000	4,800	5,300	6,100	5,000	5,700	7,100
\$400k to \$600k	900	1,200	2,100	900	1,300	2,600	1,000	1,500	3,000
\$600k to \$800k	100	200	300	100	200	400	100	200	400
\$800k-\$1m	20	30	50	20	30	60	20	40	70
\$1m-\$1.6m	20	20	40	20	20	50	20	30	is.
\$1.6m+				2	-		_	-	
TOTAL	5,600	6,300	7,500	5,900	6,800	9,200	6,100	7,400	10,700
			ADDITIONA	L DWELLING	DEMAND (0.5% p	.a. demand pr	ofile growth)		
	N	III Preference Sh			dium Preference			gh Preference Shi	ft
Dwelling Value Band	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term L	ong-Term
Up to \$400k	200	700	1,400	300	1,000	2,400	300	1,300	3,300
\$400k to \$600k	30	200	600	50	200	1,000	60	300	1,400
\$600k to \$800k		20	90	10		100	10	40	200
\$800k \$1m			10		10	20		10	30
S1m-S1.6m			10		100	20		10	30
\$1.6m+			-			-			
TOTAL	200	900	2,200	300	1,300	3,600	400	1,700	4,900
19174	-				1AND (1% p.a. de			4,100	1,500
	N	III Preference Sh	0.000000	A STORY OF THE PARTY OF THE PAR	dium Preference	AND DESCRIPTION OF THE PARTY OF	The state of the s	gh Preference Shi	ft.
Dwelling Value Band		Medium-Term		Short-Term Medium-Term Long-Term			Short-Term Medium-Term Long-Term		
Up to \$400k	4,500	4,500	4,100	4,700	5,000	5,000	4,900	5,400	5,800
\$400k to \$600k	1,000	1,400	2,400	1,000	1,600	2,900	1,000	1,700	3,400
\$600k to \$800k	100	200	800	100		1.000	100	200	1,100
\$800k-\$1m	20	40	100	30	-	200	30	50	200
The state of the s	20	30	70	20		90	20	30	
\$1m-\$1.6m	-20	30	70	20	30	770	20	30	100
\$1.6m+	5,600	6,300	7 500	F 000		9,200	£ 100	7 400	10.700
TOTAL	5,600	6,300	7,500	5,900	6,800	-,	6,100	7,400	10,700
	_			Company of the Company of	DEMAND (1% p.	The state of the s	-	* ***	
	The same of the sa	III Preference Sh	1111	Medium Preference Shift			High Preference Shift		
Dwelling Value Band		Medium-Term			Medium-Term		Short-Term	Medium-Term L	
Up to \$400k	200	600	1,200	300		2,000	300	1,200	2,700
\$400k to \$600k	40	200	700	50		1,200	70	400	1,600
\$600k to \$800k	-	30	200	10		400	10	50	500
\$800k-\$1m	(4)	10	40	-	10	70	-	10	90
\$1m-\$1.6m			20		10	40		10	50
\$1.6m+	-	2.1	-	1	2.1	-	3-		
TOTAL	200	900	2,200	300		3,600	400	1,700	4,900
		DEVELOPMENT	DENSITY OP	TIONS (Dwell	ings per Hectare)				
	Mar	gin of 20% or Gr	eater	1	Margin of 15%-20	1%			
Dwelling Value Band	Short-Term	Medium-Term	Long-Term	Short-Term	Medium-Term	Long-Term			
Up to \$400k \$400k to \$600k \$600k to \$800k \$800k-\$1m		17 to 30	34 to 40 23 to 40	23 to 31 14 to 24	26 to 40 16 to 28	32 to 40			
\$1m-\$1.6m \$1.6m+	13	13 to 19	13 to 40 13 to 17	13 to 15	14 to 15				

Source: M.E. Hamilton Housing Demand Model, 2020 and M.E. Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

Page | 39





## 5 Concluding Remarks

The economic analysis undertaken in this report has covered the key components necessary to guide an understanding of the appropriateness of potential planning parameters to apply within the Peacocke greenfield area. It is examined patterns of residential dwelling demand across the Hamilton market, and estimated the commercially feasible development options within the Peacocke greenfield area.

The patterns of development that are currently feasible within the Peacocke greenfield area reflect the past patterns of development across Hamilton's greenfield areas. These are dominated by detached, three or more bedroom dwellings on individual sites. This type of development pattern is projected to become feasible at higher densities through time, with development becoming feasible on increasingly smaller sites.

This pattern of development has the largest area of market overlap, with continued growth in demand for detached dwellings. A large share of the demand for these dwellings within Peacocke is likely to come from existing households as they move up the dwelling value bands into newly constructed dwelling stock within the greenfield area.

Higher density dwelling typologies are projected to become feasible to construct in Peacocke through time. Larger attached dwellings are projected to become feasible within the short-term, with an increasing range of dwelling densities and options becoming feasible during the medium-term. These higher density developments are estimated to have a 15%-20% margin in the short-term (slightly below the modelled threshold of 20% for feasibility), which reflects the small share of higher density dwellings currently being delivered in Peacocke by the market. The full range of modelled dwelling typologies and densities are projected to become feasible in Peacocke in the long-term.

Higher density apartment dwellings are also projected to become feasible within Peacocke at the end of the medium-term. These have a greater area of market overlap as demand for smaller attached dwellings is concentrated into the lower dwelling value bands. The feasibility of this higher density development option is likely to be contingent upon the establishment of a high amenity node within Peacocke, with feasibility constrained to location within and around the higher density node rather than spread across the greenfield area.

There are smaller areas of projected market overlap for higher density dwelling typologies. However, the size of these segments are projected to increase through time as a function of structural changes in demand and gradual shifts in demand preferences through time as households make tradeoffs between price, location and dwelling type/size. Larger attached dwellings are projected to be feasible at lower prices in the medium to long-term than larger detached dwellings. This provides a potential area where the demand in the predominant larger detached dwelling market segment may be able to be met with households making a trade-off between price and dwelling type.

A greater range of dwelling densities, within each dwelling size/typology, is projected to become feasible through time within Peacocke. The density of feasible development options is projected to increase through time. At higher densities, attached dwellings are projected to have a greater feasibility due to the greater flexibility of attached dwelling construction on smaller sites (relative to detached dwellings), although these dwellings have a lower overall demand.

Page | 40





# Part 2: 4Sight's Assessment





## 6 Introduction

Greenfield areas in Hamilton City have been earmarked to accommodate a significant share of growth over the next 30 years. The Peacocke area to the south of the city has been identified within the urban boundary of Hamilton City as an area that has the ability to absorb a substantial amount of that residential growth. To that purpose, a structure plan was prepared to inform future patterns of land use and densities for this area, Initially, growth within the Peacocke area was constrained by lack of infrastructure. With the recent allocation of Housing Infrastructure Funding (HIF) to enable major infrastructure projects for Peacocke, large scale greenfield development is likely to occur over the short and medium terms.

The Review of Peacocke Structure Plan Scoping Report<sup>5</sup> indicates that the business case for the HIF funding was predicated on achieving housing yields of 3,750 homes over the first 10 years and a total of 8,400 homes for the entire growth cell. Further work at an urban design workshop estimated a total yield of 5,200-6,300 homes could be achieved over a 30-year period. There is an indication that if patterns of previous greenfield development across Hamilton City are repeated across Peacocke, the housing yield targets will not be met. Responding to this shortfall necessitates an integrated response to ensure that greenfield development creates an attractive and sustainable community, while also delivering future housing supply. This requires an understanding of the methods which are available to promote best practice urban planning to increase housing yields while avoiding an 'urban cramming' response.

The first major subdivision application advanced within the Peacocke Structure Plan, comprising the terrace area adjacent to the Waikato River has provided for a more conventional subdivision response that is largely reflective of the underlying zone. In terms of housing typologies this comprises mainly of detached, house dominant, residential dormitory suburban outcome, with little variety of uses or housing typologies.

The primary purpose of this report is to support a plan change to facilitate a refresh of the underlying Peacocke Structure Plan to better fit the future demographics and best practice in urban form. This assessment will also contribute to Hamilton City Council's obligations for development under the National Policy Statement on Urban Development 2020 (NPS-UD). Hamilton is classified as a Tier 1 urban environment which places stricter timeframes and monitoring requirements than lower tier environments. The NPS-UD requires local authorities to provide sufficient development capacity to meet the expected demand for housing in urban areas for both standalone dwellings and attached dwellings. Sufficient capacity means: plan enabled, infrastructure ready, feasible, and provide a competitiveness capacity margin. Timelines for these capacity assessments are established for the short term (the next three years), medium term (the next three to ten years), and long term (the next 10 to 30 years).

4Sight have been commissioned alongside M.E to provide policy recommendations that can enable greater density and housing diversity while:

- 1. Promoting an attractive and sustainable urban form;
- 2. Meeting the required housing yield whilst providing for a more diverse housing stock;
- 3. Enabling commercially feasible development options; and

Page | 42

EReview of the Peacocke Structure Plan - Scoping Report, Hamilton City Council, November 2019

12 August 2021





 Delivering well designed, safe and inclusive neighbourhoods through good urban design outcomes.

This section of the report draws together the core findings from the economic assessment prepared by M.E to frame the objectives for evaluating the strategic planning options for encouraging increased density and housing typologies within the Peacocke area.

## 6.1 Summary of Market Economics Report

The M.E assessment, Part 1 of the report, informs the 4Sight assessment. The key findings inform the Part 2 work relating to planning and urban design assessment, include:

- A majority of the commercially feasible housing demand will comprise detached 3+ bedroom dwellings from the short to the long term.
- The demand and commercial feasibility for attached 3+ bedroom dwellings increase in the medium term.
- There is overlap in the feasible development density options for attached 3+ bedroom dwellings (17-30 dw/ha) and detached 3+ bedroom dwellings (17-24 dw/ha) over the medium term.
- Higher density attached 1-2 bedroom dwellings only become commercially feasible in the long term.
- The identified commercial feasibility of higher density attached dwellings is dependent on high amenity nodes being established and development being situated around nodes rather than distributed across the greenfield area.
- Higher density attached dwellings are feasible in lower dwelling value bands than detached dwellings.

The projected timeline for when the commercial feasibility of higher density development extends over the medium (2030) to long term (2050). This requires a strategic planning approach to ensure that the development objectives of a refreshed Peacocke Structure Plan are met. Demand and commercial feasibility for greenfield growth in a similar pattern to what is currently occurring over the short to medium term will need to be provided for without compromising the ability of Peacocke, or other green field development to deliver an attractive and sustainable urban form. This consideration has formed the basis of 45ight's assessment and is outlined further below.

## 6.2 Assessment Objectives

The key objective for 4Sight's assessment is to provide recommendations on strategic policy responses to enable increased housing density, diversity, sustainable urban form and urban design excellence in the Peacocke greenfield area. This assessment has been informed by the Market Economics' assessment of the commercial feasibility of development options.

Following the key findings of the Market Economics analysis, the assessment objectives outlined below provide the structure of the 4Sight assessment. These objectives build off those findings and establish a

Page | 43





framework through which policy recommendations can be made to improve housing density and typology diversity in greenfield development. These objectives are assessed through an urban design and planning lens to provide options for an integrated response to greenfield development patterns.

- How can short term demand for existing patterns of greenfield development be provided for in a way that will not undermine the future supply of higher density housing development options?
- 2. How can HCC deliver diverse housing typologies over the medium to long term when they become commercially feasible?
- 3. What tools and options are available to help deliver a diverse range of typologies?
- 4. How can a strategic planning framework enable increased density while maintaining a high-quality built environment?
- 5. What needs to be considered for establishing high amenity nodes to support higher density typologies?

### 6.3 Structure

The 4Sight section of this report is structured as follows (the numbering aligns with the section numbers):

- 8. Urban design background research and providing the key considerations of greenfield development:
  - a) What does higher density residential development look like?
  - b) Case studies of greenfield developments.
- 9. Review of planning options for greenfield development and existing Peacocke Provisions:
  - c) What planning toolboxes are available for greenfield development implementation?
    - d) Review of Operative Hamilton City Plan and Peacocke frameworks
- 10. Analysis of Peacocke structure plan and provisions:
  - a) What is currently being delivered, what could have been delivered, and what should be delivered.
    - b) Strength, weaknesses, and opportunities evaluation of the current approach.
- 11. Recommendations and implementation:
  - a) Key considerations/assumptions for recommendations;
    - b) Key recommendations from an urban design and planning perspective; and
- 12. Recommended Approach and Where to Next

Page | 44





# 7 Urban Design Considerations

A growing demand for medium density housing within the Hamilton market is identified by M.E over the Medium to Long Term. This section outlines why medium density in greenfield areas is important, the benefits that can be captured by meeting this demand in greenfield areas and why demand for medium density attached dwellings has traditionally been lower and less attractive to builders and buyers. The final portion of this section will establish what the commercially feasible development options look like. This is important for this exercise, as any strategic planning option that is progressed should reflect and enable those feasible development options.

## 7.1 Delivering Medium Density Housing in New Zealand

To understand the factors influencing the supply and demand for medium residential development in New Zealand, some understanding as to what has occurred in the past provides a useful starting point.

Throughout New Zealand, cities developed before the dominance of the car the inner-city suburbs and many small towns exhibited a built form that was compact, higher density, with a mixture of typologies and site sizes.

The advent of the car and sprawl pushed suburbia beyond walking distance of schools, shops, work and public transport. Sections have progressively got smaller and houses got larger. With sprawl came dislocation of community, followed by congestion of a road system that can never keep up with increasing commuting. The urban form made local shops uneconomic and public transport expensive and inefficient. Changing societal constructs (including escalating house prices and cost of running two or more cars) created dormitory suburbs empty during the day as all adult house members worked. There was less social cohesion and new development was advanced delivering one housing typology (the family home) usually at a single price point creating mono/socio-cultural environments.

Given this evolution of suburbia, there is a need to rediscover the carefully defined neighbourhood that provides the qualities of a traditional inner-city suburb, with a mix of housing typologies providing for a wider range of people that reflects the diversity of our people today.

Based on research and examples of medium density residential development throughout New Zealand and overseas, the following section provides an analysis and discussion on the key urban design factors influencing the prospect of medium density residential development within the Peacocke Structure Plan area.

## 7.2 Benefits of Medium Density Residential Development

The following provides an analysis and discussion in relation to the benefits of, and the factors influencing the supply and demand for medium density residential development that directly influences the possibilities of its delivery in greenfield areas. New Zealand's housing industry (from land developer, housing builders, funders and real estate industry) is focused on delivering single story houses on single

Page | 45





lots providing for two car garage, two off-street car parking spaces, a 3+ bedroom single storey house all on less than 450m<sup>2</sup>.

From a spatial planning perspective, a key question that needs to be asked is whether we can afford to let current approached determine built environment outcomes. To do this, conventional wisdom of the house building industry must be confronted to reimagine how New Zealand environments are perceived, and how we change perceptions from what is currently acceptable.

As outlined in Part 1 of the report (the M.E assessment of feasible development options for Peacocke) found that densities of up to a maximum of 40 dwellings per hectare across range of dwelling typologies were feasible over the short, medium, and long-term. While higher and lower densities than this figure may be realised across Peacocke, delivering housing within the ranges identified below can be classified as Medium density housing. It is important when we are discussing density and terms such as medium density that we start with a common definition. Table 7-1 pulls together what is generally considered in Australasia as low, medium and higher density

Table 7-1: Definitions for housing typologies and the corresponding densities.

Housing Definition	Description	Density
Conventional housing	Single detached dwellings on lots generally ranging between 500 and 1,000 square metres (sqm). The development of an area for conventional housing.	Generally, results in a gross residential density of $7-12$ dwellings per hectare.
Medium density housing	The provision of detached townhouses, two or more attached dwellings, or apartments on a site below four stories.	The development of an area for medium density housing generally results in a gross residential density of 18 – 40 dwellings per hectare
Higher Density housing	Attached dwellings(terrace) or apartments and mixed-use apartments usually more than 3 storeys in height.	The development of an area for high density housing generally results in a gross residential density of more than 40 dwellings per hectare

### Why push for medium Density when market preference is for Detached larger Lot subdivision?

In relation to the sustainable management of land resource, economic delivery of infrastructure and affordability the benefits of medium density mixed typology residential development<sup>9</sup> are well documented. These benefits include:

- . More efficient use of a finite supply of land (requiring less land per household and per capita);
- · Retaining the ability to use rural land productive purposes by delaying or halting sprawl;
- · Greater cost effectiveness in relation to the provision of infrastructure and services;
- Reduced generalised travel costs by density supporting more efficient public transport and amenity and services within walking/cycling distance of services;

Page | 46

<sup>&</sup>lt;sup>9</sup> Ccompared to post 1970's patterns of mono-cultural residential development in New Zealand characterised by a lesser density of development.





- More concentrated demand for public transport making it more cost-effect and providing a better quality of service;
- Density that supports local retail, social activities, schools and commercial development (local work) in walking distance to the family home;
- A greater degree of social connectedness, diversity and vitality;
- Greater vibrancy and safer environment (including lower levels of crime) due to a greater density
  of people working, living and playing in the neighbourhood;
- Greater levels of physical activity, with consequent health benefits through encouraging walking and cycling;
- Reduced run-off from vehicles to water, and overall emissions to air/atmosphere (although air emissions may be more locally concentrated on transit corridors);
- Providing a range of house typologies at a range of price points within the one neighbourhood allowing for a more diverse socio/cultural mix;
- · Softening the barriers between "rich" areas and "poor" areas; and
- Increased density with less emphasis on space for cars frees up land for external amenity to supplement reduced private amenity;

The ME study shows there is commercial feasibility and demand for detached 3+ bedrooms dwelling typologies. However, the feasibility and demand for a mix of housing typologies will increase from the medium term and even more so over the long term. What the study does not show is the latent demand for diversity and affordability if the design and amenity of the area increases the desirability of the area. We have a housing industry (from land developer, housing builders, funders, and real estate industry) that is focused on delivering single story houses on single lots providing for two car garage, two off street car parking spaces, a 3+ bedroom single storey house all on less than 450m<sup>2</sup>.

# 7.3 Key urban design considerations for Delivering Medium Density within Greenfield Locations

Numerous examples of high-quality medium density residential development can be identified in overseas jurisdictions. However, it is not a simple case of replicating overseas examples and expecting them to work in New Zealand. However, there is extensive literature covering the success factors of medium density residential greenfield development. The key insights from international examples are summarised below, and include:

- Consultative and collaborative planning processes,
- Provide for mixed use,
- · Walkability,
- Consideration of Planning Provisions.

Page | 47

Attachment 14







### 7.3.1 Consultative and Collaborative Planning Processes

Vancouver is often held as a standard bearer for achieving an international model for how to deliver good density. The key to this has been attributed to collaborative processes that effect cultural shift in the development community and potential buyers:

"It's about rethinking all our roles and re-educating all inputs into the city building process. It isn't just about citizens, it's about city hall, developers and many different stakeholders."

Processes tend to be based on mistrust and that can lead to the wrong kind of debates about density. Density is a tough discussion; many politicians don't like to touch it, but the truth is no city can have a serious discussion about being a greener, more economically resilient, sustainable city without talking about the D-word. It's about how to change the narrative into a more collaborative, constructive discussion; not about whether you do density but how you do it better."10

Communities may be engaged in different ways during the development of the concept plans for a large greenfield area. How they are involved will depend on what issues are being addressed and who is involved in the land ownership.

Where a good consultative process has resulted in a developed masterplan / outline development plan / structure plan to a reasonable level of detail and the parameters of any proposed development are well defined, are of a high standard, and have broad community acceptance, planning instruments can reflect and provide for those developments (in a fairly permissive manner).

Without a strong and enforceable planning framework the existing development industry is selective in what they deliver, with a tendency to deliver what they delivered in the past rather than push the boundaries to reflect community and environmental needs. The risks associated with a permissive generic approach providing for medium density residential development and a lack of adequate controls are obvious in most of our greenfield development areas.

The Outline Development Plan preparation processes provides the vehicle for community input. With more targeted and specific provisions introduced through subsequent variations or plan changes, the burden of regulatory processes, notification requirements and compliance costs can be progressively reduced.

### 7.3.2 Provide for a range of land uses: Mixed Use

Suburban residential medium density zones reflect a very typical approach throughout most district plans in New Zealand whereby zones are identified for specific purposes e.g. commercial, industrial, or residential

Based on experience, to be successful, medium density residential development needs to be comprehensively planned as part of mixed use neighbourhood approach where a variety of different living, working, retail and recreational activities are in close proximity within a walkable neighbourhood and accessible to public transport.

http://www.theaustralian.com.au/business/property/urban-density-in-a-green-world/story-fn9656lz-1226623797390

Page | 48

12 August 2021





Quality Urban Design that supports mixed use neighbourhoods (in conjunction with other factors including connectivity and a relatively high intensity of different uses) can:

- · offer people convenience, choices and opportunities, which lead to a sense of personal wellbeing;
- allow parking and transport infrastructure to be used more efficiently;
- · lower household spending on transport;
- increase the viability of local shops and facilities;
- · Increase the viability of public transport;
- encourage active transport modes, like walking and cycling bringing health benefits, reducing the need to own a car and thus reducing emissions;
- · increase personal safety; and
- enhance social equity.<sup>11</sup>

The proximity of complementary activities was an important factor in most of the case studies, which is discussed below in relation to the concept of 'walkability', below.

### 7.3.3 Walkability

Closely related to the land use approach is walkability. It has been identified as a key success factor underpinning medium density residential development. This refers to medium density residential being located within an 800m catchment from other activities, including:

- · Supermarkets, cafes, restaurants, and other shops;
- · Quality public transport (PT) routes;
- · Open space, recreation and leisure opportunities;
- Educational facilities (particularly primary/ secondary schools); and
- Regular public transport on a direct route to City or other Key Activity Centre.

According to Guy Perry<sup>17</sup>, an expert on the design of healthy cities, cities with poor 'walkability scores' (usually due to large distances between residential activities and other activities) have the highest rates of obesity and the highest carbon footprint. Therefore, they have a greater effect on human health and climate change (Atlanta, USA cited as an example). In other words, walkability delivers health benefits, reduced obesity, lower health costs, and less adverse effects on the environment.

Marchetti's research found that cities have an average time budget of 1 hour per day journey to work. This research was biologically based. His research pointed to:

- Walking City was based on people walking an average of 5/8 km/h giving a return journey city distance of 5-8km. Before transit there was no alternative.
- This was followed by the Transit City (rail and tram travelling at 30km/h)) which extended city to 30km wide however people had to be easy walking distance to the transit stations.

<sup>&</sup>lt;sup>11</sup> Michade, G., Chapman, R., McDonald, C., Holden, G., Howden-Chapman, P., Bray Sharpin, A. (2005): *The Value of Urban Design* Ministry for the Environment. ISBN # 0-478-25919-0

<sup>12</sup> http://in-vi.com/about-in-vi/management/guy-c-perry

Page | 49

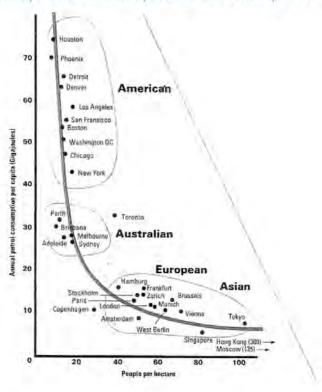
Attachment 14



- The Autocity changed to form of cities and ended up with dispersed patterns not based on walking
  and transit. A scattered approach to land uses and speeds of 50Km/h pushing cities out 50km with
  people doing separate journeys for work, education, retail and leisure.
- Autocity hits the wall with congestion leading to huge and costly interventions. (Auckland)
- A return to Transit Cities can grow density along corridors and be a more sustainable form of urban growth.

The approach to time budget and land use has been reinforced by work undertaken by urbanists like Newman and Kenworthy (1995), who looked at various cities and travel/land-use patterns and found a greater decline of private car travel happened at densities around 60-100 persons per hectare (somewhere between 20 to 40 houses per hectare for Australasian cities).

Figure 7-1: Petrol Consumption and Urban Density in 32 Cities of the Developed World



(Source: Newman and Kenworth, 1989)

### Walkability to Public Transport and Neighbourhood/and Key Centres:

Kenworthy and Newman, along with other researchers, have defined walkability to transit as being 800m (10-minute walk to a transit station) for high capacity transit and 400m (4-minute walk to bus stop) for lower capacity regular bus route. It is this level of accessibility that encourages people to use transit and local facilities by walking or cycling rather than car. An 800m walkshed gives a centre that includes a transit

Page | 50

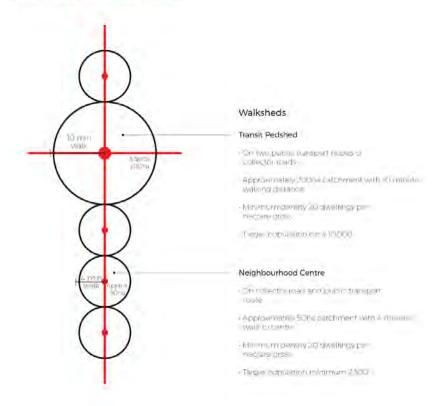




interchange or mode change, and larger commercial/ retail component. This translates into a total area of 200 hectares within that walkshed. A 400m walkshed for smaller centre around a bus route provides an area of 50ha.

If these walksheds are applied around high-quality public transit routes, a significant share of residential development can be located around activity centres. This is illustrated within Figure 7-2 which demonstrates that at a density of 20 dwellings per hectare gross, approximately 10,000 (approximately 5,000 dwellings) people could reside within 800m walkshed of a public transport route or commercial centre and thus support a centre and PT system. While for a neighbourhood centre and bus stop, 2,500 people (1250 dwellings approximately) could reside within a 400m walkshed. While these densities may not be achievable or desirable for most of Peacocke area, they demonstrate that a strong focus on housing density within the walksheds of centres and transit routes can accommodate a significant share of required housing yield whilst providing a lower level of housing in the more remote or sensitive parts of the area.

Figure 7-2: Walksheds and Density Analysis.



Page | 51





Looking at Kenworthy and Newman research the density required to achieve a transit neighbourhood is between 25-50 dwellings per hectare with commercial areas providing 123 persons per hectare in employment. As will be discussed in detail below, if this density was lowered to 25 dwellings per hectare net this translates into an average site size of 250m<sup>2</sup>. Within a 400m (50 hectare) walkshed this is delivering between 1,250 and 2,500 houses. This creates a situation where terraces, townhouses and villas can be used to create diversity but only if there are rules that ensure a mix of typologies. The higher the density the more apartments come into play.

It is recommended that around and within the local or town centre zone (walkshed), a suitable density range for Peacocke would be between 25 and 50 dwellings per hectare gross. The higher per hectare gross values within this range reflects high levels of employment opportunities within the centre. Therefore, within an 800m walkshed there could potentially be a walkshed catchment containing 6,000 dwellings, however as identified above, higher densities are dependent upon a high level of commercial opportunity, amenity and public transport. Again, this needs to be accompanied with rules that ensure diversity of site size and housing typology.

### Transit Walksheds: Implications for the 20-minute neighbourhood

There is a need to improve the planning for neighbourhood and town centre design in new growth suburbs as well as the implementation of those plans so that active transport modes are better integrated. Central to this, is the ability for residents to walk to local amenities within their neighbourhood.

From an urban design perspective, the concept of a 20-minute neighbourhood is about "giving people the ability to meet most of their daily needs within a 20-minute walk from home, with access to safe cycling and local transport options" (DELWP, Victoria, 2019). Another aspect, which is at the core of the 20-minute neighbourhood is the insight that people are only willing to walk for a certain distance. Generally, it is assumed that 800/1000 metres is a good walking distance, which translates into about a 10-minute walk (and a 20-minute return journey). In lower density environments which have limited services, the willingness to walk reduces to 4 minutes or 400/500m giving a return journey time of 8 to 10 minutes.

Overall, as part of any urban design considerations for the future development of the Peacocke area, walkable neighbourhoods should be a key underpinning. Based on the above, the following key considerations should be provided for any regulatory zoning response over the Peacocke area:

- Where there is a KAC (Suburban centre)/transit Centre, the density within 800m/1000m should be above 40 dwellings per hectare (excluding work population)
- Where there is a direct public transport route and small neighbourhood centre density within 400/500m of centre should be up to between 25/40 dwellings per hectare.
- Beyond walkable distance from centres and PT can be between 10 and 25 dwellings per hectare.
- Effort should be made to mix typologies within densities to provide a diversity of housing in all
  areas.

There will be a need for any future planning response over the Peacocke area to carefully integrate walkable neighbourhoods as a means of driving demand for affordable sustainable density. This matter is explored in more details in the recommendations section of the report.

Page | 52





## 7.4 Peacocke Area Urban Design Assessment

The ME report investigates the commercial feasibility of various typologies and densities over time. What it does not do is look at the built form outcomes and whether that is desirable or achievable if normal subdivision rules are applied.

### 2020 Hamilton Green Field Situation (ME Report)

- Densities are calculated on the net development land (after excluding roads etc. which they have taken as 34% of the site). Therefore, around 6,000m<sup>2</sup> in each 10,000m<sup>2</sup> is developable for housing.
- Detached 3+ bedroom dwellings have higher levels of feasibility (financially) with greatest returns in lower density (Sub 20 houses per hectare net).
- It is feasible to deliver detached 3+ bedroom houses on smaller lots at densities of 18 dwellings per hectare net (372m² section). However, at 24 dwellings/ hectare (270-350m²) the profit falls to 15/20% margin.
- Modelling assumes you need a site of at least 250m<sup>2</sup>
- . Smaller dwellings do not give same return as larger dwellings.

#### 2020-2023

- It is economically feasible for developers to construct detached 3 +bedroom houses at around 18 dwellings/hectare with an average section size of 330m<sup>2</sup>.
- However, there is marginal feasibility of detached 3+ bedroom at 24 dw/ha and attached at 31 Dw/ha.

### 2020-2030

- Economically Feasible to have detached 3+ bedrooms at 24 dw/ha (270m² average).
- Economically Feasible to have Attached 3+ bedroom at 30 dw/ha (200m) average).
- Detached and attached 1 and 2 bedroom also become economically feasible at 30 dw/ha (200m<sup>2</sup> average).

### 2020-2050

 Market shifts and it becomes marginally more feasible to construct attached dwellings (1-3+ bedrooms).

The real drivers behind this appear to be:

- . The development industry is geared up to build and sell detached single story dwellings
- There is a cultural preference for a detached dwelling with a garden (the ¼ acre pavlova paradise).
- The market shifts with affordability.

Based on the ME findings, the commercial feasibility assessment provides an understanding of the development options (in net dwellings per hectare) and housing diversity (in the broad detached/attached categories) that is achievable in Peacocke area over the short to long term. However, if the strategic planning options are to be assessed, an understanding of how these development options translate into greenfield development patterns and what does that mean in terms of built form outcomes needs to be explored.

Page | 53

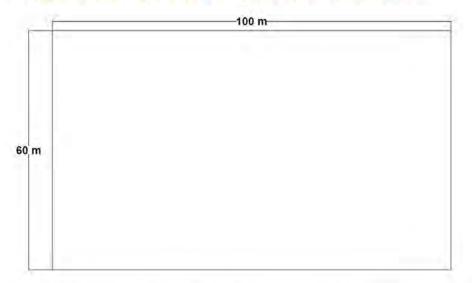




### 7.4.1 Density and Built Form Outcome

The M.E modelling approach utilises net development density and provides the example that, for a yield of 20 detached 3+ bedroom dwelling per hectare, the model allocates 34% of developable land to roads and reserves etc. However, for simplicity and for the purposes of exploring these densities, an assumption that 40% of land area is undevelopable due to the requirement for roads and reserves has been made. It is acknowledged that the M.E model assumes that this loss varies with density, however for consistency across typologies, we have adopted this figure. Therefore, in one hectare of land (10,0000 m²) only 6,000m² is available for housing as net developable land. This is explored by looking at a basic 6,000m² developable block in the figures below. The block size is dictated by maximum Urban Block layout that creates a permeable urban form (100m long x 60m in width). Error! Reference source not found. illustrates the base 6,000m² block from the ME report representing developable area for dwellings per hectare.

Figure 7-3: Diagram A representing net 6,000m2 developable lot out of overall total of 1ha



**Diagram A:** The diagram presents a net 6,000m2 developable lot out of overall total of 10,000m2 (one hectare) gross area. This represents an optimum block formation to achieve permeability and flexibility for intensification. Net 6,000m<sup>2</sup> developable lot out of overall total of 10,000m<sup>2</sup> (1 hectare) gross area

The shape of the block assumes a shape based on good urban form outcomes. The shape factor is not arbitrary but a block of  $60 \times 100 \text{m}$  surrounded by access roads creates an acceptable level of permeability whilst minimising amount of road to build area. The 60m depth allows for a buildable lot with sufficient room for setbacks and back yards. The block can be reduced below 60m but that increases the amount of road required and above 60m encourages back lot development with right of way access. This results in a high number of vehicle crossings that can compromise safe pedestrian movement along the footpath and reduce on street parking. The blocks can be in an orthogonal grid form which facilitates pedestrian movement and wayfinding, and regular lots or irregular grid (non-orthogonal) which still facilitates pedestrian movement, needs wayfinding built in and creates interesting lotshapes.

Page | 54





Figure 7-4 illustrates a more conventional development approach translated against the base case, where 10 lots of 600m² could be achieved. This would give the lot a shape factor of 20m wide by 30m deep. This can accommodate a standard single-storey house with attached double garage of 260m² and a yard and a decent back yard. A two-storey house increases that backyard and/or front yard. However, at a density of 10 dwellings per hectare this falls short of the density targets and would have to be supplemented by higher density and diversity. However, this is acceptable lower density suburbia. This density would provide for low density size lots and fits ME commerciality calculations in the short term

Figure 7-4: Diagram A1 showing 10 dwellings achieved in the 6,000m2 block.

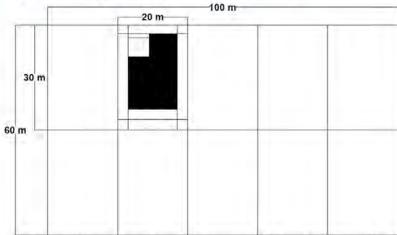


Diagram A: 10 dwellings per hectare; 16 dwellings per hectare net using ME model of density. This achieves a Lot size of  $20 \times 30 \text{m}$  ( $600 \text{m}^2$ ). Detached dwelling footprint of up to  $160 \text{m}^2$ ; garage of  $36 \text{m}^2$ . Total building footprint of  $196 \text{m}^2$ . Net  $6,000 \text{m}^2$  developable lot out of overall total of  $10,000 \text{m}^2$  (1 hectare) gross area.

Figure 7-5 illustrates the application of the District Plan rules that are applicable to the Peacocke Structure Plan which enables subdivision down to 400m<sup>2</sup> and results in around 14 - 15 lots depending on lot shape factor. Therefore, this equates to an average site size of 714m<sup>2</sup> per hectare (gross). This density falls within the low-density definition and ME commercially viable 2020-2023 analysis.

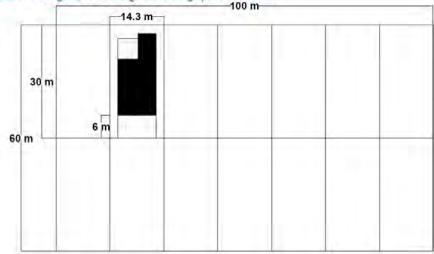
Figure 7-5 also illustrates that a house footprint of around 220m² fits within the lot, which means a standard single storey 3-bedroom house, can be accommodated on the site. This allows for a minimum front garden and a courtyard garden. In this configuration the garage is equal to the street both presenting 6 m to the street front. This creates a low- level quality streetscape with car driveways compromising the pedestrian environment. There is only provision for one off-street car park in front of the house for visitors. With a site coverage of over 50%, there is not enough garden for larger trees to supply the tree canopy that defines more traditional large lot suburbs in Hamilton.

Page | 55





Figure 7-5: Diagram B showing 23 dwellings per hectare net



**Diagram B:** This diagram shows 23 dwellings per hectare. This achieves 14 lots in the black of  $14.3 \times 30 \text{m}$  ( $429 \text{m}^2$ ); detached dwelling footprint of  $213 \text{m}^2$ ; garage footprint of  $36 \text{m}^2$ ; total building footprint of  $250 \text{m}^2$ .

A two-storey house would supply a larger back courtyard and reduce the presence of the garage. This configuration (14 dw/ha) does not reach the maximum density identified as commercially viable in the ME report and does not meet the definition of medium density. This provides a relatively poor urban design outcome. It really is a sub optimal suburban environment outcome for detached housing.

Figure 7-6 illustrates the density that is identified as commercially viable between 2020 and 2023 for detached dwellings. This creates 20 lots of 300m<sup>2</sup> or 10m x 30m. To increase lot size to fit 18 dw/ha the width would increase to 11m. There would be no substantive improvement in the built form outcome. This is only marginally acceptable in best urban design practice.

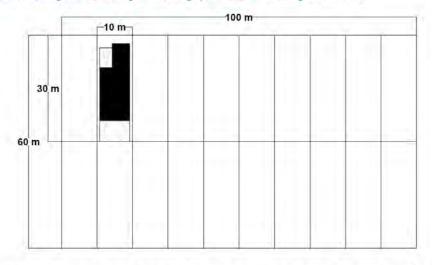
Figure 7-7 illustrates ME's next level of commercially viable density of 40 dwellings per hectare net detached and identifies that up to 22 lots at an average of 234m² (with shared lane taking it up to 260m²) with rear access lane, can be achieved in a 6,000m² block. A rear lane achieves a 234m² site which allows a 2-storey house and double garage at rear. The lot also shares a right of way in form of a rear lane. This drops the number of dwellings in the block and average lot size. However, the streetscape improves as does the shape factor for the house and yard. If a small proportion of semi-detached or terrace houses are incorporated into the block, this can increase density.

Page | 56





Figure 7-6: Diagram C showing 33 dwellings per hectare net using ME method.



**Diagram C:** This diagram shows 33 dwellings per hectare net. This achieves 18 lots per block of  $10 \times 30 \text{m} (300 \text{m}^2)$ ; detached dwelling footprint of  $142 \text{m}^2$ ; single garage footprint of  $18 \text{m}^2$ ; total building footprint of  $160 \text{m}^2$ .

Figure 7-7: Diagram D showing 40 dwellings per hectare net using ME methodology.

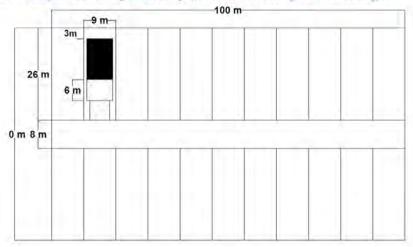


Diagram D: Reflects 40 dwellings per hectare net. This achieves 22 lots per block with parking accessed off a rear lane  $(8 \times 100 \text{m}; 80 \text{m}^2)$ ; lots  $9 \text{m} \times 26 \text{m} (234 \text{m}^2)$  plus share of lane  $(36 \text{m}^2)$ ; detached dwelling footprint of  $100 \text{m}^2$ ; garage footprint of  $36 \text{m}^2$ ; total building footprint of  $136 \text{m}^2$ .

Page | 57



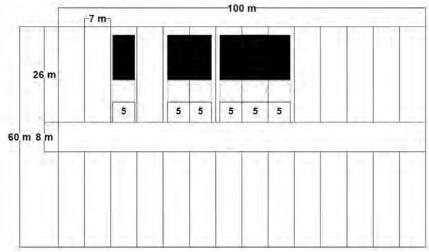


When good Urban Design Outcome is applied to delivering detached houses at this density to reduce the impact of a street of garages, we have moved to delivering car parking at the rear of the site accessed off a lane. The density remains at 22 dwellings per hectare.

This creates a building platform of about 80m² which could have a small 2-bedroom cottage or a two-bedroom family 4-bedroom house of 160m², both excluding garages. By adopting a rear lane, they all have capacity to have double garages and of course a secondary studio unit above.

Figure 7-8 illustrates a density of 50 dwellings per hectare net which the ME report advances can provide marginally commercially viable detached (250m² lot) and attached (200m² site) family dwellings in the short term (2020-2023), detached (250m² lot) and attached (200m² lot) in the medium term (2020-2030), and detached (200m²) 1 and 2 bedroom houses (200m² lot) in the long term (2020-2050). To achieve the recommended ME lot size of 200m² for detached dwellings, the lot size would have to move to a bigger block width of 68m x 100m, however for the sake of consistency, the 6,000m² block is retained, and as a consequence this will reduce the size of the lots. In this iteration to accommodate a detached housing, a 7m wide lot has been adopted. This means 28 dwellings and not 30 are achieved in the block. If the lot width is reduced to 6.6m, 30 dwellings per hectare is achieved, however this would only have a 4m wide detached townhouse.

Figure 7:8: Diagram E showing 50 dwellings per hectare net.



**Diagram E:** The diagram show 50 dwellings per hectare net. This achieves 28 lots per block with parking accessed off a rear lane  $(8 \times 100m; 80m^2)$ ; lots  $7m \times 26m (182m^2)$  plus share of lane  $(36m^2)$ ; detached dwelling footprint of  $36m^2$ . Building footprint dependent on typology.

What this analysis shows is that while it may be economically feasible to deliver detached dwellings at the density identified in Diagram D, when a combination of planning provisions such as front yard, side yard, site coverage and good design practice are applied it may not be practicable. The theoretical subdivision illustrated does not necessarily deliver diversity and while the existing rules allow larger lots there is a strong reason why the market would not deliver higher density.

Page | 58





Two-bedroom houses are best facilitated through apartments or narrow terrace lots (4.2 m wide) and single garage to the rear off a courtyard or lane. Anything above this density would need rear access lanes to have garages off street, smaller front yard setbacks, zero lot boundaries to allow terrace attached houses or a mix of terrace, apartments and townhouses. In effect, if a minimum terrace lot of 4.2 x 26 m with an 8m rear lane is applied, 46 houses per hectare (2+ bedroom) net would be achieved. Beyond 46 house/hectare net the density drives apartment style typologies. A best-case outcome is to create a suite of rules that a variety of lot sizes using a variety of house typologies.

This pattern gives a lot configuration of 7x26m and a lot area of 182m². This is effectively the 200m² site size raised in the ME report when factoring in the redundancy of driveway access from the road and garage setback which is replaced by a common lane. The diagram illustrates a standalone townhouse with a 55.2m footprint which could deliver a generous 110m² two bedroom detached house (as outlined in the ME report) which if it went to 3 storeys or attic, could be a family house. The semi-detached typology increases the footprint of the house to deliver a footprint of 70m² which gives a 140m² family home with detached double garage; a row of 3 attached houses with end terrace with footprint of 70m² and a mid-terrace of 84m². This could supply single storey one and two bedroom houses or two-storey family houses.

### Conclusion regard ME's densities when applied to a development scenario

When analysing the ME report and applying it to a built form outcome the density and the block pattern and garage access become important to create houses that have better frontage to the street and more usable outdoor space. Above 33 dwellings per hectare net and a lot width of less than 10m there is a need to move to a rear lane or courtyard for car parking and access if a good Urban Design outcome is sought.

Anything above 33 dwellings per hectare net would need to provide rear access lanes and garages to the rear, smaller front yard setbacks, minimum or zero lot side boundaries to allow a mix of detached townhouses, semi-detached, terraced, and apartments.

To ensure one and two-bedroom houses at an affordable price and profitability, there would be an opportunity to have a minimum terrace lot of  $4.2 \times 26 \text{m}$  ( $109 \text{m}^2$  lot), with an 8m rear lane, which would deliver a two-storey home of  $80/90 \text{m}^2$  and a density of over 80 dwellings per hectare net would be achieved. Beyond 80 house per hectare net the density drives apartment style typologies.

A best-case outcome is to create a suite of rules that a variety of lot sizes using a variety of house typologies.

## 7.5 What do these typologies look like?

The following section breaks down several housing typologies that could be established at the feasible development option densities as indicated in the M.E report (i.e. dwellings per hectare). The examples provide the indicative site size and site coverage needed to achieve these developments, taking into account the work undertaken by ME. This has been presented as useful inform to the development of specific planning policies and rules that could be considered to either enable, or prevent specific typologies being established and create a better built form outcome in medium density areas. These are important as it has been shown in the analysis above that site size and density alone cannot be relied upon to deliver housing diversity.

Page | 59

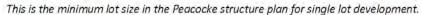




### Detached dwelling at 30 dwellings per hectare net (greater than 330m²) site size

The ME report indicates that there it will be commercially feasible in the short term to develop 3+ bedroom detached dwellings at a density of 20 dwellings per hectare (dw/ha) which translates to a minimum 330m<sup>2</sup> site size. An example of a detached dwelling that could be constructed within these parameters is shown below in Figure 7-9. This form of dwelling would requires a minimum lot size of 350m<sup>2</sup>, a minimum lot width of 16m in order to accommodate the double garage at street front, and a maximum site coverage of 40%.

Figure 7-9: Detached dwelling typology with double garage on street (greater than 400m2).





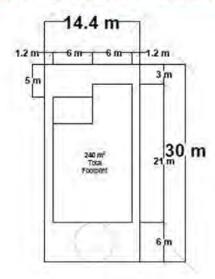
Detached 3+ bedroom dwellings on  $400\text{m}^2$  sites give a density of approximately 25 dwellings per hectare net and is commercially feasible throughout the short, medium, and long term as assessed in the ME report. This is defined as low density housing. At this density it is possible to present a double garage to the street front. The typology example shows an acceptable design with parking in front of set-back garage and garage integrated into the house. This provides a total building platform of  $12 \times 21\text{m}$  ( $240\text{m}^2$ ) and back courtyard of  $87\text{m}^2$  and a front yard setback for landscape,

Figure 7-10 illustrates a two-storey, four-bedroom dwelling which can be constructed on a footprint of  $12 \times 10 \text{m}$  (giving a  $240 \text{m}^2$  home including garage and a  $230 \text{m}^2$  backyard).

Page | 60



Figure 7-10: Detached house with double garage layout (400mf site) at 25 dwellings per hectare net.



In order to achieve the 30 dwellings per hectare net as cited in the ME report and achieve a good urban design outcome with medium density townhouses the lot configuration changes to 10m x 30m (300m<sup>2</sup> as shown in Figure 7-11). There are two options:

- The car access is from the street the site can only accommodate a single garage leaving 4.6m. This
  is only marginally acceptable from a streetscape and street amenity lens. This creates a maximum
  building footprint of 138m<sup>2</sup> ample for 3-bedroom single storey dwellings but more suited to a
  smaller footprint two storey dwelling.
- From an urban design view at medium density it is better to move to car access from a lane or court. This increases the density to 37 dwellings per hectare which effectively reduces lot length by 4m as a share of access lane. This makes the lot 9m x 26m (234m²) and therefore within commercially viable range for detached dwellings. This unlocks the street from garages and car access. It also allows for a single or double garage at the rear of the property as illustrated. A building footprint of around 130m² (6.6m x 20m is possible on this lot) However, to achieve a double garage and decent back yard a two storey house is preferable with a footprint of 6.6m x 10m or 66m (house of 130m²) not including the garage. This gives a full 3+ bedroom house with excellent solar access and useful yard. In the rear lane configuration, the garage is perfect to absorb a mews house unit.

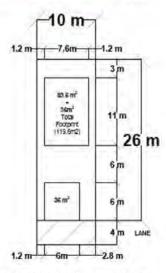
Page | 61

Attachment 14





Figure 7-11: Detached Townhouse with Garage off Lane Layout (300m<sup>2</sup> site) at 20 Dwellings Per Hectare.



Medium density attached and detached dwelling typologies: 33 dwellings per hectare net (greater than 270m2 site sizes)

Attached 3+ bedroom dwellings will become feasible in the medium term at a range between 25-35 dw/ha net. These are likely to appear in the form of townhouse, semi-detached and broad terrace (illustrated in Figure 7-12) A broad terrace is terrace developments. To accommodate detached townhouse, semidetached and terrace with a double garage at rear with separate pedestrian access we achieve a density of 33 houses per hectare net, 7m x 26m lot configuration. In removing the pedestrian access from the lane and by including a double garage of 6m or single garage and lot configuration of 6 x 26m we get a density of over 50 dwellings per hectare net.

Figure 7-12: Townhouse Typology (Minimum Lot Size 250m²).



Page | 62

12 August 2021





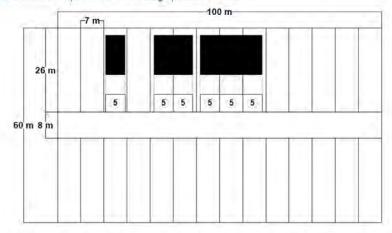
Figure 7-13 shows a larger family terrace 3+ bedroom typology with a rear access double garage. To encourage 2-bedroom terrace house the lot width should reduce to between 4.2m and 5m wide allowing for 2 upstairs bedrooms rooms front and back and a single garage of court or lane. If this configuration is used exclusively you achieve around 40 dwellings per hectare which pushes it into high density.

When using lot layout of  $7 \times 26m$  (average lot size of  $182m^2$ , excluding lane access) an attached townhouse with a footprint of  $4.6 \times 11m$  ( $50m^2$ ) can be achieved, and a double garage and  $42m^2$  back yard. This would be a  $100m^2$  two-bedroom house and  $36m^2$  garage which can have a studio above. To achieve a larger 3+ bedroom family house, a  $3^{rd}$  storey attic room could be included. Figure 7-14 below shows this typology layout in further detail.

Figure 7-13: Broad-Terrace housing example.



Figure 7-14: Townhouse layout at 55 Dwellings per hectare net.



**Diagram E:** 55 dwellings per hectare net using MF model. This achieves 28 lots per block with parking accessed off a rear lane  $(8 \times 100m; 80m^2)$ ; lots  $7m \times 26m (182m^2)$  plus share of lane  $(36m^2)$ .

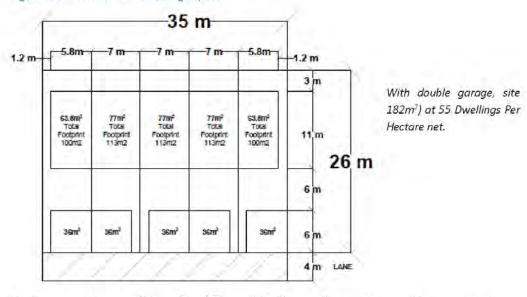
Page | 63

Attachment 14



Another typology is a Semi-Detached House which saves on one side-yard and has a footprint of 5.8 x 11m whilst providing a more spacious layout for the house. This typology has a footprint of 64m2 which at twostorey gives a full 3+ bedroom family home with a double garage. An example of this site layout is shown below in Figure 7-15.

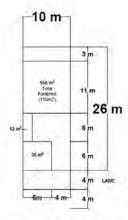
Figure 7-15: Broad Terrace Housing Layout



Furthermore, when considering a Broad-Terraced dwelling typology, end-terraced houses with the same 64m2 footprint as semi-detached and mid terrace with footprint of 77m2 can be established. Figure 7-16 below shows the site layout of this typology.

Figure 7-16: Attached Broad Terrace Layout

with double garage, site 300m2, @ 33d/h



Narrow-terrace Houses (Higher Density) can be achieved with a lot shape of a between 5m and (5.7m for an end lot if side-yard is applicable) and 26m (resulting in a lot size of 130m²) at a density of up to 75 dwellings per hectare net. This will deliver a terrace house footprint of 55m2 and a house of a minimum of

Page | 64

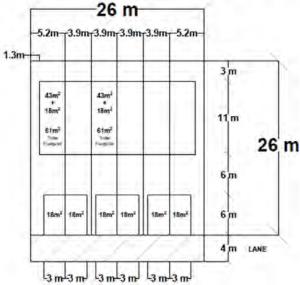




110m². This lot configuration allows for two bedrooms upstairs, a single garage and possibility of attic room. The layout of this typology is shown below in Figure 7-17.

Figure 7-17: Narrow Terrace House Layout

With single garage, site size End Terrace: 140m², mid terrace: 110m²) at 83 Dwellings Per Hectare net using ME Methodology.



Attached Dwellings Typologies - Maisonette Housing: up to 80 dwellings per hectare net.

At up to 80 dwellings per hectare, residential development starts to become considered as higher density development which is appropriate for meeting longer term commercial feasibility.

The maisonette typology illustrated below in Figure 7-18, resembles a large house but is comprised of four apartments. This would typically have a lot configuration of  $18-20 \,\mathrm{m} \times 26 \,\mathrm{m} \,(470-520 \,\mathrm{m}^2)$  with space for 4 garages at the rear of the lot serviced by a lane or court. This would have a total building footprint of  $154 \,\mathrm{m}^2$  and internally can be configured as two apartments at ground level and two upper apartments at the upper level. This equates to an average site size of around  $125 \,\mathrm{m}^2$  and a density of 80 dwellings per hectare.

Perhaps the most familiar housing typology that also meets this density is the studio—terrace. This has a lot size of approximately 4m x 26m (110m2) and a building footprint of 46m2. This achieves a density of 40 dwellings per hectare, a single garage and rear yard of 25m2. This is better suited to one or two bedrooms. Extra open space can be created through balconies and roof gardens. The site layout of this typology is shown below in Figure 7-19.

Page | 65

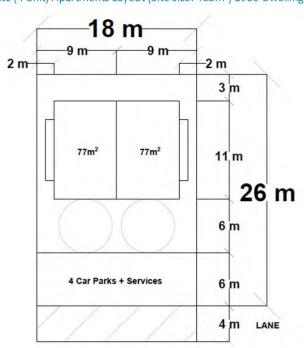




Figure 7-18: Maisonette Example (150m²)



Figure 7-19: Maisonette (4 unit) Apartments Layout (Site size: 468m²) at 80 Dwellings Per Hectare



Page | 66





Attached Dwellings Typologies: Apartments and Mixed-use apartments (High Density above 80 dwellings per hectare).

Moving beyond 80 dwellings per hectare net the dominant typologies are typically walk-up apartments, mixed-use and potentially mid-rise towers. These are comprehensive developments with a high level of design input and a requirement to have access to a high level of services, open space, amenity, and public transport. Mixed-use apartments at around 80 – 120 dwellings per hectare net may be suitable in key activity and neighbourhood centres with easy access to public transport. Typically, these have rear lane access with basement or semi basement parking, with commercial or community uses on the ground floor. The mixed-use components typically include commercial activities at the ground floor with residential apartments on upper floors. This could be constructed up to 4 stories in height with a density of over 60 dwellings per hectare and with complete site coverage.

Alternatively, density of at least 40 to 70 dwellings per hectare can be achieved further from the transit stop through 2 or 3 storey walk up apartments. These typically have at grade parking off a rear lane and a common garden shared by residents. These are flexible in location and can be used as part of the area within walking distance of neighbourhood centres or areas of very high visual and physical amenity.

An example of mixed-use apartments is shown below in Figure 7-20 and 'Walk up apartments' are shown in Figure 7-21. A subdivision lot layout to support apartments is shown in Figure 7-22 below.



Figure 7-20: Mixed Use Apartments Typology Example

Page | 67

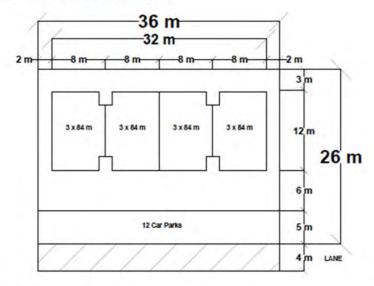




Figure 7-21: Walk Up Apartments Typology Example



Figure 7-22: Apartment Typology Example Layout



Site Size: 936m² 3 Storey – 12 apartments – 2 storey 8 Apartments at 125 Dwellings Per Hectare

Page | 68





## 7.5.1 Conclusion of Typologies

The quality of the built and public environment, and the approachableness of the architecture are key success factors for medium density developments. The following case studies will look at some developments that led the market in delivering variety of housing and density. As shown in the analysis, medium density does not need high rise apartment towers, but a mix of detached, terraces, semi-detached, walk up 2 and 3 storey apartments and buildings capable of accommodating non-residential activities. The Market Economics assessment shows what could be expected under different conditions.

The reality for the Peacock area is that it needs to be supported over the medium to long terms with a mix of typologies that achieve an optimum density which supports local services and public transport within a short walking distance. This means achieving a minimum density of 30 dwellings per hectare net within a neighbourhood delivering a variety of densities and typologies within the urban blocks with densities of nearer 60 dwellings per hectare closer to the centres drifting to suburban densities beyond 800m from centres.

The analysis of housing typologies is discussed further in our recommendations section where we discuss strategies for delivery a range of densities and typologies to support housing delivery within the Peacocke Structure Plan area.

Page | 69





# 8 Urban Design Case Studies

The following section builds on the urban design considerations discussed in the previous section and illustrates how, and to what extent, they have been applied in the New Zealand context. We have focussed on these case studies as they display a broad array of design-led planning responses that could be applied to Peacocke area. The examples demonstrate how good urban design and planning can be integrated within a strategic framework for greenfield development. The examples include:

- Halswell (Christchurch);
- · Hobsonville Point (Auckland); and
- Kensington Park (Auckland).

# 8.1 Halswell North ODP Area

Halswell North located on the outskirts of Christchurch, is an example of a greenfield development with the aim to deliver a diverse range of medium density residential and commercial development. The development was first initiated as a private plan change by one of the major landowners, which was subsequently adopted by the Council as part of the Land Use Delivery Plan. This development provides a useful comparison to Peacocke in that the land is in private multiple ownerships and governed by an Outline Development Plan (ODP) and a specific zone in the District Plan.

The area is zoned Residential New Neighbourhood Zone by the Christchurch City Plan and has had an ODP prepared by Council in conjunction with the landowners through a full consultative process, which was subsequently integrated within the Plan. The ODP is used to inform subdivision and land use for that area regardless of land ownership. The ODP provides a broad structure and framework for the implementation of development at the ground level. Once the overall ODP has been completed, Councils and developers can create visions for neighbourhoods enabling the identification of main streets for mixed use development and neighbourhood centres to create a sense of place.

The Halswell North ODP area was considered an exemplar and resulted in a new zone within the District Plan - the Residential New Neighbourhood Zone. Proposed developments that do not align with the ODP and relevant subdivision or built form standards results in a more stringent activity status' (i.e. 'restricted discretionary' instead of 'controlled') allowing Council to have a greater level of control and discretion in the type of development delivered.

Key features of the implementation of the ODP at subdivision stage within the Residential New Neighbourhood Zone included:

Minimum net density<sup>13</sup> requirements of 15 households per hectare (Rule 8.6.11(b)(iA));

Page | 70

<sup>&</sup>lt;sup>13</sup> The definition for net density within the Christchurch City Plan includes all open space, reserves, and local roads but excludes highways and major arterial roads, stormwater retention areas, esplanade reserves, land set aside for community, retail or designated facilities.





- Subdivisions are exempt from achieving this density if a site (future development allotment) is specified for achieving the relevant minimum net density requirement that has a legal instrument that effectively prevents subdivision and land use at that site below the required specified density (Rule 8.6.11(b)(iii);
- Set minimum areas for traditional subdivision at 4 hectares;
- Comprehensive residential development consents for sites larger than 6000m<sup>2</sup>;
- Set minimum site areas for allotments at 300m<sup>2</sup> while allowing 20% of allotments to be between 180-299m<sup>2</sup>; and
- · Precludes public and limited notification for restricted discretionary and controlled activities.

Any subdivision is also considered against the principals of the Residential New Neighbourhood Zone and whether the subdivision provides allotments that enable diversity of housing types and distributes allotments for higher densities throughout the subdivision area.

Dwellings that meet the built form standards can then be constructed as a permitted activity. These standards enable semi-detached dwelling typologies to be constructed as permitted activities. Comprehensive development activities can be undertaken as restricted discretionary activities and the Council as such have a limited discretion over urban design matters.

The key point of difference for Halswell has been in the delivery of Meadowlands as an exemplar development and the requirement for all subdivision and land use activities to be applied for concurrently. This area is subject to the Meadowlands Exemplar Overlay (North Halswell). This introduces additional place specific controls, including:

- · Requiring the development of a neighbourhood plan covering a minimum area of 8ha;
- Provides for comprehensive development consents as restricted discretionary activities and that
  they shall be for a developable area of a minimum of 7000m<sup>2</sup>;
- Provides for future development allotments encumbered to achieve the density required for the zone:
- Requiring the comprehensive development consent to contain three or more dwelling typologies with no single typology making up two thirds of the total dwellings; and
- Applying non-complying activity status for subdivision and land use activities that do not form part
  of a comprehensive residential development consent.

In evaluating applications for comprehensive development consents, rather than rely on traditional built form or subdivision standards within the Plan, they are evaluated against a robust framework established within the matters of discretion that is essentially an urban design led evaluation that specifically provides for the building typology, mix, and location as matters of discretion. The successful implementation of comprehensive development consents is the strength and quality of the neighbourhood development plan (NDP). The NDP is a detailed urban design tool that, importantly for this assessment, requires allotment size, allotment arrangement, and allocation of housing typologies to be identified.

Regarding implementation of the ODP and development process, the plan was split into stages in which Stage 1 is currently underway. This staging identifies the areas that are being targeted for development and as well as an overarching layout of the block design, whilst protecting the unstaged areas from

Page | 71

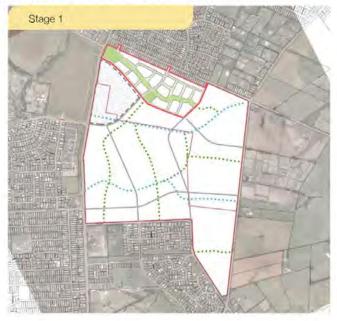
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development. The greenways and main roads are identified and provides staging super lots. The implementation of the NPD is shown for Stage 1 of the Development in Figure 8-1, Figure 8-2, and

Figure 8-3. These show how the NPD relates to the wider greenfield area, the indicative lot layouts within the defined blocks, and the typologies that are linked to those allotments. The first stage has a community hub, early education centre (already completed) and is immediately adjacent to the Key Activity Centre.

Figure 8-1: Block layout from the Neighbour Development Plan.



Page | 72





Figure 8-2: Allotment layout from the Neighbourhood Development Plan



Figure 8-3: Typologies from the Neighbourhood Development Plan.



Figure 8-4 provides an early illustration of the neighbourhood concept with a variety of housing typologies and tenures, a small mixed- use neighbourhood centre and a very green public realm to provide the tree canopy that more compact development cannot provide. In reality, this could only have been developed through a detailed Comprehensive Development plan with the supporting design guidelines.

Page | 73





Figure 8-4: Meadowlands Neighbourhood Concept Plan



# 8.1.1 Outcomes from Implementation

In discussions with the Planner and Urban Designer connected with the development, it was considered that the development is being largely delivered, although the finesse of the original proposal is being lost with time. A site visit confirmed the larger components of the zone response are being delivered, including restoration of a historic house as a community facility set in a heritage garden, the greenways and naturalised watercourses, the stables converted to a pre-school facility, a mix of stand-alone, townhouse and terrace-house typologies at a variety of price points, 10% community/social housing. The following figures illustrate what has been delivered so far.

Figure 8-5: Existing stables have been converted into a Montessori School in a Park setting



Page | 74





Figure 8-6: Derelict homestead has been restored as a community building



Figure 8-7: Attached terraces overlooking the greenways



Figure 8-8: Mixture of attached and detached, single and two storey



Page | 75



Hamilton City Council
Te kaunihera o Kirikiriroa

Page | 76





Figure 8-9: The greenways delivered with play equipment, seating and productive gardens



Figure 8-10: Housing is developed overlooking the greenways with parking from lane.



Page | 77





#### Lessons from Halswell

It is considered that some of the special qualities proposed during the consultative process have not been delivered. While not achieving the original intent, the Hallswell ODP area provides for the following key observations that are of relevance for Peacocke:

- Was developed in a collaborative process (even though this was not mandated under the LURP);
- Allows for mixed use within the neighbourhoods and ODP area and a KAC;
- It is based on walkability with a major KAC transport hub to be developed as well as neighbourhood centres:
- Has more prescription in the District Plan than other medium density suburban zones and is driven by an ODP;
- . The Open space and movement network is being delivered in accordance with the ODP;
- The densities are being delivered (at the minimum level), however does not deliver the diversity of typologies originally envisaged;
- The first subdivision has adhered to the superblocks illustrated in the ODP;
- This area was first to be developed because of proximity to the collector road. It is also adjacent to
  the planned KAC and bus interchange. The ability to do apartments on key corners has been lost;
- It is delivering affordable housing and community housing as prescribed;
- · Cars are taking less of a profile than in conventional development; and
- The process would have been better served if the typologies and qualitative design had been captured by Design Guidelines as part of the Plan and ODP.

#### 8.2 Hobsonville Point

Hobsonville Point is located to the northwest of the Auckland CBD on a peninsula on the Waitemata Harbour. It is the largest master-planned residential development in Aotearoa. The site has an area of 167 hectares, predominantly consisting of land owned by the New Zealand Defence Force (NZDF). The remainder of the land was previously owned by the Waitakere City Council and some owned privately. Following the closure of the Airbase in 2002, the land was amalgamated and the Hobsonville Land Company (HLC) was formed (under Housing New Zealand) to lead the development. Overall, the aim was to provide 3,000 new dwellings targeted at lower income earners and is seeking to achieve a density of 27 dwellings per hectare by 2024. This was later altered under the National Government Direction, establishing a public-private partnership with HLC. The PPP set a target of 20% of the housing to be affordable. Later, the housing target was increased to 4,500 by 2030.

Hobsonville Point is an example of a greenfield area that has then been delivered through a Master Plan. The Master Plan area is comprised of a variety of precincts which are further designed in detail and achieved through the resource consent process administered by Council. While the Master Plan guides the overall development plan for Hobsonville Point, each resource consent provides design details for residential, commercial, and education areas, as well as open spaces, reserves, and transport networks. The Master Plan provides detailed guidance regarding:

Page | 78





- density and block layout design,
- height and frontage plans,
- and use activity layout,
- · road and infrastructure layout, and
- open space design.

A detailed set of regulating plans, technical annexures, and design guidelines accompany the Master Plan in order to specifically shape different typology areas across land uses. Through this, planning practitioners seeks to provide a varying residential density and typologies, connectedness, and key node areas.

Hobsonville Point was implemented through Plan Change 13 to the then operative Waitakere District Plan. While it is of limited relevance to the delivery of Hobsonville now, it is important to consider as it established the lot layout and development patterns. The delivery on the master plan was through the division of the area into precincts and then requiring the development of a comprehensive development plans (CDP) for entire precincts before any development can occur. These CDP were required to outline the indicative block layout, the proposed location of residential and non-residential activities, the method of staging and managing vacant land, and a precinct specific site development and building design guide. In the development of the CDP, the rules were flexible, including precinct boundaries that could move, as long as the underlying rationale gave effect to the principles. Additionally, housing yield targets were specified for each precinct constituent block and importantly, this could be a method for implementing targeted housing outcomes for Peacocke.

One of the approved CPD for Hobsonville was the Buckley Precinct CPD<sup>14</sup> and included. As required by the Plan this broke down the precinct area into indicative blocks and established a minimum and maximum residential unit yield target of 1080 and 1200 units. This was then broken down into the indicative yield for each block defined within the CPD. Built form standards, and indicative land uses were then prescribed for each block. The land uses for residential uses were prescriptive and included specific apartment typologies for areas and enabled all housing typologies in others such as single-detached houses on small lots, duplexes, two and three storey terraces, and apartment buildings up to six storeys high. The delivery of these typologies was then guided through residential building typology matrixes that specified built forms and the lot layouts that are required to achieve those typologies.

As the name suggests, this enabled an extremely comprehensive design process to occur. The consequence of this was that a simple policy and rule framework could be prepared. No Hobsonville specific objective and policy framework was required as the CPD outlined the intended outcome in far greater detail than could be achieved using the traditional zoning approach. The rule framework applied controlled activity status to the development of a new residential buildings with matters of control limited to compliance with the comprehensive development plan standards and CPD conditions and the relevant design guidance. Subdivision within these precincts was either restricted discretionary if it supported the implementation of the CPD or was the site specified within a land use consent application, otherwise, subdivision activities are non-complying. This encourages comprehensive development activities and provides for the exclusion of developments that did not achieve the CPD vision.

Page | 79

<sup>&</sup>lt;sup>14</sup> Approved as LUC-2008-389 by the Waitakere City Council





The way the CPD's were formulated enabled yield and typology to be controlled through the resource consent process. Diversity in housing was encouraged through specifying target yields for blocks. The formula for achieving these yields was left to the block developer using the prescribed typologies. This allows a staged approach where precincts are delivered over different timeframes through the resource consent process.

Figure 8-11: Hobsonville Point Illustrative Concept Plan (Source Hobsonville Point, 2020)



The initial precinct approach has been carried through into the Partially Operative Auckland Unitary Plan (AUP). The AUP utilizes the existing spatial boundaries and target yields of the original precincts, however has applied standardised residential zoning that targets specific development outcomes such as the Mixed Housing and Suburban Zone and the Terrace Housing and Apartment Buildings Zone that generally align with the desired outcomes for Hobsonville. These zones have respective minimum net site areas for vacant proposed sites of  $400\,\mathrm{m}^2$ ,  $300\,\mathrm{m}^2$ , and  $1,200\,\mathrm{m}^2$ . The nature of urban development within Auckland has facilitated this approach as the policy and rule frameworks are well tested to deliver density and housing diversity due to operating in a market with an established demand for these typologies and a development sector with experience in delivering them. Precincts are widely used across the Auckland Unitary Plan for the development of residential areas (E.g. Karaka North Precinct and Wairaka Precinct). These are often backed up by Precinct Plans that promote an integrated approach to the development of these areas.

As the AUP relies on generic zones the Precincts have been overlayed to provide the place specific framework that is required to achieve the intent of the original master plan and CPD's. The overarching Hobsonville Precinct is divided into 6 sub precincts that align with the original master plan and CPD's that were prepared for those areas. For example, The Buckley CPD has been pulled through in the built form standards for the Buckley Sub-Precinct. This can be seen in applying a strong policy emphasis on achieving a mix of housing typologies and intensification that retains amenity in those areas. As a result, existing planning zones have been utilised where they best suit the intended nature of development. We note, for completeness, that Hobsonville is supported with a specific policy framework (refer Table 8.2) that assists with guiding future development outcomes.

Page | 80





Table 8-1: Hobsonville Precinct Objectives and Policies.

	Objectives and Policies
Objective I605.2(1)	Hobsonville Point Precinct is developed in a comprehensive and integrated way to provide for a compatible mix of residential living, commercial and employment in order to increase housing supply
Policy I605.3(5)	Enable medium and high density housing to make efficient use of the land resource while maintaining the reasonable amenity of adjoining residential sites and providing high-quality on-site amenity.
Policy I605.3(18)	Require integrated, accessible and usable public open spaces to be provided within walkable distances for all residents.

#### Lessons from Hobsonville:

To summarise, the implementation of Hobsonville Point was undertaken through the following key processes:

- a. Plan Change and Zoning Framework that designated areas of indicative land use;
- b. Comprehensive Development Plans for each defined precinct were then developed;
- Application of specific subdivision and land use consents to authorise development. Had to meet both the CDP requirements (design guidelines and relevant planning rules) and building consent approval;
- d. A departure from the original provisions for Hobsonville has been in applying permitted activity status to the development of up to three dwellings per site. The AUP still supports the linkage between subdivision and land use activities through applying a restricted discretionary activity status for subdivision that is in accordance with an approved land use consent (Policy E38.3.6 and Rule E38.4.2(A14), Otherwise discretionary activity status applies;
- e. In assessing subdivision applications, the primary consideration is on the effect of the design and layout of the sites achieving the purposes of the zones;
- Regarding density targets, Hobsonville Point is seeking to achieve a density of 27 dwellings per hectare by 2024;
- g. The masterplan approach combined with the Comprehensive Development Plan has delivered certainty of outcome for the Council, investors and residents;
- The CBDs were further reinforced by the release of superblocks for developers /builders to deliver the diversity of typologies;
- The area has delivered a mix of typologies, a higher than normal level of architecture by most of the builders;
- j. Has mixed use schools and other community amenity delivered by HLC and other government agencies; and
- k. Has achieved a high level of landscape amenity.

Page | 81





# 8.3 Kensington Park

Kensington Park is a 15.76 hectare development located in northern Orewa. Orewa is a coastal suburb located in the northern reaches of Tāmaki-Makaurau. Formally known as the Puriri Park Holiday Resort, Kensington Properties purchased the land in 2006. The area is a predominantly residential development including a range of existing buildings, single-detached houses, townhouses and apartments. A number of Council reserves, community facilities and a water feature were established through the subdivision process.

The area is targeted for the development of 750 homes with a proposed density of 48 dw/ha (gross), not including non-residential development, community reserves, and infrastructure.

The development integrates mixed residential dwellings into the Kensington Special Zone through the master planning approach. These typologies include:

- 'The Kensington House' generally a two-storey standalone dwelling with double garage.
- Hill Top House generally a three-storey stand alone or duplex with semi excavated garage.
- Townhouses two-, to three storeys in terrace formation.
- Walk-up apartments designed to appear as large houses, contain several units.
- Type 'A" Apartments two to six apartments per floor, with three/four levels, plus basement carparking.
- Type 'B' Apartments Larger buildings with six to ten apartments per floor, spread over four or five levels plus carparking.

Regarding implementation of the development, Special 31 Zone (Kensington Park) in the northern section of the Orewa East Structure Plan, was established in 2011 over an existing resort. The transition began in 2006, when Kensington Properties (private company) purchased the land and began amalgamating it through a series of land use and subdivision consents.

The Kensington Park Special Zone comprised of three key policy areas:

- Residential Policy Area
- Mixed use Policy Area
- · Communal Activity Policy Area

These then became divided into six specific precinct areas, each with their own development controls. Policy areas dictate the appropriate location of residential and non-residential activities within the area, while the density rules and development controls dictate the appropriate scale, form and intensity of the built from through the varying areas. This was carried over into the development of the AUP(OP), now known as the Orewa 1 Precinct. Examples of the typologies are shown in the below Figures.

Page | 82





Figure 8-12: Kensington Park Apartment building (Source: Haydn & Rollett, 2020)



Figure 8-13: Kensington Drive mixed typologies (Source: Southpark Corporation, 2020)



Page | 83





#### Lessons from Kensington:

- a. This was driven by one individual landowner/ developer with a vision for a New Urbanist development.
- b. This was a Private Plan change and has its own Rules.
- c. Kensington Park had a strong aesthetic vision for architecture driven by an individual developer,
- d. This broke all the rules around what the market "wanted" in the area and delivered high density housing on a challenging site.
- e. Is walking distance to the Town Centre.

# 8.4 Key Learnings from Case Study Examples:

- Conclusions from case studies is that all of these examples have relied upon a high level of urban design led development that has been formalised into either an outline development plan, masterplan or comprehensive development plans.
- The more restrictive and more committed the development community are to the vision the better the outcome from an urban design and housing diversity perspective.
- 3. The case study examples had a mixture of land ownership. Halswell is in various ownerships, Hobsonville is in one ownership, however, was delivered by various developers; Kensington Park is a design/build delivery model. Obviously, with fewer landowners it is easier to achieve a consensus on a development vision. Given that the Peacocke area is in multiple ownerships, there is likely to be a need to promote more regulation to create certainty for all parties and to ensure that there are no 'winners' and 'losers'.
- 4. A high level of buy in and support is required from the development community and we note that Peacocke landowners' interests have an ongoing relationship with Council through a Development Forum through which developer stakeholders' interests can be heard.
- 5. In a number of cases identified above, successful planning and urban design outcomes have been secured where land use and subdivision have been tied together. Lot size and dimension are inextricably linked to the resultant typologies. We see that introducing housing diversity and typologies rules should be explored further given their successful application, where they have been carried through as a regulatory response (i.e. Hobsonville and wider Unitary Plan Precinct responses).
- Only Kensington Park had a strong aesthetic vision for architecture driven by an individual developer.
- 7. Strong emphasis on location around mixed use nodes and public transport.

# 8.5 Conclusion and considerations (urban design lens)

There is a wide range of economic and sociological factors which influence the supply and demand for particular development patterns and diversity of residential typologies in green field locations. However,

Page | 84





one of the main reasons appears to be an immaturity in the New Zealand land development and house building industries combined with permissive regulations around medium density subdivision.

There is a new prerogative to maximise the use of land and infrastructure, combined with a commitment to creating walkable communities that encourages modal shift away from the private car to walking, cycling, public transport and using local facilities and amenities. This is all dependent on density that supports these activities and quality of the environment.

Large scale change in the housing stock within the Hamilton Residential Medium Density Greenfield development will take time, however as discussed above, there are a number of factors that form part of a suite of economic, social and regulatory conditions that mitigate against major advances in the short term:

Extent of the Residential Medium Density Zone - Within greenfield areas, the zone should reflect proximity to specific facilities such as retail centres, public transport and schools and landscape amenity. Outside of that amenity it is better to have good suburbia at lower density.

Where there is a KAC and Transit Centre - The density within 800m/1000 m of a KAC or Transit Centre should be above 40 dwellings per hectare (excluding work population), which is conducive of high density development densities. Beyond this distance density can be from 22 to 40 dwellings per hectare.

Where there is a direct public transport route and small neighbourhood centre, density within 400/500m of the neighbourhood centre should be up to between 30/40 dwellings per hectare; between 500m and 1000m distance between 22 and 40, which is conducive of medium density development.

Beyond walkable distance from centres and public transport can be between 10 and 22 dwellings per hectare, which is more conducive of low density development.

Mix Housing Typologies - As discussed in the Case Study examples set out in this report, effort should be made to mix typologies within densities to supply a diversity of housing in all areas.

Community and developer Resistance - The lack of understanding and clarity regarding medium density residential development in the Hamilton context will tend to fuel opposition rather than foster consensus and support. For medium density residential development to become an increasing reality in New Zealand generally, there are several key challenges to overcome:

- Negative perceptions associated with medium density residential developments resulting in reduced demand and greater risks for developers;
- Opposition to proposed medium density residential developments from owners of more traditional forms of residential accommodation (exhibiting the classic NIMBY syndrome); and
- · Resistance from developers and their consultants.

Development Options - If a Plan continues to provide an easier option to make short-term gains landowners and developers will most likely pursue that option in preference to the costs and uncertainty of a more challenging development and associated planning processes.

Page | 85





Development Standards - A continuation of conventional approaches of setbacks, separation and protection of an individual's amenity expectations will perpetuate existing building patterns with a gradual reduction in available opportunities for more imaginative comprehensive development.

The review of research material undertaken as part of the preparation of this report, suggests that a prerequisite for instigating a successful change in direction for delivery of medium density development appears to be a shared understanding that there is an issue that requires attention in the particular area and in a particular way. The experience of other cities faced with needing to respond to sprawl and the tyranny of the car show that it takes leadership, resolve and time. The response needs to have a degree of immunity from the risk of regular changes in regulatory regimes, funding programmes and policy direction.

'Enabling' planning provisions alone are unlikely to result in significant change unless there is the capacity and commitment to deliver larger scale comprehensive development providing the full range of activities expected by communities. Most of the successful examples of medium density residential development in overseas jurisdictions have occurred as a result of:

- consultative and collaborative planning processes resulting in well-defined outcomes to be achieved:
- a comprehensive mixed use approach including walkability to goods and services, public transport, and open spaces / recreational opportunities;
- · an emphasis on good urban design and quality architecture; and
- A building industry to geared and committed towards comprehensive development or compelled to do it.

A key finding of the UK, Canada and USA is that it is not so much about building; it is more about community and neighbourhood development and sustainable densities.

The broad-brush identification of a generic Residential Medium Density Zone does not provide an appropriate vehicle for embarking on such a debate. Such debate risks being mired in the relative merits of one density target rather than another, whereas more constructive dialogue is likely to be had around land use and building types rather than numbers. What this points to is a need for a regulatory response that promotes a Neighbourhood Zone for Greenfield development that promotes a range of housing densities including medium density housing typologies. This indicates the need for an overarching planning response that includes Structure/ODP Plans, Comprehensive Development Plans and Design Guidelines.

Page | 86





# 9 Planning Background

To inform the strategic planning options assessment, an analysis of the current greenfield development process for Peacocke, and of the strategic planning options for greenfield development that have been used elsewhere in New Zealand are outlined in detail below. The purpose of this section is to establish what approaches have been implementing throughout New Zealand in order to determine best practice approaches for the layout of greenfield development.

# 9.1 Options (Toolboxes)

A review of NZ-wide, greenfield development examples has identified a variety of options/toolboxes that local authorities utilise when it comes to developing new areas. This section outlines several toolboxes/options that are currently being used or have been used recently to deliver new greenfield residential development. The options/toolboxes that have been considered as part of this review are as follows:

- Bespoke Zones and Precincts,
- · Outline Development Plans,
- Staged Plan Changes using Existing District Plan Zones,
- · Future Urban Zoning and Transition Zoning, and
- · Utilising Design Guidelines in Planning Instruments.

#### 9.1.1 Bespoke Zones and Precincts

Defining bespoke zones and precincts for a greenfield area can be advanced through the plan change process. This method of planning for greenfield growth enables the spatial identification of areas where additional place-based provisions apply through precincts to achieve outcomes that differ from the underlying zone(s). This can promote specific development outcomes through providing certainty as to what can and what cannot be undertaken within those precincts. This approach can enable targeted urban design outcomes to be achieved through the identification of areas that can accommodate or achieve those outcomes, and the development of robust objective and policies that enable the desired housing densities and typologies. Bespoke zones and precincts provide the opportunity to develop a policy and rule framework that can be used to manage lower density patterns of greenfield growth.

Bespoke zones and precincts have been widely employed by authorities for addressing specific issues within greenfield areas. This approach has been employed by Porirua City Council in Plan Change 18 prepared for the Plimmerton Farm area and has enabled the site context and sensitivities to be incorporated within the approach. This is detailed in Appendix 1.

#### 9.1.2 Extending existing zoning

An option for enabling residential greenfield development is to utilise the existing zoning provisions available in district plans and apply these to new areas. Structure Plans can be used to identify areas that should be set aside for residential, within which areas for low density, medium density, and high-density areas (as well as commercial and other zones) are identified. A plan change can then be progressed to

Page | 87

Attachment 14





modify the existing zoning in the greenfield area to the existing zone that is most appropriate for structure plan objectives. This could be achieved through multiple, staged plan changes thereby only allowing the release of a part of the overall structure plan area, or the entire structure plan area could be rezoned through one plan change. For larger areas with more comprehensive structure plans, it might be more appropriate to undertake multiple plan changes in stages, whereas in small areas, it might be appropriate to implement the structure plan zoning under one structure plan. The application of this method For Whenuapai is explored in Appendix 1.

#### 9.1.3 Outline Development Plans and the Resource Consent Process

Outline Development Plans (ODPs) are place specific plans that can be prepared to establish land use patterns for a specific scale and discrete area. These can promote housing choice and diversity through enabling a range of housing typologies in identified areas and can exclude competing land uses that may threaten the core development objectives. The development of these plans can enable the process to be 'design led' with specific outcomes identified early, and with decisions relating to land use, transport, and infrastructure being integrated to achieve those outcomes.

These plans can be prepared for identified areas within early stages of structure plan implementation. These plans are then typically integrated within the district plan framework to control the land use patterns for these areas. This offers efficiencies of resourcing as only those areas to be developed in the short to medium term require an ODP to be prepared. The process can also allow for a high level of guidance over the development of a new greenfield area. ODPs can be implemented in stages through the resource consent process where development is only undertaken in small sections at any one time. Typically, through the eventual development stage after implementation of the ODP, the district plan will require resource consent to be required for undertaking development in these areas, with the activity status varying depending on compliance with the ODP.

This approach has been used in Christchurch by private developers in the Halswell North area where greenfield areas have been targeted for residential and commercial development,

#### 9.1.4 Future Urban and Transition Zoning

Future Urban and Transition Zoning allows for current land uses to continue whilst ensuring that future urban development can still occur. Future Urban Zones are provided for within the National Planning Standards and have been utilised within operative plans to avoid the fragmentation of land and inappropriate land use activities that could impede the potential capacity of the land in the future.

Transition Zoning provisions seek to achieve the same outcome as Future Urban Zones, however, generally have a more evolved policy framework. The removal of the transition zoning allows for the underlying zone to change to an established residential zoning. The use of transition zoning can enable the release of land in a coordinated way that supports the overarching urban growth strategy and objectives for greenfield areas. There is also the added benefit of removing onerous plan change requirements. For transition zoning to be implemented effectively, specific conditional triggers need to be identified and incorporated within the rule framework of the District Plan to provide certainty to landowners, developers and Councils as to the process and where development can occur. The application of this Method by the Dunedin City Council is explored in Appendix 1.

Page | 88





### 9.1.5 Master Planning

Master Planning can be utilised to deliver greenfield development through a detailed design exercise that can give effect to the overarching Structure Plan or ODP. A Master Plan describes the final expected outcome of a large site and may be used to direct development on smaller sites. It describes the physical block or lot level configuration and phasing of buildings, infrastructure, and/or public spaces. Master Plans can be advanced either by local government or by private developers. Master Plans like ODPs and Structure Plans can be implemented within a district plan to ensure that development is undertaken in accordance with an existing or a proposed master plan.

Master Plans often deliver more integrated and comprehensive, design focussed development strategies to deliver a specific type or variety of developments. For example, a Master Plan can identify individual neighbourhoods and the anticipated land uses, residential typologies, densities, and may include a specific set of design guidelines. It may also help determine the necessary housing yield that may be required within an area to ensure housing supply goals are met.

Hobsonville Point is an example of a Master Planned development which is comprised of multiple precincts which each deliver their own unique typologies, residential densities, and design outcomes. This includes areas specifically for commercial and community activity with high density apartments and offices, as well as areas comprised and targeted for mixed housing typologies, such as townhouses, apartments.

## 9.1.6 Design Guidelines in plans

Based on experience, it is difficult to develop performance standards which will guarantee quality architecture and good urban design outcomes, especially where there is no inherent urban design guidance. There are, however, examples emerging in NZ where second generation planning instruments are integrating urban design guidelines into planning documents. This is giving Councils a greater level of discretion over design outcomes.

District plans often rely on the integration of urban design guidelines to help achieve high quality residential development in new and existing residential environments. These guidelines, though separate to the district plan, are typically referenced in the relevant policy or rules section (i.e. residential development standards in a district plan). These plans generally establish assessment criteria which would apply to certain types of residential development (for example, duplex, townhouse, and apartment typologies).

Examples of design guidelines include Tauranga's proposed urban design assessment criteria which will include a set of criteria for residential development to follow as part of a restricted discretionary activity resource consent process. Tauranga's urban design assessment criteria has been utilised within many previous examples including Kapiti District Council's Medium Density Housing Guide which involves utilising best practice principles developed in the New Zealand Urban Design Protocol (2005) and People+Places+Spaces: An Urban Design Protocol (2002).

Other examples include the Catalina Sub Precinct Design Guidelines, which have been integrated with the Hobsonville Point Master Plan (as outlined above) to ensure that the best quality urban design outcomes can be achieved by following several core principles. For example, these guidelines provide guidance for a range of residential typologies on how best to achieve effective on-site amenity, residential coherence

Page | 89





through building design, landscaping guidelines, layout of lanes and car parking and access and many other core principles.

More recently, Queenstown Lakes District Council (QLDC) has preferred a regulatory approach to enable/support delivery of medium and higher density development. QLDC recently implemented variations to its Proposed District Plan to integrate residential design guidelines to support Medium and High Density Development given that the Council was concerned that the initial phase of the staged District Plan Review that provided for the underlying residential zones, would not be effective in delivering positive design outcomes for these areas without residential design guidelines forming part of the District Plan. QLDC as part of the section 32 evaluation supporting Stage 3 of their District Plan Review considered that there was greater effectiveness having Residential Design Guidelines as part of the matters of discretion to be considered for development over a certain threshold (three or more dwellings). QLDC considered that having design guidelines that sat outside of the Proposed District Plan would be less effective and would not provide Council with the ability to refuse consent for development that is poorly designed.

Design guidelines can be successfully used as part of the assessment and determination of Controlled, Restricted Discretionary, or Discretionary Activity resource consent applications. The most common activity status where Council has confirmed adherence with design guidelines is a Restricted Discretionary Activity status.

The examples above typically provide guidance for residential development on site design, building components, and amenity values and character. Design guidelines can be an effective tool for assisting developers with new residential development and throughout the resource consent process, however from the above analysis it is evident that Design Guidelines are more effective in a regulatory sense when they are incorporated within the plan itself.

## 9.2 Review of ODP and Peacocke Plan Provisions

An assessment of the current regulatory framework for Peacocke is required to establish the baseline for greenfield development in the area. This will consider the Waikato Regional Policy Statement and the Hamilton City District Plan as it relates to Peacocke. While the intent of this assessment is to establish the baseline, it will also contribute to the strength, weakness, and opportunities assessment in Section 10.3.

#### 9.2.1 Waikato Regional Policy Statement

The Operative Waikato Regional Policy Statement 2016 ("the RPS") requires consideration for this assessment as under section 75(3) of the Resource Management Act 1991, district plans must give effect to any regional policy statement. The RPS contains a number of a objectives and policies that must be considered in the evaluation and recommendation of any policy responses to increase housing density and diversity for the Peacocke Growth Cell. Minimum housing targets are set for Hamilton City over the Short, Medium, and Long-term (Objective 3.27) and establishes a housing density target of 16 households per hectare gross for the Peacocke area (Policy 6.15). However, the RPS does not contain policy direction as to the desired housing outcomes beyond general direction that development within the built environment should occur in an integrated, sustainable, and planned manner, and minimise energy demand from

Page | 90





transport. The emphasis within the RPS for achieving minimised energy demand from transport is on housing intensification within existing areas of Hamilton (Objective 3.12 and Policies 6.5, 6.15 and 6A).

### 9.2.2 Peacocke - Current Strategic Planning Approach

This section will not review all the objectives and policies that apply to Peacocke. Rather, the current strategic planning approach for greenfield development is outlined and objectives and policies presented as required. This will allow a strength, weakness and opportunities assessment to be undertaken as part of an integrated urban design and planning assessment below. This overview can be broken down into three sections:

- · Peacocke spatial organisation.
- · Subdivision requirements, and
- Master plan evaluation.

The current activity status following subdivision/master plan approval will not be explored due to the *ultra* vires provisions 15.

#### Current Approach - Peacocke Structure Plan Area

The Peacocke Structure Plan has been integrated within the Operative District Plan. The Structure Plan chapter provides the overarching strategic framework for Peacocke including specifying an overall target density of 16 dwellings per hectare. Reference is also made at this policy level to development providing for population densities that support passenger transport and mixed modes (Policy 3.3.1(c)), and interim land use and development that does not compromise the integrity and the viability of the land use pattern for the structure plan (Policy 3.3.1(d)). Importantly, the Peacocke Structure Plan does not seek to control subdivision and land use activities directly. Rather, it establishes the framework through the establishment of a comprehensive objective and policies that reflect the overall vision for the area. The majority of all objectives and policies for Peacocke are contained at this strategic level, with the lower levels of the framework focusing on the implementation of these objectives and policies (See Figure 9-1). The framework adopts a strong spatial planning approach through this framework within the Peacocke Structure Plan area with discrete areas being identified and their role in implementing the overarching objectives and policies being defined.

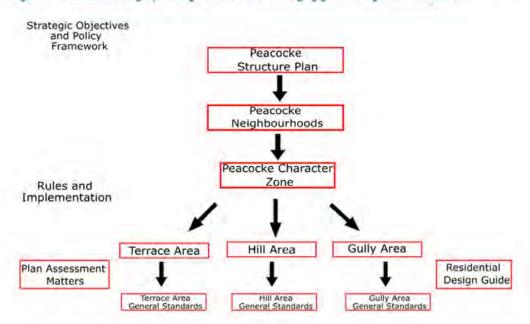
Page | 91

<sup>15</sup> Two Environment Court decisions -activity status must be set by the RMA or by the Plan. A resource consent cannot be used to establish activity statuses.





Figure 9-1: Current strategic planning framework for managing greenfield growth in Peacocke.



The first layer of implementation of the Peacocke Structure Plan are the defined Neighbourhoods. These have been defined to support a well-planned and integrated manner. Additional support for the neighbourhood scale development pattern is provided through the identification of a Suburban Centre and Community Focal Point nodes. The suburban centre is earmarked within the Structure Plan for integration with the transport routes and to provide for the majority of commercial activities within Peacocke. The potential is identified for this centre to provide the opportunity for apartment style development within and beside the suburban centre. The Structure Plan contains generic statements surrounding the intent (street-based, mixed use) and location (transport route junction) but with limited translation into the objectives and policies. There is some support for mixed uses, however, this sits independent of the policies for the nodes. As neighbourhoods and nodes are couched within the Structure Plan, they are still focused on the relatively high-level objectives and policies for Peacocke. This is demonstrated within the wording of the objectives and policies which can be described as vision oriented (see Table 9-1).

Page | 92





Table 9-1 Objectives and policies relating to the implementation of neighbourhoods

	Objective/Policy			
Objective 3.4.1.5	Ensure that higher density development is linked to social and natural amenity.			
Policy 3,4.1.5a	Increase density around nodes, parks and riverfront areas.			
Policy 3.4.1.5c	Intersect proposed passenger transport routes with nodes for critical mass of population and efficient interchange capabilities.			
Objective 3.4.1.6	Encourage an overlapping mix of land uses.			
Policy 3.4.1.6a	Provide a wide variety of land use activities within comfortable walking distartion of the highest population densities and amenity.			
Policy 3.4.1.6b	Use mixed use planning rules to encourage a diverse and compatible range of activities, both vertically and horizontally.			
Objective 3.4.1.12	Develop the Neighbourhood as the building block of the area			
Policy 3.4.1.9a	Development should be contained in distinctive neighbourhoods that are walkable and safe and linked by a high-quality open space network			
Policy 3.4.1.12a	Establish an integrated network of neighbourhoods, each distinctive and each with its core and sense of place.			
Policy 3.4.1.12b	Focus neighbourhoods around parks, schools, centres, and main streets.			

Character Areas have been defined based upon natural landforms and were promoted as a method of ensuring that urban development responds to the characteristics of that area. The structure plan provides for three-character areas that are defined across the structure plan area shown in Table 9-2.

Table 9-2: Character areas and the purpose of the areas from the Structure Plan.

Character Area	Area Purpose
Terrace Area	This area is located adjacent to the Waikato River edge and has a high level of amenity. High density residential development would benefit from location in this area. Residential development will be a combination of general residential development, terrace housing and apartments.
Gully Area	The environmentally sensitive area of the Mangakotukutuku Gully network runs through the centre of Peacocke. Because of the natural sensitivity of this area lower urban densities are appropriate; lot sizes of between 800m <sup>2</sup> and 1,200m <sup>2</sup> would be more suitable for land immediately adjoining the gully system.
Hill Area	The undulating topography in the southern area of Peacocke is proposed for lower overall density (lot sizes of 1,000m <sup>2</sup> +) with higher intensity arranged along the ridgeline

The objective and policy framework for these Character Areas is contained within the strategic framework of the Structure Plan as shown Table 9-3. The focus has been on preserving the natural/environmental characteristics through development that is sensitive to the site context and the policy framework has been geared towards achieving this. While policy references 'higher density housing' opportunities within the Terrace area, it appears as if this is relative to the specific lot sizes referenced for other areas i.e.  $800 \, \text{m}^2$ + sites along the gully network and  $1,000 \, \text{m}^2$  sites in areas of undulating topography. Given the above, we

Page | 93

is Peacocke Structure Plan 2007, Hamilton City Council,





consider that higher density housing development is unlikely to be achieved when the comparative baseline for density is at such a high level.

Table 9-3: Objectives and policies that relate to the implementation of the character areas.

Objective/Policy Number	Objective/Policy
Objective 3.4.1.1	Protect and enhance significant natural areas.
Policy 3.4.1.1c	Encourage lower density development (lot sizes of 800m <sup>2</sup> +) along the gully network.
Policy 3.4.1,8a	Use natural features to define neighbourhood edges and inform the development of a diverse range of living environments across the growth cell
Policy 3.4.1.3b	Large-scale earthworks and modifications to landforms should be avoided to ensure development responds positively to the landscape and enables the creation of a distinctive urban form.
Objective 3.4.1.5	Ensure that higher density development is linked to social and natural amenity.
Policy 3.4.1.5a	Increase density around nodes, parks and riverfront areas.
Objective 3.4.1.16	Protect surrounding rural views behind ridgelines, distance views to the City and regional landscape features.
Policy 3.4.1.16d	Provide for lower density development (lot sizes of 1000m²+) in areas of undulating topography.

The established strategic framework for Peacocke places a clear emphasis on providing for residential development while ensuring that development is sensitive to the natural landscape. Essentially, this creates a bottom line for residential development and limits what can be done. For example, the identified suburban centre is couched within the Terrace Area. While generic references to higher densities and mixed uses made within policy, there is limited translation of this into rules and strong wording of policy using words like 'require' and 'avoid'. These limits extend to which increased densities and true mixed uses can be achieved. The supporting Structure Plan provides a clear summary of the desired outcomes from implementing this approach:

"create neighbourhood cells that are distinct from each other and follow a logical and well-crafted pattern. The purpose of the structure plan is to provide an overall vision and promote certain outcomes, that can then be used by individual developers when designing their subdivisions and through master planning of key areas, so that the components can contribute to the overall urban form. This is about how urban development responds to the natural and historical characteristics of the area in terms of being creative with urban form and avoiding a blanket approach to residential development".

#### Greenfield Development Process

Subdivision in the Peacocke Character Zone, where lots created are less than 2ha in the Terrace Area and less than 5000m<sup>2</sup>, in the Gully and Hill areas requires an accompanying Master Plan otherwise a non-complying activity status applies. The Master Plan approval process is assessed as a discretionary activity.

Page | 94

<sup>17</sup> Peacocke Structure 2007, Hamilton City Council



Master Plans are subject to specific information requirements contained in Appendix 1.2.2.3 of the Operative Plan and must be prepared for the entire structure plan neighbourhood. Importantly, this requires the master plan to identify the location of commercial activities as well as residential densities, the urban from of the neighbourhood for which the master plan is prepared.

Land use consents can be bundled within the Master Plan approval process, otherwise they can be assessed for the individual development of a site within the Master Plan area at a later stage. The activity status for the relevant residential land use activities forming part of the Master Plan are outlined in Table 9-4 below.

Table 9-4: Residential Activity Status in Master Plan approval.

Residential Activity	Activity Status	
Single Dwelling: first residential unit per site	Permitted	
Single dwelling: second and subsequent residential units per site	Discretionary	
Apartments	Discretionary	
Duplex dwellings	Discretionary	

#### **Evaluation of Master Plans and Resource Consents**

Currently, the Operative Plan allows for three evaluative tools to be employed within the Master Plan approval process and any subsequent land use consent:

- General Standards for Peacocke Character Zone,
- · Residential Design Guide, and
- Assessment Criteria.

Generic guidance is provided within the Residential Design Guide for developments within the Peacocke Character Zone for developments providing apartments, papakaianga, duplexes, three or more single dwellings per site and integrated residential development.

There is policy support for the design guide; new development in the Peacocke Structure Plan area should demonstrate consistency with the urban design guide for the development (Policy 5.2.1f). However, in our opinion, the wording of this policy is not strong and the design guide has not been effectively integrated into the rule framework, which may limit the effectiveness of securing positive urban design outcomes. Assessment criteria are included within the Plan that can be used as guidance for discretionary and non-complying activities. The assessment criteria include specific reference to the design and layout of development within a structure plan area and enable the consistency of the development to be evaluated against the Structure Plan and whether it could prejudice or foreclose options for future urban development (Appendix 1.3.3 (B17)). There is, however, no guidance as to the translation of the structure plan into subdivision design or urban form. Rather, the approach is to detail the specific information requirements for a masterplan (particularly the detailed development response) and rely on the developer to translate the structure plan into the master plan.

Page | 95





A number of General Standards are established for the Peacocke Character Zone that are used as a guide to assess any Master Plan(s), and as standards after a Master Plan has been approved. Established standards vary between the Character Areas in accordance with the desired outcomes for those areas. The Terrace Area and parts of the Hill Area provide for increased density supported through more permissive bulk and location standards while lower density patterns of greenfield development. No average minimum or average site areas are prescribed, and with the exception of 800m² for Hill Area (slope less than 5 degrees), no maximum allotment sizes are included. These are summarised in Table 9-5 and Table 9-6 below.

Table 9-5: Peacocke Character Zone Minimum site areas

Activity	Terrace Area	Hill Area (Slope Less than 5 Degrees)	Hill Area (Slope greater than 5 Degrees)	Gully Area
Single dwellings	400 m <sup>2</sup>	400 m <sup>2</sup>	800m <sup>2</sup>	800m <sup>2</sup>
Duplex dwellings	200m² (400m² per Duplex)	200m² (400m² per Duplex)	-	~
Single dwellings with an ancillary residential unit (*total area for both dwelling and ancillary residential unit)	*435m² (net site area)	*600m² per unit	*800m² per unit	*800m <sup>2</sup> per unit
		Shape Factor		
All dwellings	15m diameter circle			

Importantly, we note that for the Peacocke Character Zone there are currently no provisions and supporting guidance for integrated residential development activities that have been included for other residential zones. If land use consent for more comprehensive patterns of development are not sought at masterplan stage, there is a gap in the current ability of the Plan to enable or encourage comprehensive development after the master plan. This could potentially impact upon the delivery of master plans that identify super lots or blocks for development at a future stage and reduce the expected yields from those areas.

Page | 96





Table 9-6: Bulk and location standards for the Peacocke Character Zone

Zone	Terrace Area	Hill Area (Slope <5 Degrees)	Hill Area (Slope>5 Degrees)	Gully Area
Site Coverage %	40 Detached Dwelling 50% Apartments	40%	35%	35%
Permeability across entire site	20	35	40	40
Permeability of front setback excluding vehicle and access provisions	100	100	100	100
Building Height	12m (12.5m for rear sites)	10m	10m	10m
Height in relation to boundary	Measured at point 3m above ground at an angle of:  28 degrees between northeast and northwest  45 degrees in all other directions			
Building Setbacks	From Road: 3m Side and rear boundaries: 1.5m			
Interface between public and Private				
Residential Buildings on Same site	3m from nearest part of any other residential building Not required for shared walls Where windows are located to avoid views: 1.5m			
Outdoor living space	60m² per unit			

## Medium Density Residential Zone

The application of the Medium Density Residential Zone (MDRZ) with other greenfield areas within Hamilton requires assessment due to the parallels with Peacocke. This zone has been implemented to provide opportunities for comprehensive planning of greenfield areas to facilitate medium density housing. Any strategic options assessment must consider the tools that have already been exercised.

The MDRZ has been applied to greenfield areas that have established structure plans. The main considerations with the MDRZ is in division of the areas subject to this zone into a number of comprehensive development plan areas and specifying target residential unit yields for those areas. The MDRZ requires the preparation and approval of a CPD prior to any development occurring in that zone. The information requirements for CPD's are prescribed within Appendix 1.2.2.8 of the Plan, and includes:

- i. Staging,
- ii. Main block pattern,
- iii. Roads and access ways,
- iv. Stormwater solutions,
- v. Reserves,
- vi. Bulk and location of buildings,

Page | 97





- Demonstrating land use patterns and alignment with structure plan, assessment criteria and urban design guides, and zone standards,
- viii. How the development integrates with infrastructure, and
- ix. Site development patterns that illustrate the activity types, building footprints, number of residential unites proposed, typologies, and how the target yields are to be met.

The implementation of the MDRZ incorporates a number of elements that have been identified in the case study assessments. The first of which is in requiring comprehensive development that links land use and subdivision consents. This enables the resultant housing typologies to be considered as part of the consenting process and generally provides for more intensive forms of development. Subdivision alone is unlikely to achieve duplex, terraces, or apartments as it is difficult to enable these as permitted activities through enabling performance standards. The comprehensive development process also enables the consideration of Identified target housing yields for entire greenfield areas and on a smaller block scale (e.g. Te Awa Lakes) and how these targets are to be met through the development process. This is a significant strength of MDRZ as it establishes a bottom line for the evaluation of the comprehensive development consents. While a focus on yields can come at the cost of urban design outcomes, the yields are supported by:

- Specific policies for individual greenfield areas (e.g. Te Awa Lakes Medium Density Residential Zone) that promotes medium density in conjunction with high amenity and multi modal transport that gives effect to the objectives and policies of the relevant Structure Plan.
- Provides support through rules and policy for establishment of mixed-use node within a specified area (Ruakura Integrated Retail Development)
- Zone specific design guidelines to be used as assessment criteria for comprehensive development plans.

While several strengths can be identified within the implementation of the MDRZ, a number of weaknesses can also be identified when considering achieving density and diversity in greenfield areas. The first weakness is the absence of incorporating desired or possible housing typologies within the planning framework for these areas. While still a strength, the focus on density and target yields comes at the expense of housing diversity. The target density (16 dwellings a hectare) and requirements on yields lends itself to the delivery of standard detached dwellings on smaller sections. This could be compounded by the design guidelines for the MDRZ providing largely bulk and location requirements for the entire zone that do not provide guidance as to achieving housing typology diversity. While this is not necessarily a criticism of the implementation for this zone, it does limit the transferability of the MDRZ to Peacocke without solid retrofitting to achieve the purpose and required outcomes for that area. If land use and subdivision are to be considered together then this does not provide certainty to developers as to what is expected and increases the regulatory discretion required for achieving good quality development.

Page | 98





# 9.3 Conclusion

The review of the current strategic planning framework for Peacocke has shown that, at the time of formulation, the intent of the zone was on the conservation of the natural landscape values of the area. Higher residential densities are unlikely to be realised when this is the priority within the framework. While the Structure Plan does contain a vision for higher densities around key amenity nodes and a mix of land uses, there is a disconnect between that and the translation into the rule framework for the underlying zone. The current approach to managing greenfield development is a hybrid of options, including the bespoke zoning (Peacocke Character Zone) and the delivery of this zone through a developer led Master Plan. The emphasis of implementation of a detailed design at the developer level is typical for greenfield development that promotes suburbia. Any Master Plan that is prepared within this environment will largely reflect this and deliver a continuation of established patterns of greenfield development that are provided for within the rule standards. There is a 'ready built' option available for Peacocke in the Medium Density Residential Zone, however this is not without shortcomings. Peacocke has a number of unique constraints presented with the gully network and areas of high value, and the landscape approach clearly has been formulated to reflect them. Protection for these areas and intensive residential development are not mutually exclusive and can be achieved through a framework that enables the delivery of high quality urban development.

Page | 99





# 10 Peacocke Analysis

Following the review of current strategic planning approach in the above assessment, this section considers from an urban design perspective what has been delivered, and what are the missed opportunities in terms of what could have been delivered based on the existing structure plan and planning framework. This allows for careful consideration of what should be provided under a revised structure plan and framework. As development has already been realised at Amberfield, there is an evident understanding of how the existing provisions have shaped development already.

## 10.1 Greenfield development in Peacocke to date

The character areas of the Structure Plan are largely based on topography which creates significant constraints in this part of Hamilton. This leads to a different approach to each character area based on its ability to absorb development whilst retaining the character and ecological/environmental conditions. In general, the terraces and hills are the easiest to develop. With the gully area the most sensitive.

The design guidelines within the Structure Plan appear to be too basic to guide development that would significantly enhance the character of these distinct areas. The densities also appear to be inappropriate and open to interpretation by the land developer. This is because, as the planning assessment has shown, the rules concentrate on lot size rather than net density. Therefore, the plan would anticipate lots of 800-1,000m² to preserve an environment rather than increasing open space in sensitive areas and increasing net density on developable areas. A dramatic change in the greenfield development paradigm is unlikely to be achieved where the focus in the planning framework remains on the preservation of the natural characteristics of that area. The rule structure as it currently stands is likely to continue the status quo.

The Structure Plan fails to address or reinforce higher density neighbourhoods based around neighbourhood centres and a public transport route. The character areas, which are landscape based, appear to drive the urban outcome rather than develop the correct urban response to the landscape and road network. There also appears to be a missing component when it comes to locating key activity centres, neighbourhood centres, and specialist centres.

A first tranche of development has been consented within Peacocke. This is significant for the entire Peacocke area in that:

- It occupies a prime riverfront area;
- It is in the terrace character area, which is suitable for higher density development;
- It was allocated a suburban centre;
- It has access to the river and potential ferry stop;
- . It has two local arterial roads converging with potential of public transport; and
- Is connected by a good cycling network to the city centre.

The development in its consented form has not delivered upon a suburban neighbourhood centre (yet), ferry wharf, diversity of housing stock or density. It is important to acknowledge that the first tranche will deliver a density (18 dwellings per hectare) that is above the target density (16 dwellings per hectare) that is articulated within the planning framework for the area. However, it is important to consider that the

Page | 100





remainder of Peacocke has large areas have constraints that will prevent higher density greenfield development.

This development has delivered upon the vision for Peacocke as it was articulated within District Plan and the Peacocke Character Zone. While the Structure Plan establishes a broader vision for higher densities in areas that can accommodate them (the Terrace Area), the result has been a mix of large section sizes (60% of sections are larger than 500m²) that will provide for predominantly single storey, detached dwellings. An important implication for the consenting of a master plan over such a large area is that the subdivision design reflects current development option feasibility. While this development will use a staged approach, there is limited variability within the lot sizes that have been consented from the first stages to the latter stages. Without a variation to the consent, large scale changes to the subdivision design in response to changing feasibility will be difficult.

Rather than provide a detailed design of the suburban centre at this stage, a super blocks have been identified around the suburban centre. While this makes commercial sense now as the M.E analysis has shown that these development options are not currently feasible, there is little certainty as to what will be delivered in the future. Under the current District Plan and without encumbrances on the titles of those lots requiring density targets, there is very limited control over whether higher densities will actually be realised from these super blocks. A further consideration is in the hard interface between the dominant 'Suburban design' and these super blocks, particularly on the northern end. Much of this area is still within the pedestrian catchment for the suburban centre and potential public transportation routes.

Additional medium density lots for duplex dwellings (~200m²) have been identified close to the suburban centre, however with the excess of open space through the area these could have been more widely distributed throughout the subdivision area. An important feature of these medium density lots has been the incorporation of rear access to improve the streetscape. This indicates that attempts at implementing good urban design principles were made, however, were largely buried beneath the commercial desire to deliver upon current buyer expectations and market demand. The key implication of this development is that it is underdelivered on housing density and diversity. This may have compromised the ability of Peacocke to cater for further residential growth and increased typologies through the removal of land by way of delivering conventional subdivision i.e. largely 3+ bedroom detached houses which do not reflect the intent of the Structure Plan or the consultation process. It is sprawling suburbia set within an excess of open space making it even more sprawling. This is not urban design led. It is obvious through the subdivision of that the vision and intent to deliver higher densities within Peacocke area cannot be enforced using the mechanisms within the existing District Plan. The densities are too low and based on:

- site size.
- the character areas have only generic design guidelines, and
- · the activities expected (Key suburban Centre and diverse housing stock) are not enforceable.

# 10.2 Missed Opportunities

On review of the developments within several of the 'Terrace' neighbourhood areas, the following key lessons are outlined as a result of missed opportunities:

Page | 101





- There needs to be more emphasis on diverse typologies clustering development into higher net development areas within the character landscapes.
- The amenity of the riverfront terraces are other high amenity value natural areas are attributes that can be used to lift density and variety of housing types by tapping into demand considerations.
- Access to the river is paramount, it is the greatest asset for the Peacocke greenfield area. Access
  along the river by walking and cycling, access to leisure on the river, and to a ferry that could take
  residents to the city centre or even airport should be capitalised on in these scenarios.
- Furthermore, development intensity should be increased around neighbourhood centre areas by integrating mixed use typologies including apartments overlooking the river.
- The integration of rear lanes can also be utilised across the entire development rather than in small
  areas to increase density without destroying streetscape with garages.
- The use of rear lanes to deliver high quality streets that encourage walking, cycling and just spending time.
- The existing Structure Plan and District Plan are inadequate in delivering an outcome very different from conventional suburban subdivision.

Furthermore, the transport network has public transport absent from the Structure Plan. One of the drivers of higher density is access to amenity (open space, community, work, retail, and public transport). The new state highway effectively cuts through the Peacocke area, delivering through traffic to the city. There may be reasons why it did not join the existing State Highway earlier and reduce to a local collector. Given that this route is set in place, it is assumed that connections to this route will be limited until it splits at the north towards the city and the north-west of the city. Given that much of the State Highway also follows the gully there would be little point in running a public transport corridor along it. That leaves the local collectors (or minor arterials) as the potential public transport routes.

# 10.3 Strategic Planning Assessment

While both the Structure Plan and the District Plan establish the attractiveness of and desire for higher densities in areas of Peacocke, the evidence shows that this is not sufficient for realising a range of densities and housing typologies. It is clear that what has been delivered has largely been the desired outcome for this area, however there is a requirement for a substantial shift in greenfield development patterns if yield targets are going to be met. The M.E report provides a clear understanding as to what development options and densities are currently feasible and what will be feasible in the future. However, evidence from recent developments in Peacocke, as enabled under the current planning framework, show that the development options that are feasible are unlikely to be achieved, particularly as this relates to medium density development. The evaluation of the strategic planning framework within this report enables strengths and weaknesses of the current strategic planning framework to extracted. While it is acknowledged that HCC are aware of the limitations of this framework, it is important to undertake this exercise to inform the recommendations and options assessment that are presented in the following section. The strength, weakness and opportunities assessment is a method that enables the planning and urban design aspects previously presented in this report to be tied together in a digestible format. This is presented in Table 10-1 below.

Page | 102





Table 10-1: Strengths and weakness - Strategic planning framework for Peacocke:

#### Strengths

- The Vision and Objectives are well expressed and seek to deliver a more sustainable urban form that respects nature, landform and culture.
- The Structure Plan is based on landscape and topographical character and recognises the landscape and ecological sensitivities of the zone area.
- Promotes comprehensive neighbourhood scale approach to Master Planning to prevent ad-hoc development.
- Provides framework for encouraging different densities in different areas.
- Provides for duplex dwellings.

#### Weaknesses

- The District Plan does not reflect increased development densities. The policy framework places a clear emphasis on the preservation of the natural characteristics which has led to the delivery of status quo greenfield development.
- The character design guidelines are not as strong or directive as they could be and could have a stronger emphasis in the rule framework supporting the zone.
- Without showing public transport it is difficult to address density.
- Absence of comprehensive development requirements or opportunities.
- The neighbourhoods promoted through consented development shows that the developer driven master plan approach is not delivering diversity, mixed use centres or good urban outcomes.
- Limited provision for non-residential activities and mixed-use nodes. Lack of walkable neighbourhood centres and the area has now lost the opportunity to deliver a Key Activity Centre.
- Provides easier development option with permitted activity status for single dwelling per lot development in Master Plan process.
- If density is increased there are no rules to reduce impact of car on the streetscape.
- Lack of comprehensive planning relies on neighbourhood scale development to deliver on overarching vision.
- Urban design guidelines not implemented strongly in policy and rules.
- There is limited integration of subdivision to density and urban form.

#### Opportunities

- To address the Vision more directly in the Policy and rules.
- Strengthen the policy framework to provide explicit support for achieving higher densities and housing diversity (targeted towards maximising key activity nodes).
- Revisit the Design Guidelines so that they better articulate landscape character, and topography, dwelling typologies and densities expressed in the Vision and are better articulated within the statutory planning process.
- Create denser neighbourhoods based on Walking distance to public transport.
- There is opportunity to tighten up on density and subdivision rules to deliver better urban design outcomes through a new zoning framework and more prescriptive design guidelines.
- Need to revisit the mixed use and retail strategy.
- Need to link subdivision With typologies and design guidelines to get diversity, density and good urban design outcome through a comprehensive process.

Page | 103





# 11 Recommendations & Options

This chapter considers the conclusions made by Market Economics and the planning and urban design analysis undertaken in the above chapters, to formulate a variety of recommendations for Hamilton City Council. Several recommendations have been outlined below that seek to enable the feasible development options over the short, medium, and long-term while considering the strategic assessment objectives outlined in Section 6.2.

These recommendations have been framed as what needs to happen to enable the commercially feasible development options. These recommendations have been categorised into two parts. Firstly, general recommendations that are established from best practice review on how to deliver a range of densities and housing diversity in greenfield areas. The second part includes Peacocke specific recommendations.

## 11.1 Considerations Informing Recommendations

The assessment undertaken thus far has relied upon qualitative assessment of Peacocke and examples from other authorities in New Zealand. To provide further guidance as to the recommendations progressed in the following section, a review of literature was undertaken to ensure that they are informed by an understanding of how a strategic planning response can influence outcomes. The following points from this review have been considered:

Efforts to exert control or to manage greenfield development through planning are required to address market failures which in this case is the delivery of housing that, from an urban design and overall yield standpoint, has occurred in an undesirable manner. Any regulation that seeks to promote an outcome will accrue regulatory costs to the local authority and to the developer. Therefore, it is important to consider how and where these costs accrue prior to promoting a certain strategic planning response. No attempt has been made to quantify the cost of the recommendations below as this is out of scope and our expertise, however, good practice and section 32 of the Resource Management Act 1991 dictates that these must be considered.

Costs on Council's end are relatively easy to quantify in terms of time and resources of a particular policy response. However, it is in estimating the efficiency of these responses in terms of time spent vs the observable outcome that can be difficult, especially as the benefits of well managed development can take years to accrue before there are any observable positive benefits. The recommendations and suggested approach below have not attempted to make a judgement on efficiency, rather they are based on the resourcing required to implement.

Two types of costs from regulatory control can be identified for greenfield development: compliance costs and deadweight costs. Compliance costs are direct costs on individuals seeking to develop a greenfield site through a resource consent process. They are essentially the resource costs required to prepare the information for, and the processing of, resource consents. This also considers delay induced costs through public notification, further information requests, and hearings. Front end costs accrued through consenting

Page | 104

<sup>&</sup>lt;sup>18</sup> Understanding the Costs and Benefits of Planning Regulations: A guide for the Perplexed. Auckland City Council Technical Report 2016/018.





can directly influence a developer's decision to progress with development<sup>19</sup>. Deadweight costs are those that arise from limits on what individuals can do with greenfield sites (e.g. achieving typology mixes and design requirements for balconies or minimum floor areas) and through the uncertainty that arises from applying for resource consent.

Compliance and deadweight costs can be examined through the urban design and the regulatory discretion applied to evaluating resource consents. While (almost) universally acknowledged as a pre-requisite for ensuring public good from higher density developments, good urban design outcomes are difficult to achieve solely through blunt instruments such as built form standards. Planning frameworks that do not provide strong guidelines for progressing a development can lead to increased costs through the uncertainty and requirements for the redesign of development areas following feedback<sup>20</sup>. In theory, deadweight costs can be reduced through a highly prescriptive or codified planning framework that provides clear thresholds for whether a development can be supported from a policy standpoint. However, this can result in a high compliance costs early on for developers and potentially 'lock in' a development that cannot react to changing market conditions. Therefore, if a highly prescriptive approach is adopted it must be forward thinking and reflect feasible development options in the future. This is the value integrating the modelled commercially feasible development options within the strategic planning response for Peacocke.

Several other key considerations/assumptions have been made in the formulation of these recommendations that are important to communicate:

- These recommendations have been made based on the housing yields outlined within the business case for the HIF funding which forecast Peacocke to supply 3,750 dwellings over the next 10 years (through to 2029/30) and the aspirational target yield of 8,200 houses.
- Consented development will deliver approximately 800 dwellings and will absorb most/all of the
  available servicing infrastructure capacity. This is also an area identified in structure plan as
  having greatest potential for density and a key suburban centre.
- The supply of infrastructure to service Peacocke will introduce a "natural" staging/sequencing
  of development.
- Whilst District Plan provisions are important, development will still be shaped by demand and feasibility for residential typologies. However, if left to its own devices the building industry will deliver detached family housing regardless of demand for other typologies.
- The influence of the NPS-UD and the removal of minimum carparking requirements has not been expressly considered. It is assumed that market demand for off street parking and garaging will still be met by developers.
- Existing Medium Density Residential zoned greenfield areas in wider Hamilton have the capacity
  to meet a share of short-term demand for diversity of typology but there is little evidence that
  it is delivering different typologies in any quantity.

Page | 105

<sup>19</sup> Impacts of Planning Rules, Regulations, Uncertainty and Delay on Residential Property Development. Arthur Grimes and Iari Mitchell. Motu Working Paper 15-02

<sup>&</sup>lt;sup>201</sup> Impacts of Planning Rules, Regulations, Uncertainty and Delay on Residential Property Development. Arthur Grimes and Ian Mitchell. Motu Working Paper 15:02





The recommendations below will allow us to assess the 'best fit' of the options presented in the planning toolbox section and is presented in further detail in following sections.

### 11.2 Recommendations

A number of general recommendations are made below that have informed specific recommendations below.

### Overall

- The strategic planning approach for achieving quality greenfield development requires more than a
  permissive planning rule framework.
  - Develop a planning framework that allows for the assessment of greenfield development against the desired outcomes.

Examples of the successful delivery of medium density development has shown that there is a need for an urban design evaluation process that has the ability to assess proposed developments against a range of criteria, in a robust and defendable manner. The absence of good examples of medium density housing using this approach illustrates that it is difficult to develop rules or performance standards for a permissive rule framework that actually translates into quality greenfield development.

Experience has shown (and can be seen in Tauranga) that if loopholes are available within planning instruments, then good policy intentions will not be realised. Proposals must be subject to scrutiny and a policy framework exists that enable Council to maintain a position of strength within the "negotiations" for greenfield development.

b. Avoid a broad-brush zoning approach that seeks a single housing outcome.

A planning framework that enforces a range of housing typologies is critical to ensuring that they are provided in greenfield development. There also needs to be an additional layer of planning tools that Council and the developer can rely on to promote a subdivision pattern and built form outcome that delivers good urban design, architecture, and public realm design.

Tools such as the Structure Plan, Outline Development Plans, Master Plans, and Urban Design Guidelines are critical to guiding the development of mixed typologies. Generous planning provisions on their own may enable development, but without further tools guiding overall development and spatial planning of an area, whether it is big or small, development may otherwise occur lot by lot, resulting in uncoordinated, ad hoc pattern of intensification.

Quality medium density development requires mixed uses to be enabled to realise the full range of benefits available.

Overcoming negative perceptions of medium density housing will rely upon the market delivering a product that provides an acceptable level of public amenity. Medium density provides less private amenity for the household and is generally sacrificed for proximity to public amenity such as shops,

Page | 106





hospitality, leisure, open space and public transport. It is therefore paramount that these are offered and enabled within any strategic planning response to increasing housing densities and diversity.

Consultation that enables a developing understanding between council, landowners, stakeholder interests and developers is important to the successful implementation of higher densities and nodes/mixed uses.

Realising the opportunities for delivering the modelled commercially feasible development options will require a significant paradigm shift in the way current greenfield residential development is delivered. Encouraging developers to supply a product that they have limited experience in, to a market with little exposure to those products, requires buy in from multiple parties. This can only be achieved through a comprehensive consultation/collaborative process that will require education and negotiation on all sides.

 The availability of 'easier' development options in planning framework needs to be reconsidered to encourage increased density and housing diversity.

Lower density development options are superficially attractive to the existing building industry which is focused on house and land packages. The implications of this are that it can constrain the ability of greenfield areas to provide/deliver comprehensive development opportunities. The impact of this can be seen in the consented development which is located on the easiest developable area (the Terrace Area) and has only delivered a net dwelling density of 18 units per hectare. Higher density housing was weakly promoted within the policy framework, resulting in the delivery of the status quo as the easier outcome and the opportunity for increased densities has been lost. Large scale change is more likely to be achieved where it is less likely to be affected by fragmented patterns of ownership and development. However, this has not stopped the largest landholding in the area delivering a sub-optimum result in pursuit of short-term gain.

Attempts at providing for a comprehensive development option within areas earmarked for medium density in Tauranga (Papamoa Medium Rise Plan Area) were hamstrung by the availability of an easier, and in the short term more profitable, option to deliver independent dwellings at a significantly reduced yield than what was possible within that regulatory environment. If a strategic planning option is progressed that provides for a comprehensive development process to achieve density and diversity, other pathways for greenfield development that deliver on the status quo must be disincentivised or removed completely. These pathways must remain in certain areas over the short term due to commercial feasibility and market demand, however they should not be the default option moving forward. While any move to attach, for instance, a non-complying activity status on detached independent dwellings will be hugely unpopular within the development community, forums are available for education and consultation on the areas where these may still be progressed and those for which higher densities are required to ensure efficiency of infrastructure supply and land use within Peacocke.

Reduce consenting risk by Council lowering the risk of notification during the Resource Consent process where developers are following a desired process.

The risk of notification can be a significant barrier and hindrance for developers wanting to undertake large comprehensive developments in a greenfield area. Notification creates another layer of uncertainty and cost as it may draw attention away from the matters for which Council has reserved control or discretion. Increased risk and uncertainty will directly influence developers' decisions to

Page | 107





progress with more challenging models of development due to issues with financing. Precluding notification is one of the easiest ways in which Council can incentivise a development pathway provided that it is not *ultra vires*. In this regard, it may be necessary to only offer this in areas where there is a high degree of confidence that the effects of the proposal will be internalised and less than minor.

If a developer follows a desired planning process (for example, preparing a resource consent for a comprehensive development within the requirements of the ODP and/or Urban Design Guidelines), Council should consider precluding notification alongside a lowered activity status. Opposingly, if the developer does not intend meeting ODP requirements, a heightened activity status and subsequent risk of notification should be considered. Ultimately, this steers the developer to complying with Council's desired outcomes, whilst providing a level of certainty that they can achieve a resource consent in a low risk, time, and cost-efficient manner.

Additionally, developers may be more inclined to push for more innovative development plans which encourage a range of mixed typologies and uses, rather than what becomes immediately obvious as the 'path of least resistance'.

## Structure Plan

 Develop a strategy for consultation with landowners and developers to identify areas that will be promoted for comprehensive development and intensification through the Structure Plan refresh process.

Landownership in Peacocke is fragmented. The largest area within single ownership has already been consented for development. If the ley activity/mixed use node approach is to be implemented, it is likely that they may be located in an area with multiple owners. Consultation will be required to ensure that the location of activities and, if required, intensive design processes have buy in from all parties involved. The opportunity for promoting a land amalgamation policy could also be introduced. The consultation platform can also be used to educate the development industry and landowners of the viability and desirability of good density within the correct urban framework. This includes discussing the typology ranges and communicating the feasibility of development options. The case studies have shown that buy in or early adoption from a single developer or consortium can be a key factor for delivering on densities and diversity in housing typologies.

- 7. Revise the Peacocke Structure Plan through:
  - a. Identifying new areas suitable for key activity nodes and along local transit arterial routes and prepare guidelines for those areas that support the realisation of available intensification opportunities.

This recommendation means adopting the walkable neighbourhood approach to spatial planning. This will enable medium density residential development within a comprehensive mixed-use approach for development that promotes increased walkability to goods and services, public transport, and open spaces / recreational / leisure opportunities. This will mean a base minimum density of at least 20 dw/ha. With sufficient controls to assure diversity and good urban design outcomes.

Page | 108

**Hamilton** City Council



b. Supporting key activity nodes through a detailed design led process for the entire Peacocke Area.

Outcomes from the existing neighbourhood scale masterplan process have compromised the ability of the previously identified suburban centre to deliver the full range of benefits it could provide. The loss of this area and the benefits that could be provided therefore require a rethink of how these could be delivered in other areas in Peacocke.

While the likely densities realised (18 dw/ha) are above the minimum target set within the RPS, the Terrace areas supporting this development could have realised much higher densities. The implication of this is that higher densities may be pursued in areas that are less suited to support them. These can comprise the ability of Peacocke to provide a high quality, sustainable urban environment.

c. Undertaking a detailed urban design exercise that defines discrete spatial areas, block layouts and informed individual housing yield targets.

A core theme of the successful medium density examples has been the level or urban design that has happened prior to any development occurring. This has happened either at the plan change stage or as a comprehensive development plan. This enables an easily communicated vision for the development area that can then be pulled through into the policy framework that gives effect to the structure plan. Defining housing yields can often become mired in debating the benefits of one target over another. However, it is necessary in that it provides guidance to developers and for the implementation of increased density and diversity in housing typologies. Setting a target that is beyond the threshold for what can be achieved with standard greenfield development patterns can push developers to look at other housing typologies. This can then also be pulled through into a rule framework that can apply noncomplying activity status for those developments that do not current meet the yield targets.

### Plan Change

- Develop and deliver a policy and rule framework through the Plan Change that differentiates between areas that have been identified to:
  - a. Accommodate key activity nodes that contain complementary activities to promote a transit based focus to development

To be successful, medium density residential development needs to be comprehensively planned as part of 'mixed use' approach where a variety of different living, working and recreational activities are in proximity within a walkable neighbourhood. Neighbourhood centres should be within 400/500m walking distance from residential and a larger centre such as a Key Activity Centre can extend that walking distance to 800/1,000m. This gives a catchment of 50 hectares and 200 hectares. Neighbourhood, mixed use centres should include:

- Food outlet, cafés, restaurants and other shops;
- Public transport stop;
- Open space / recreational / leisure opportunities;
- Educational facilities (not necessarily any particular type);

Page | 109





- · Regular public transport on a direct route to City or other Key Activity Centre; and
- Some low level commercial activities (doctors, dentists, shared office space).
- b. Requires development to be undertaken in accordance with urban design guidelines implemented within the district plan that can be used to assist developers and decision makers. Urban Design guidelines should be developed to guide developers on a range of housing typologies and should form part of Council's regulatory decision-making process. Design guidelines need to be implemented and integrated within the district plan processes (i.e. a requirement to consider as part of any master plan, or resource consent matter of discretion when development does not comply with ODP). The guidelines should consider the typologies presented in Section 44 and the subdivision design that should be considered for the delivery of these. Guidelines should outline;
  - Site sizes:
  - Outline site dimensions that support various housing typologies,
  - Propose a mix of typologies,
  - Bulk and location of buildings,
  - Materiality of buildings,
  - · Private, semi-private and public space, and
  - Landscape and public realm.
- c. Provide strong policy framework that supports for proposal satisfying a range of criteria that:
  - Provides for Mixed uses;
  - · Achieves specified density or yield targets;
  - Meets a required target mix of housing typologies;
  - Innovative design to recognised standards;
  - Provision for alternative transport modes and density that supports that;
  - · High quality urban and architectural design;
  - Establishes density or yield targets for a spatial areas. E.g. Minimum of 20 households per hectare net for the entire with preference for a higher figure in specified areas, and
- 9. Provide for a Comprehensive Development consenting approach to greenfield development.

There is an implicit connection between land use and subdivision when it comes to achieving density and housing diversity. Achieving a desired built form outcome relies upon a lot or lot arrangements that can provide for a housing typology mix. Where medium density development has been achieved successfully in the case studies, subdivision been married to the resultant typologies. This is not to say that the exact architectural designs should be known prior to consenting, rather there should be a clear understanding of what style of residential development will be delivered in that location.

This is where the Comprehensive Development approach is an important tool for the delivery of a mix of housing typologies. As discussed previously in recommendation 4 the availability of easier development options needs to be reconsidered. The Comprehensive Development consenting approach can be an effective regulatory vehicle for removing these options. This approach does not need to preclude traditional patterns of greenfield development, as these can be delivered alongside present or future development that will deliver upon other typologies.

Page | 110

12 August 2021



Require the supply of identified super lots within subdivisions in the short term to ensure that a mix
of housing densities and typologies can be spread throughout Peacocke.

A key identified issue and objective for this assessment is in how the interplay between achieving housing density while accommodating development option feasibility can be achieved. This is especially important due to the need to meet short-term yield targets for Peacocke and avoiding mono housing supply in areas where infrastructure becomes available earlier. Our assessment has identified that supe lots or future development lots that are reserved within subdivisions for higher density housing typologies are an effective way of managing this trade off. Identified super lots can accommodate shortfalls in housing yields for subdivision in the short term that will not meet the required or identified density targets for that development area. It would be impractical and detrimental to require all development in the short term to meet those yield targets as developer resistance could mean that no housing is delivered in Peacocke over the short term.

Super lots or future development lots are a pragmatic solution for achieving yield targets through avoiding applying non-complying activity status to development that will meet short term demand and overall yield targets over the next 10 years. These allotments can be earmarked for more intensive forms of development when they become commercially feasible. The successful implementation of these is in how required densities will be met for these allotments. Encumbrances can be placed upon the title of these lots that require the development of the lot to achieve certain yields or densities. This approach has been used within the Residential New Neighbourhood Zone in the CC Plan and the Auckland Unitary Plan. The palatability of such an approach should be explored.

## 11.3 Analysis of Strategic Planning Options for Peacocke

The options presented in Section 9.1 above have been evaluated to identify a 'best fit' approach to realising the commercial feasible development options identified in the M.E Report. The following table (Table 11-1) considers the strengths and weaknesses of the planning toolbox options, in order to identify an effective implementation strategy for greenfield development in the Peacocke area.

Page | 111





Table 11-1: Strength and weakness assessment of the planning tools available for managing greenfield growth in Peacocke.

Option	Strength	Weakness
Bespoke Zoning and Precincts	<ul> <li>Can be used to manage areas within Peacocke to facilitate different densities and housing typologies/housing development options.</li> <li>Strong emphasis on spatial planning through requiring zone and precinct boundaries to be defined that will contribute to high amenity value/mixed use nodes being established. This recognises that not all areas of Peacocke can provide/are suitable for more intensive patterns of greenfield development.</li> <li>Enables the natural characteristics of Peacocke to be accommodated.</li> <li>Can enable comprehensive planning of high value areas that will prevent ad-hoc development that ultimately reduces the potential yield and opportunities for the establishment of high density residential.</li> <li>Enables specific policy framework to be prepared for these areas that supports the desired outcome for these areas</li> <li>Zoning/precincts can be developed that target/enable the delivery of housing that meets the forecast feasible development options.</li> <li>Provides for standards/design guidelines to be developed for areas that can be used to exclude current greenfield development patterns</li> <li>Implementation through plan change process will enable consultation and engage developers/landowners early</li> <li>This is an agile approach that can easily allow for other tools to be integrated into this response and applied where they are appropriate.</li> </ul>	<ul> <li>Resource intensive to develop policy framework for each zone.</li> <li>Effective implementation relies on robust policy framework and activity status that enables Council to decline development that does not deliver desired outcomes.</li> <li>Potential for rules and framework to be watered down through plan change process.</li> <li>Requires a comprehensive consultation to legitimise what the 'desired' outcomes are intended for the area.</li> <li>Difficult to achieve consensus when there are multiple landowners.</li> </ul>
Apply existing Medium Density Residential Zone	<ul> <li>Creates a greater level of consistency across the district and certainty for developers on how rules/applications are assessed.</li> <li>Established and tested policy framework that can employ existing assessment criteria for design, layout, character, and amenity for residential development</li> <li>Greater certainty on what the existing zone provisions currently deliver and how it would therefore shape new greenfield development areas.</li> <li>Existing Medium Density Residential Zone provides for design assessment criteria and comprehensive development plan process.</li> </ul>	<ul> <li>Danger that if the existing zone provisions are not 'well tested' and are inappropriate for the scale of greenfield development in Peacocke, the desired housing supply and typologies and built form will not be delivered.</li> <li>Medium Density Zone provides for a very limited range of non-residential activities. Would not effectively provide for mixed uses around any activity nodes, so the zoning response would need be wider than just a Medium Density Zone response.</li> </ul>

Page | 112





Option	Strength	Weakness
	<ul> <li>Duplex, apartment, and single dwellings all have the same activity status within comprehensive development plan process.</li> <li>Easy to transition through plan change process with limited resource required compared to creating new provisions.</li> </ul>	<ul> <li>Suitability of existing zone has not been evaluated since implementation. Insufficient evidence to support the effectiveness of this response for Peacocke.</li> <li>Emphasis on total yield from greenfield areas subject to this zone are not supported by strong urban design guidelines.</li> <li>There is little evidence of this delivering different outcomes from normal conventional development.</li> </ul>
Outline Development Plans and the Resource Consent Process	<ul> <li>Allows Council to guide high level design process prior to rollout of development in greenfield areas.</li> <li>Could be used as a tool to design and implement key activity areas with a high level of transparency for developers as to where specific residential typologies of different densities should be focussed (as well as other mixed uses i.e. commercial, educational).</li> <li>Allows a natural 'staging' approach to be enabled, by having staged areas within the ODP which can deliver the most in-demand housing typology (i.e., 3+ bedroom detached dwelling over short term), whilst setting aside key activity areas for when area is more established.</li> <li>Allows Council to manage 'complimentary activities' i.e. the location of key transport hubs, ensuring walkability of less than 800m to mixed use activities (i.e. commercial, educational, open space).</li> <li>Allows for further detailed design integration of good urban design principles such as green and blue lanes throughout the development (such as was achieved in the Halswell North area).</li> <li>Allows developers to prepare resource consent applications with a lowered activity status (i.e. controlled compared to restricted discretionary) if complying with the requirements of the ODP and therefore, creating an incentive for developers to follow Council strategy as well as making application process more attractive by providing greater investment certainty.</li> <li>Could promote 'comprehensive design' planning rules which require developers to undertake subdivision and land use under the same consent.</li> </ul>	<ul> <li>Resource intensive before greenfield development can commence.</li> <li>Require additional resource from Council compared to a developer led master plan process.</li> <li>Halts development from occurring until ODP has been approved and implemented within District Plan.</li> <li>Often relies on 'comprehensive development' provisions which can be onerous for developers.</li> <li>Is only as strong as the rules that control subdivision application.</li> </ul>
Future Urban and	<ul> <li>Sensitive to the changing commercial feasibility of land through time and the changing demand over the medium to long terms.</li> </ul>	<ul> <li>Could artificially constrain land supply and harm overall housing affordability in the long term.</li> </ul>

Page | 113





Option	Strength	Weakness
Transition Zoning	<ul> <li>Could contribute to limiting the cherry picking of easy developments that meet the short to early medium-term demand but overall harm the delivery of an integrated neighbourhood.</li> <li>Controls land scarcity to increase commercial feasibility of higher densities to meet the demand in the short to medium term.</li> <li>Increasing land scarcity could encourage developers to explore higher density development options with marginal feasibility over the short and early medium term.</li> <li>Integrates well with the overall timing of infrastructure supply across Peacocke.</li> </ul>	<ul> <li>Does not address or provide policy response for encouraging greenfield development with increased density and housing diversity.</li> <li>Relies on market response to deliver diversity which is subject to external influences and the unavailability of easier greenfield development options with urban boundary of HCC.</li> </ul>
Master Planning	<ul> <li>Developer led and therefore not cumbersome on Council in terms of resources but also timeframes compared to ODP approach.</li> <li>Enables early design review and tailoring of master plan to deliver on desired housing density and diversity.</li> <li>Requires developer to provide high-level detail around housing typologies, design, and implementation therefore providing greater certainty on meeting housing requirements.</li> <li>Promotes coordinated development across a whole neighbourhood rather than ad hoc development of individuals sites/areas.</li> </ul>	<ul> <li>Developer led exercise.</li> <li>Most often for subdivision only so control extends to lot size and arrangement.</li> <li>Land use consent can still be obtained for single storey dwelling.</li> <li>Requires robust policy framework for evaluation of masterplan and to provide leverage to request change.</li> <li>Has not worked effectively as shown by Amberfield development.</li> </ul>
Design Guidelines	<ul> <li>Provides strong evaluation tool for Council within the resource consent process that goes beyond standards within the plan.</li> <li>Can be tailored for specific areas and zones.</li> <li>Additional level of control that can have more subtlety than exact rules.</li> <li>Can be used in the education or raising the awareness of development options for developers.</li> </ul>	<ul> <li>If not integrated within the district plan often ineffective. Evidence has shown that if implemented at a non-statutory level they cannot be considered an effective tool.</li> <li>Needs to be accompanied by an ODP to be successful.</li> </ul>

Page | 114

12 August 2021





# 12 Recommended Approach

As evidence from multiple local authorities in New Zealand shows, relying on the market to deliver housing can compromise the sustainable use of land, infrastructure and deliver sub-optimum housing and community outcomes. The M.E report is invaluable to the options assessment for encouraging greenfield developers to deliver increased densities and housing diversity in Peacocke. What is clear is that increased density requires better and walkable amenity, enhanced design, public transport and quality public realm. This section and the recommended approach provide for a 'where to next' for Hamilton City Council within the Plan Change process that has been informed by our assessment of the considerations and options for increasing density and housing typologies within Peacocke. The recommended approach has been shaped by the core assessment objectives and how these relate to the overall aim of the options assessment:

- 1. How can short term demand for existing patterns of greenfield development be provided for in a way that will not undermine the future supply of higher density housing development options?
- 2. How can HCC deliver diverse housing typologies over the medium to long term when they become commercially feasible?
- 3. How can a strategic planning framework enable increased density while maintaining a high-quality built environment?
- 4. What needs to be considered for establishing high amenity nodes to support higher density typologies?

Hamilton City Council has a number of options to facilitate greenfield residential development in Peacocke that achieves the key considerations and recommendations from the planning and urban design assessment. What is clear from this assessment is that a detailed design led process is required to achieve increased density and housing diversity. This establishes the overall vision for Peacocke and is not dissimilar to the approach of the current Structure Plan. However, the emphasis within this vision is required to be on increasing housing density and diversity in the Peacocke area that do not adversely impact upon the areas important natural and ecological values of the Peacocke receiving environment. Stronger policies are required to deliver diversity, density and good urban- and environmental outcomes. This can then be used to inform the creation of a policy and rule framework that can be relied upon to deliver, for example, attached terraced housing at 25-30 dwellings a hectare (net) within the decision-making process.

From the strengths and weaknesses assessment, each available tool has limitations. However, they need not be used in isolation and can be deployed together as complementary pieces. Therefore, the following section provides a recommendation on a mixed or 'hybrid' approach which combines the key strengths and reflects best practice as identified within the National Planning Standards. A broad-brush response to greenfield development issues that applies to the entire Peacocke area will not address the opportunities and constraints that exist within Peacocke. The solution therefore lies within layers of implementation of the strategic vision for Peacocke and the spatial scale and location at which these layers apply (Figure 12-1, see the above numbers items). The use of Structure Plan, Zone, and then Precincts enables differential outcomes to be outlined within the planning framework and enables the appropriate tools to be applied where they are necessary to achieve those outcomes. This approach forms the basis of our recommended approach below that explores what is required to deliver on the recommendations provided, the tools that should be used, and how these tools deliver upon those recommendations. We believe this could provide an overall implementation strategy for Hamilton City Council and the applicability/efficiency of the tools

Page | 115

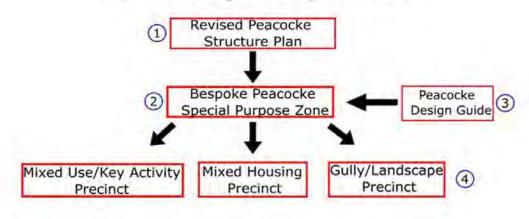




and recommendations under should either form the basis of Council's evaluation or strongly influence the response that is progressed.

Figure 12-1: Recommended strategic planning approach

## Peacocke Strategic Planning Framework



#### Peacocke Structure Plan (Revisit through Plan Change)

Updated Peacocke Structure Plan advanced by a Plan Change process which would be prepared as a detailed design exercise and provide the overarching vision for Peacocke. The detailed design exercise would break down the block layout and anticipated land uses for the entire Peacocke Area and outline expected yields either from those blocks or from broader development areas. The method for the delivery of those yields would be managed through the layers below the Structure Plan (Zone and Precincts). Importantly, the design exercise could account for fragmented land ownership in defining the spatial boundaries.

This exercise would identify the key nodes and transit arterial routes and provide an indicative block layout and open space networks. As discussed in further detail below, this would also include defining the spatial boundaries for the various precincts that will manage the greenfield development.

Undertaking a detailed design exercise for the entire area represents a significant resource cost for Council, however, we consider that in order to achieve a robust platform to underpin the future plan process, it is a necessary expense. This will provide greater certainty to developers and Council as to the outcomes that can be expected from these areas and importantly, ensure that the natural character and ecological values contained within the Peacocke area can be safeguarded. Undertaking the design of these areas at this level then enables it to become a strong evaluative tool for consenting and avoids the potential for *ultra vires* provisions relating to activity status that currently exist.

No other option was considered as appropriate for achieving density and diversity in greenfield development. Experience has shown that a detailed design exercise needs to be undertaken and this is our

Page | 116





strong recommendation for achieving an effective and efficient, in a section 32 evaluative sense, approach to underpinning a future plan change process.

#### 'Peacocke Special Purpose Zone'

The implementation of a Structure Plan relies upon a Zoning response that is fit for purpose. This can be best demonstrated by the development of the Residential New Neighbourhood Zone for Halswell for the delivery of that structure plan. To achieve density and diversity in Peacocke, it is considered that a bespoke zoning approach should be employed. While this will come at a considerable cost, the trade-off between retrofitting an existing zone to deliver the revised structure plan and the potentially compromised outcomes that may result from that course of action should be considered in any evaluation of the costs and benefits involved. A Bespoke Peacocke Special Purpose Zone is also required to provide the basis for the Precinct style of regulatory response that is explored further below. Decision making within those precincts will rely on a policy framework that is commensurate to and sufficiently robust to aide in the delivery the outcomes envisioned for those precincts. If it is decided that Precincts should not be developed for all of Peacocke, the framework within this zone can then be employed to manage greenfield development outside of those precincts.

The Bespoke Peacocke Special Purpose Zone would be formulated with an objective and policy framework that gives effect to the vision outlined at the Structure Plan level. This can be loosely based upon the existing Peacocke Character Zone, however, as has been discussed, the approach of the existing zone is inappropriate for achieving the desired housing outcome for Peacocke. There are two main options for managing development activities within this Zone.

Option A is requiring an additional detailed design exercise to be progressed by the developer requiring resource consents to be applied for as comprehensive development activities. This can enable a simplified rule framework where this is, for instance, a restricted discretionary activity otherwise, a non-complying activity status will apply. A well established and clear assessment criteria will need to be established that includes meeting the target yields and achieving a typological mix. To simplify linking subdivision and land use, indicative housing typologies will be specified in the supporting urban design guidance that can be used by the developer. These would be informed by the established commercially feasible development options. This approach would also use the detailed design proposed within the revised structure plan as a test for whether the development is appropriate. This is needed to provide certainty to the developer as this represents a significant compliance (consenting) cost and should not be compounded by additional deadweight costs from uncertainty.

Option B is in the formulation of an enabling rule framework through technical standards surrounding initial subdivision site size, target lot size mixes, typology mixes, and technical urban design standards for lot layout, frontage, and amenity spaces. Breaches to these standards result in a progressively elevated rule framework that enables more regulatory discretion. Issues arise with the implementation of this option, as enabling approaches managing greenfield growth to achieve density and diversity can be mutually exclusive. Technical standards would need to be sufficiently robust to enable the feasible development options in the short term, while ensuring that higher densities can still be achieved. The resource required to develop this framework duplicates some of the work for the detailed design of the Structure Plan. The compliance costs associated with this approach are significant and could result in an increasingly complicated regulatory environment that may not achieve the desired outcomes. While this approach

Page | 117





could prevent ad-hoc development patterns, an easier development pathway would likely be found that may produce an undesirable outcome.

Option A is the preferred approach as variations of this is what has been shown to work in the past (e.g. Hobsonville Point and Halswell). Key features of this zone would be:

- Comprehensive Development Process required for either an entire development area defined in the Structure Plan or for a minimum site area eg. 10 hectares.
- Provides for super lots/future development lots for intensive development when it becomes
  feasible in the medium term to long term. These would require encumbrances on the allotment
  title that sets a specified density to ensure that shortfall in achieving minimum yield is met from
  this block
- Provides policy framework that is robust enough to apply non-complying activity status to comprehensive developments that do not meet the yield thresholds and for non-comprehensive development activities.
- Establish as matters of discretion or assessment criteria that require alignment with the Urban Design Guidelines and the Structure Plan.

The comprehensive development activities would establish that all subsequent subdivision and development in the underlying zones will be subject to a restricted discretionary resource consent process that allows for an urban design review as part of Council's discretion.

In development areas where multiple landowners are located, Council should look to promote integrated development responses across property boundaries linked through development agreements that sit outside the regulatory framework.

The creation of the Peacocke Special Purpose Zone has been assessed as appropriate for managing greenfield growth in this area. This zone has been assessed against the criteria for additional special purpose zones within the National Planning Standards below. Additional Special Purpose Zones must only be created when the proposed land use activities or anticipated outcomes for the additional zone are:

- Significant to the district, region or country: The creation of the special purpose zone is considered to be significant for the district and region due to the proportion of housing demand that this area will meet in the future and the consequences for housing affordability and loss of productive land if yields are not realised in this area.
- 2. Are impractical to be managed through another zone: As detailed above, the other available zones (particularly the Medium Density Residential Zone) are unlikely to achieve the desired outcomes of a revised Structure Plan for Peacocke. The policy and rule frameworks for existing zones would require significant retrofitting to achieve the density and diversity in Peacocke. This would have consequences for the accessibility, readability, and legibility of the overall Plan. A robust and bespoke policy framework is required to simplify the process for developers and Council.
- Are impractical to be managed through a combination of spatial layers: Further spatial tools
  are proposed to be applied below the zone. As a high-level design tool, the Structure Plan
  requires translation into a policy framework prior to spatial layers being applied to give effect
  to the Structure Plan Vision.

Page | 118





#### Design Guide

A comprehensive design guide underpins the delivery of the Precincts outlined below as it informs the development of and the evaluation of subsequent developments. The design guide is the essential interpretive tool between the commercially feasible development options identified by the ME report and what is required for the delivery of those development options. A comprehensive design guide is an essential element for the delivery of this Precinct approach as it provides a strong evaluative framework that be used to deliver a mix of housing typologies that achieve either the density targets or yield targets that are established for those Precincts. This can be seen in the case studies that were explored. The use of a typology matrix such as in The Buckley Comprehensive Development Plan clearly outlined what is required for the delivery of each typology and links these to the lot size and dimensions. It was an essential interpretive tool between the yield targets for those development areas and how they could be delivered.

It is essential that the design guide is incorporated as part of the regulatory response so should be referenced directly within the plan through its inclusion within the rule frameworks for each subsequent Precinct. This enables developments to be considered for consistency with the design guide. The contents of the design guide were outlined in recommendation 8b.

The design guide is developed so that it offers certainty to developers as to what is expected and how subsequent subdivision and development will be assessed which reduces the uncertainty with the development process. If the developer decides to deliver typologies that do not align with that guide and what is expected within that Precinct, then the costs incurred are the responsibility of the developer including an elevated consenting risk.

This preferred approach avoids the alternative response of codification of urban design which is a blunt instrument to be delivering the nuances of a successful greenfield development. The codification would require or imply that development that satisfies all standards could be undertaken as a permitted or controlled activity. Due to the difficulty in drafting standards it would be possible for an undesirable outcome to occur despite compliance with all those standards. This alternative response incurs significant costs in both preparation and the regulatory environment as it provides for a complex rule framework with little recourse for an agile application of regulatory discretion within development.

#### Precincts

Precincts are the appropriate spatial tool for Peacocke as they allow for character, intensity, development areas, and yields to be considered. This is where the differential outcomes for areas identified within the structure Plan would be implemented. Precincts are the recognised through the National Planning Standards as an appropriate spatial overlay method for achieving a modification in the outcomes from what an underlying zone would achieve. Precincts will be embedded within the Peacocke Special Purpose Zone and give effect to the policy framework. They are the simplest way of providing for key activity nodes and mixed uses. We recommend that the implementation of the following precincts be explored further:

- Mixed Use/Key Activity Precinct;
- Mixed Housing Precinct; and
- Gully/Landscape Protection Precinct.

It is important to identify the housing outcome envisioned for each precinct. The assessment of typologies provided in Section 44 has informed the development of the housing outcomes envision for each precinct.

Page | 119





Should this Precinct approach be advanced, we strongly recommend that Council should look to or assess the suitability of providing for the activities, typologies and tools within each Precinct:

- 1. Mixed Use/Key Activity Precincts are defined for the key activity centres and neighbourhood centres. These mixed-use precincts would contain the commercial, community and other complementary non-residential activities. The establishment of these precincts is the essential component for providing high amenity nodes to facilitate high density residential development. They would support higher densities of residential development (up to the feasible development option of a minimum of 40 dwellings for KAC). The policy and rule framework should be strong enough to exclude lower density development options from these areas to avoid comprising the potential yield from these zones. Required typology mixes could be established for these areas. The following typologies that were discussed in Section 44 would be envisioned within this Precinct:
  - Maisonette
  - Mixed Use Apartments
  - Walk Up Apartments
  - Narrow Terrace House
  - Attached Broad Terrace
  - Detached Townhouse

We strongly recommend that the implementation of the Mixed Use/Key Activity Precinct be explored by Hamilton City Council within the plan change process. This includes the consideration of the following tools that reflect the recommendations from this assessment for the delivery of these areas include:

- Enable commercial and community land uses in the short term on lots or development areas identified within the revised Structure Plan. Explore the application of lower activity status for these activities.
- Density or Yield Targets that achieve a minimum density of 40 dwellings a hectare net.
- Design Guide that reflects the subdivision design identified in Section 59 required to support the typologies identified above.
- Identify and reserve areas for apartment buildings.
- Specify typology mix targets for residential development, with typologies promulgated through the urban design guidelines as discussed above.
- Provide for Comprehensive Development Consents.
- · Exclusion of low density through application of non-complying activity status.
- Enabling ground floor retail for residential units.
- 2. Mixed Housing Precinct are defined to cater for a range of residential densities. Site sizes are defined that reflect the overlap of feasible development density options between standalone dwellings and attached typologies. Super lots/future development lots will be expected to be provided in subdivisions within this precinct to ensure a mix of typologies is spread through-out the area and cater for future housing opportunities above what are currently feasible. These should be located either alongside key transit routes or areas of high public amenity. This provision of super lots enables short term demand to be met while transitioning to higher densities through time. The policy and rule frameworks provide support for increasing required densities from

Page | 120





subdivision through time. The areas sit beyond the immediate walkable catchment of the neighbourhood (50 hectare) and KAC (200 hectare) centres but still well connected to encourage walking and cycling to these centres. The following typologies that were discussed in Section 44 would be envisioned within this Precinct:

- Attached Broad Terrace
- · Detached Townhouse
- Narrow Terrace House
- Maisonette
- Detached Dwelling.

We strongly recommend that the implementation of the Mixed Housing Precinct be explored by Hamilton City Council within the plan change process. This includes the consideration of the following tools that reflect the recommendations from this assessment for the delivery of these areas:

- Density or Yield Targets for that achieve a minimum density of 20 dwellings a hectare net.
- Design Guide that reflects the subdivision design identified in Section 59 required to support the identified typologies above.
- Specify typology mix targets for residential developments, with typologies promulgated through the urban design guidelines as discussed above
- · Require Comprehensive Development Consents.
- Provide or require super lots/future development lots to enable short term demand to be met.
- Exclusion of low-density development through application of non-complying activity status for those developments that do not meet yield or density targets.
- 3. Gully/Landscape Protection Precincts are defined that reflects the existing landscape sensitivities. Larger lot development is enabled where appropriate, but this zone is primarily for the formation of a reserve network and ecological corridor through Peacocke. Small more intense clusters may be appropriate to preserve larger areas of landscape.





# Appendix 1 Planning Toolbox Examples

## Bespoke Zone and Precincts: Porirua City Council – Plimmerton Farm Plan Change 18 special

The Plimmerton Farm Zone has been developed to provide a planning framework that reflects the constraints and opportunities that exist for growth within the Plimmerton Farm greenfield area. The development of a bespoke zone and precincts was the preferred approach due to the certainty that this approach offers for achieving high quality residential and urban development. The development of a bespoke zone has enabled new objectives and policies to be established, with the overarching objective for the entire zone to be achieving integrated development that increases housing supply and diversity through the implementation of the Plimmerton Precinct Plan. Further objectives and policies have been established that reflect the constraints.

The key to achieving the overarching objective Plimmerton Zone is in the implementation of the Plimmerton Precinct Plan which divides the zone into four precincts based upon their suitability for increased housing densities and diverse housing typologies. Each Precinct has objectives that outline the precincts purpose and expected character and amenity as shown in Table 1 below.

The precinct plan is then implemented through urban design policy and bulk and location rules that reflect the desired character and amenity. The implementation is also supported through the objectives and policies for subdivision in the Plimmerton Zone. All subdivision is required to result in allotments that give effect to the Precinct Plan<sup>22</sup> and the subdivision standards are established which further support the desired character and amenity. For example, subdivision within Precinct A does not have minimum lot sizes, nor does it prescribe a shape factor for multi-unit housing development.

The strength of this approach is in that it provides for high quality development in conjunction with the protection of extensive areas of high landscape, biodiversity, and visual amenity value. The site specific constraints were not catered for within the existing District Plan. This enables specific criteria to be established that can be used to drive a detailed analysis of development proposals to ensure that it is achieving the intended outcome of the Zone.

Page | 122

<sup>21</sup> Proposed Plan Change 18 Plimmerton Farm Section 32 Report, Porirua City Council, December 2019.

<sup>&</sup>lt;sup>22</sup> Policy SUB<sub>PC</sub>-P3 — Notified Plimmerton Farm Zone Chapter, Porirua City Council





Table 1: Plimmerton Farm Zone Precinct Plan Summary

Precinct	Precinct Purpose	Precinct Character and Amenity Values
Precinct A	Primarily provides for medium density residential activities.  Provides for range of non-residential activities that support the health and wellbeing of people and communities and are compatible with the character and amenity values of Precinct A.  To enable medium density residential activity, no minimum lot sizes are defined.	The scale, form and density of subdivision, use and development in Precinct A is characterised by:  1. A built form of predominantly two-storey and three-storey buildings, detached, semi-detached and terraced housing and low-rise apartments;  2. High quality urban design and residential amenity; and  3. An urban environment that is visually attractive, safe, easy to navigate and convenient to access.
Precinct B	1. Primarily provides for general residential activities; and 2. Provides for a range of non-residential activities that support the health and wellbeing of people and communities, and are compatible with the character and amenity values of Precinct B.	The scale, form and density of subdivision, use and development in Precinct B is characterised by:  1. A built form of single-storey and two-storey buildings;  2. A lesser density of buildings than anticipated in Precinct A;  3. Landscaping and trees, especially on street frontages and within road corridors; and  4. High quality urban design and residential amenity
Precinct C	Residential development is sensitively located in relation to identified natural and landscape features and in accordance with the Plimmerton Farm Precinct Plan.	This precinct is further divided into areas based on landscape sensitivity and enables a range of development types that reflect the character of the existing natural environment.
Precinct D	Precinct D is characterised by commercial, retail and residential activities in accordance with the Precinct D Plan, with associated employment opportunities.	Precinct D is safe and attractive with buildings that are well-designed, and where they adjoin another precinct, are of a compatible scale and proportion.

Page | 123





### Extending Existing Zoning (Auckland Unitary Plan): Whenuapai Structure Plan

Whenuapai has been identified by the Auckland Council as an area for accommodating future growth within the urban growth boundary and has had a structure plan prepared to inform greenfield development. Whenuapai is a semi-rural area located 23km northwest of Auckland's CBD. The Structure Plan area comprises approximately 1,500 hectares and is currently zoned Future Urban under the Auckland Unitary Plan.

The Structure Plan provides a housing yield target of between 8,100 and 10,700 dwellings and it also offers residential densities across different areas. These range from ranging from low to high yield areas. The implementation of the Whenuapai Structure Plan will rely upon a staged plan change approach that applies existing zoning under the Auckland Unitary Plan that aligns with the indicative land uses. *Plan Change 5*: Whenuapai Plan Change has targeted the southern section of the wider structure plan area which adjoins Hobsonville Point for rezoning where existing zone provisions are overlaid. The zones that are proposed to be applied include:

- Single House Zones,
- Mixed Housing Suburban Zones,
- · Mixed Housing Urban Zones,
- · Terrace Housing, and
- Apartment Buildings Zone.

A range of densities and variation of housing typologies are realised. For example, the Mixed Housing Urban Zone enables up to three dwellings per site as a permitted activity and bulk and location rules than support multi-unit residential development. Subdivision of parent sites greater than 1 hectare to support development in this zone establishes minimum, minimum average, and maximum average net site areas of 240m², 300m², and 360m² respectively.

This approach has the benefit of a utilising a well-tested planning framework for achieving the desired densities and typologies within a market that has significant demand for diverse housing typologies, and developers with extensive experience in delivering them,

### Future Urban Zoning: Dunedin City Council - Urban Land Transition Zoning

To accommodate future urban growth within the operational lifetime of the 2GP, the Dunedin City Council (DCC) applied a Residential Transition Overlay Zone (RTZ) which enables land to be transitioned to residential zoned land through the establishment of clear circumstances or triggers for this to occur. This zone enables landowners to apply for the transitional zoning to be removed if evidence can be supplied of:

- The estimated total residential capacity is less than 120% of the projected total residential demand in the RTZ residential capacity assessment mapped area over the next five years;
- 2. Infrastructure capacity is sufficient to support additional residential development, and
- An agreement between the DCC and the developer is in place for the method, timing, and funding of transportation infrastructure.

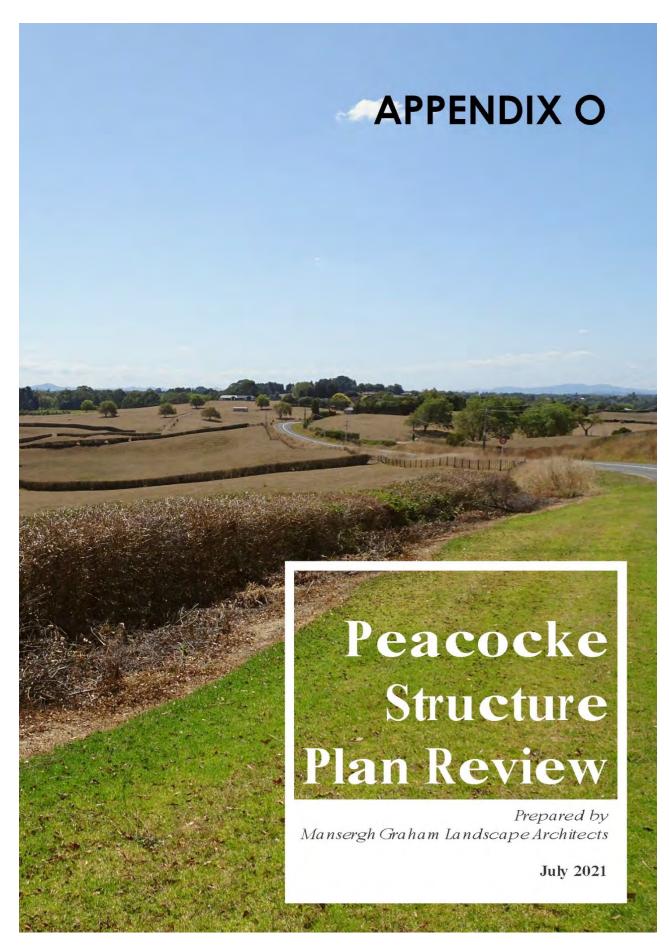
Page | 124





The application is required to also include a structure or development plan for that area that outlines at a minimum, the allotments, stages of development, and public infrastructure. This is to ensure that the ensuring subdivision and development will be in accordance with the objectives and policies of the specific future residential zone.







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.

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Report Version: R6 Date: July 2021



2 | Peacockes Structure Plan Review July 2021

Attachment 15

# Contents

Hamilton City Council
Te kaunihera o Kirikiriroa

L	Introduction	
9.	Introduction	7
2.	Methodology	7
3.	Typical Approach Guidance	8
n.	Site and Context	
1.	The Plan Change Area	10
2.	Landscape Character	10
	Landscape Cover	10
	Landform	12
3.	Further Information	13
	Geotechnical Hazards	13
	Significant Ecological Habitat	14
	Significant Ecological Habitats & Proposed Corridor Habitat	14
	Additional Infrastructure	16
	Distinct Spatial Pattern	16
4.	Operative District Plan	18
III.	Site Development Analysis	
1.	Permitted Rule Set and Anticipated Yield	19
	Preliminary Potential Yield	19
2.	Consented Developments	21
	Northview Development	21
	Amberfield Development	21
	Comparison of Average Lot Size	22
3.	Implications for the Structure Plan Area	24
	Benefits of Scale	24
	Topographical Challenges	24
	Grain of Development	25
4.	Potential for Increased Yield within the Structure Plan Area	25
	Intensification	25
	Rationalisation	27
	Remnant Rural Plantings	27
	Combined Approach	28

Peacockes Structure Plan Review July 2021 | 3

7
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V.	Urbanisation	
1.	Effects of Urbanisation on Landscape Character within the Structure Plan Area	29
	Landform with Overlying Residential Development	29
	Landform around Ecological Reserve Areas	30
	Guidances and Recommendations	31
2.	Retention of Natural Landform	31
	Guidance	31
	Recommendations	32
3.	Key Bat Habitats and Proposed Bat Corridors	34
	Guidance	34
	Recommendations	35
4.	Lighting Approach Within the Structure Plan Area	37
	Guidance	37
	Recommendations	38
5.	Residential Development adjacent to SNA's and Proposed Corridor Habitat	39
	Bat Buffers and Bat Corridors	39
	Rules	39
	Set Back Zone	39
	Rules	39
6.	Developed Structure Plan	43
V.	Conclusion	
	Further Information	47

4 Peacockes Structure Plan Review July 2021

Page 1442 Attachments



# 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 Inform ation

The further information considered as part of this report includes;

- 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;
- 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.

Peacockes Structure Plan Review July 2021 | 5



#### Ana lysis

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.

6 | Peacockes Structure Plan Review July 2021



#### Introduction I.

#### 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.

> Peacockes Structure Plan Review July 2021

## 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;

- 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).

Peacockes Structure Plan Review
July 2021



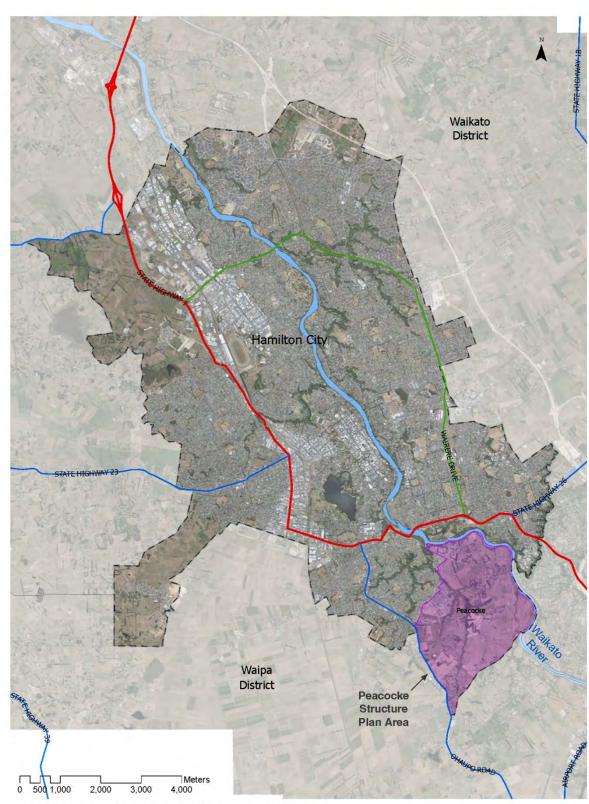


Figure 1. Location and context of Peacocke Structure Plan Area

Peacockes Structure Plan Review July 2021 9



# 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.



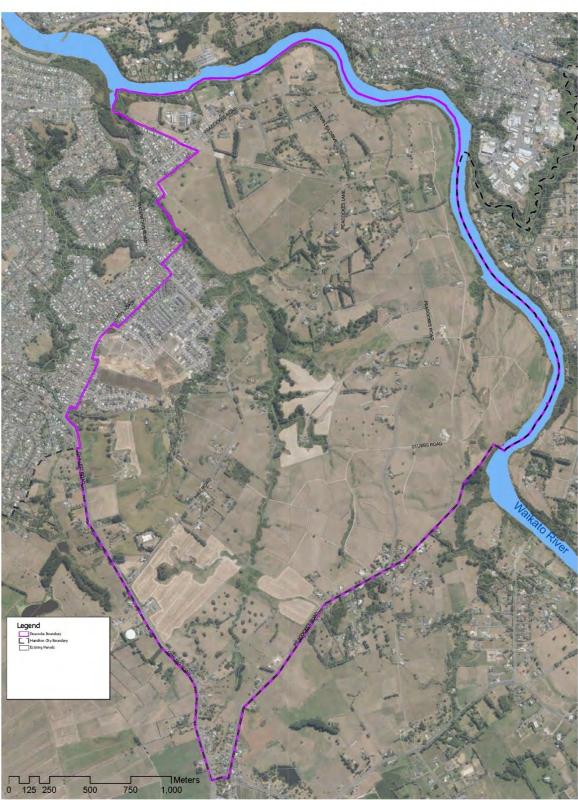


Figure 2. Aerial Photograph of Structure Plan Area showing existing land cover distribution.

Peacockes Structure Plan Review July 2021 | 11



## 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.

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.

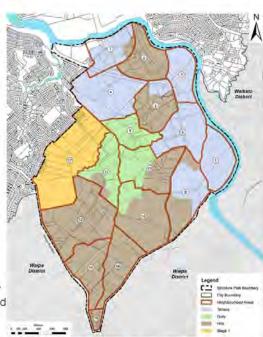


Figure 3; Peacocke Structure Plan - Character Areas and Neighbourhoods

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 Chapter 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.

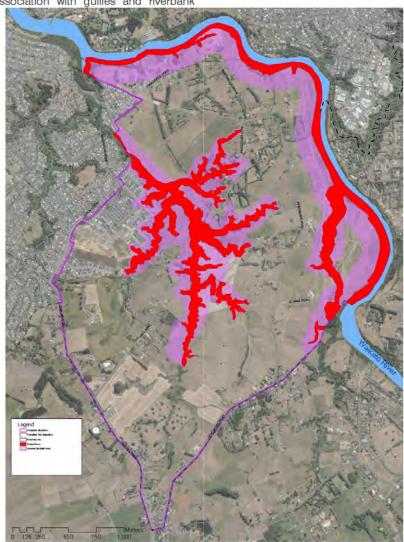


Figure 4; Geotechnical Hazard overlay shown in red. Seismic buffer area shown in pink. Development can occur within Seismic buffer area subject to engineering validation.

Peacockes Structure Plan Review July 2021 | 13



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 long-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.

14 Peacockes Structure Plan Review July 2021



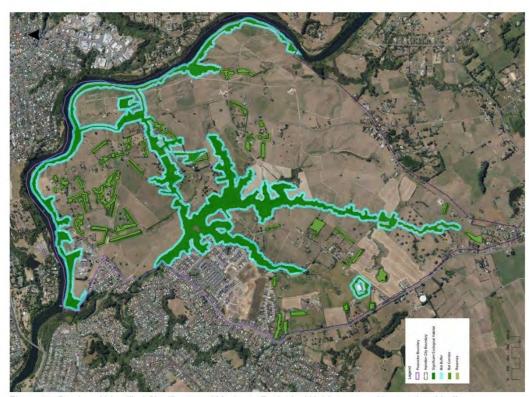


Figure 5a; Overlay of identified Significant and Moderate Ecological Habitat areas with associated buffer zones.

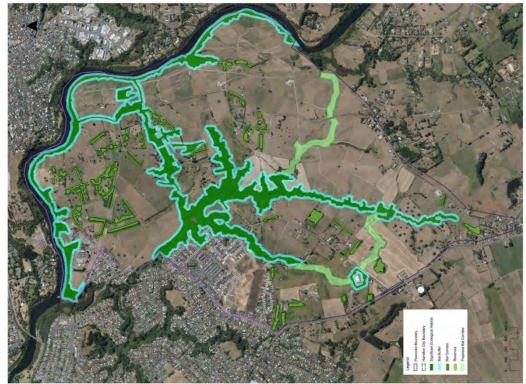


Figure 5b ;Overlay of *Proposed Habitat Corridor* creating continuous ecological corridors. *Proposed Habitat Corridor* shown with associated buffer zones.

Peacockes Structure Plan Review July 2021 | 15

## 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.

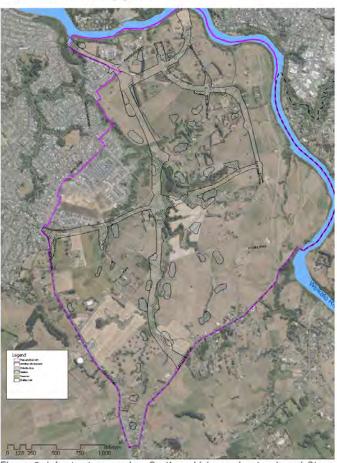


Figure 6; Infrastructure overlay. Southern Links road network and Storm Water Detention Areas.

## 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 Southern 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.

16 Peacockes Structure Plan Review
July 2021



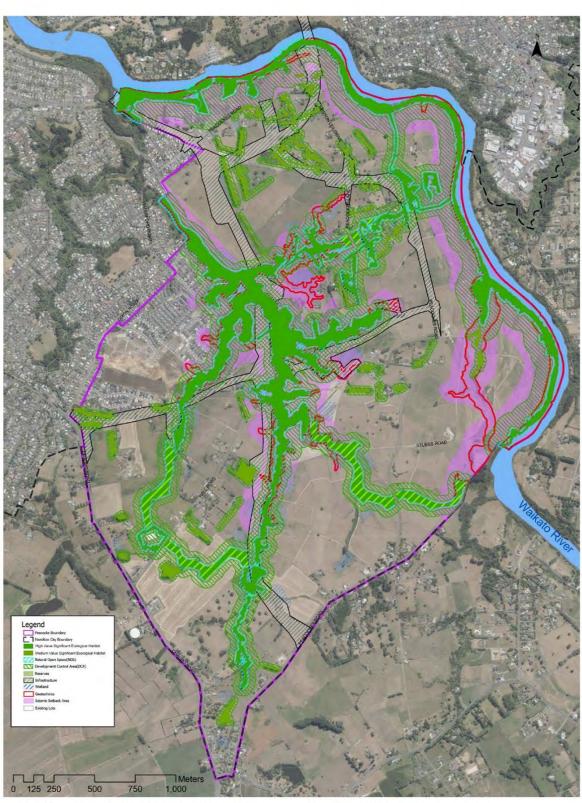


Figure 7; The combined spatial distribution of the additional information exhibits a moderate degree of overlap.

Peacockes Structure Plan Review July 2021 | 17



## 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*.

Hamilton City Council

## 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 Hills 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).

#### Prelim inary 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.

Peacockes Structure Plan Review July 2021 | 19



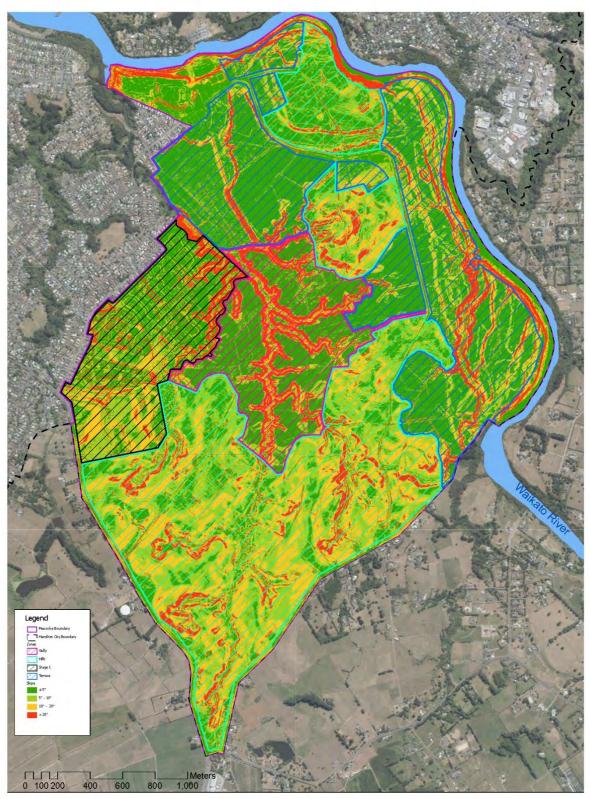


Figure 8; Overview of structure plan area showing existing slope angle distribution over site with character areas outlined.

20 | Peacockes Structure Plan Review July 2021



#### 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.
- 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.

Peacockes Structure Plan Review July 2021 21



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.
- 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 400m²). The average lot size for Amberfield is 532m² while for Northview is 355m².

Zone	Total Land Area	Potential Lot Yield	Average Lot Size	Consented Lot Yield	Average Lot Size	Gross Density
Northview Subdivision	25 ha	266	436 m²	315	355 m²	794 m²
Amberfield Subdivision	111 ha	993	474 m²	909	532 m²	1221 m²
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

22 | Peacockes Structure Plan Review July 2021

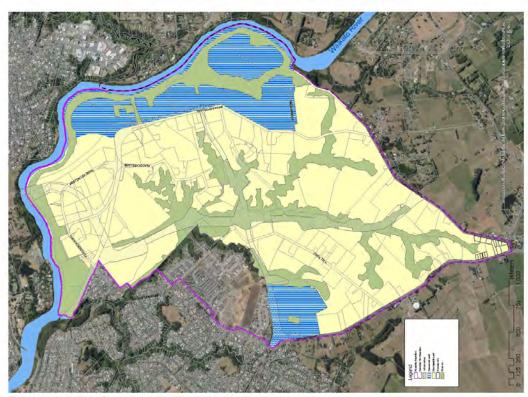


Figure 9a; Location of two areas of consented land.

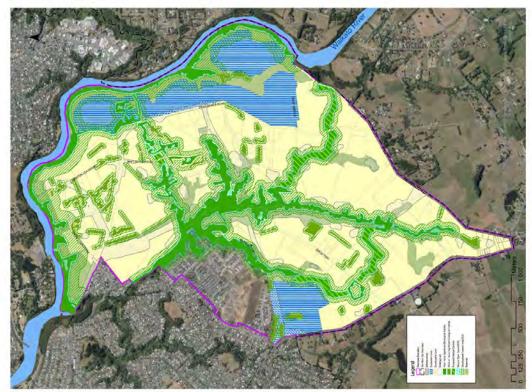


Figure 9b; Location of two areas of consented land.

 $\begin{array}{c|c} \text{Peacockes Structure Plan Re view} \\ \text{July 2021} \end{array} \Big| \, 23 \end{array}$ 



- 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.

#### Topographica l 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.

24 | Peacockes Structure Plan Review July 2021



## Grain of Developm ent

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;

- A reduction in the minimum lot size or grain of development, which allows a greater number of lots within the same area; OR
- 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.

Peacockes Structure Plan Review July 2021 25





Hamilton City Council

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.

Peacockes Structure Plan Review July 2021 27





28 | Peacockes Structure Plan Review July 2021

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## 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

Peacockes Structure Plan Review July 2021 29



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.

30 | Peacockes Structure Plan Review July 2021



#### 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

- 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.
- 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

Peacockes Structure Plan Review July 2021 31



where those retaining walls are seen from publicly accessible locations.

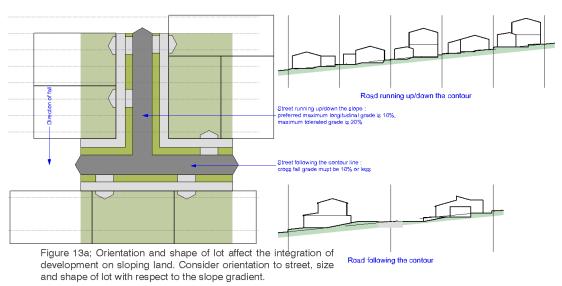
- xi. Where larger scale subdivision is being undertaken by a single developer it is preferred that the developer should undertake the bulk of the retaining work in a consistent style.
- xii. Consideration of a design guide for the area to assist with an understanding of the desired approach and expectations.

#### Recommendations

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

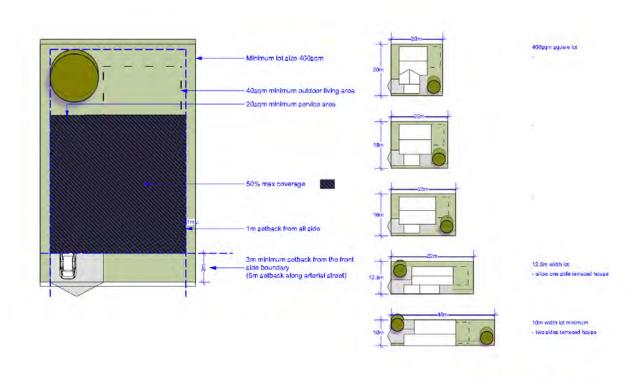
- a. Significant Ecological Habitat and Proposed Bat Corridors should not be subject to landform modification or the adverse effects of modification to the surrounding landform.
- b. The existing general landform should be used to guide any landform modification by replicating the general orientation 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.

Streets should be design to respond to the natural landform to minimize earthworks



32 | Peacockes Structure Plan Review July 2021

**Hamilton** City Council





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.

33 | Peacockes Structure Plan Review July 2021

Peacockes Structure Plan Review July 2021 33

Attachments



## 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 *Waikato 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)
- 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.

Attachment 15

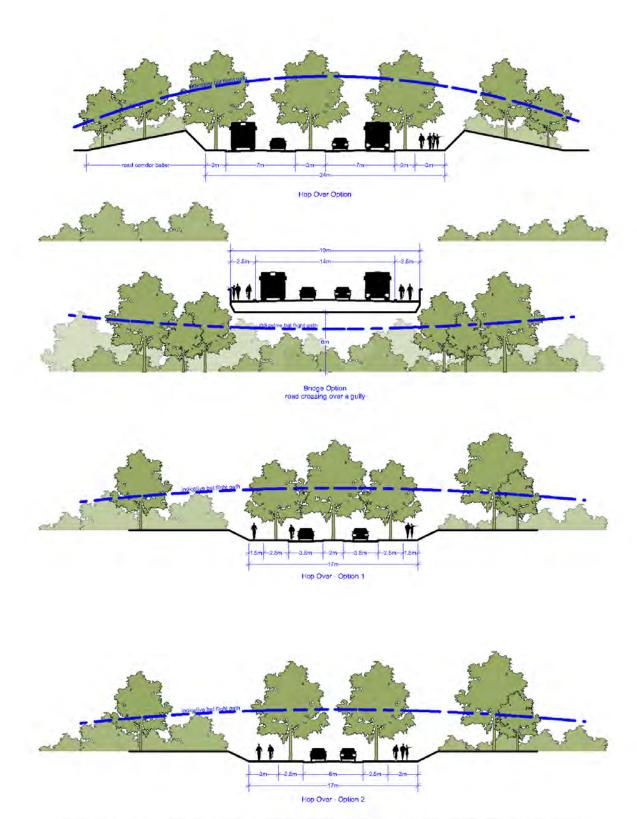


#### Recommendations

- 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.





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

36 Peacockes Structure Plan Review
July 2021

Hamilton City Council



The development of the Structure 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 sportsfloodlighting. 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

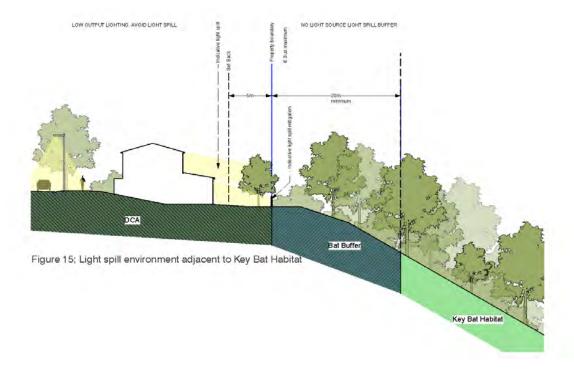
- Led luminaires should be used where possible due to the sharp cut off, lower intensity and good colour rendition and dimming ability. They should always be mounted on the horizontal (no upward tilt).
- ii. Light pole heights should be carefully considered to minimise light spill.
- Streetlights can 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.

Peacockes Structure Plan Review July 2021 37

#### 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.
- 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.



38 | Peacockes Structure Plan Review July 2021



# 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 *Significant 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

- The Bat Buffer and Bat Corridors may contain predominantly native vegetation and/ or grass, and may contain walking, cycling or maintenance tracks.
- No buildings are permitted within Bat Buffers and Bat Corridors.
- 3. Lighting is not permitted within Bat Buffers or Bat Corridors
- Barrier structures and informational or interpretive signage are permitted.
- 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*.

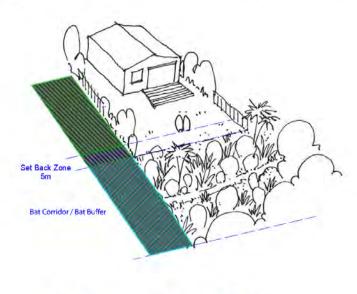
#### Rules

- Within a Set Back Zone no building development is permitted within 5 metres of a Bat Buffer or Bat Corridor.
- 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).
- 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.
- Any proposed building or structure located within a Set Back Zone shall be assessed with regard potential environmental effects caused

Peacockes Structure Plan Review July 2021 39



- by the development on the associated a Bat Buffer or Bat Corridor. This shall include water discharge, light spill shading and noise generation
- 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.
- Boundary fences addressing a Bat Buffer or Bat Corridor shall not exceed 1.6m height and shall provide a minimum 50% visual permeability.
- 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.



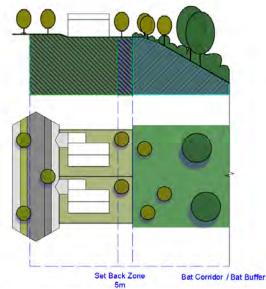
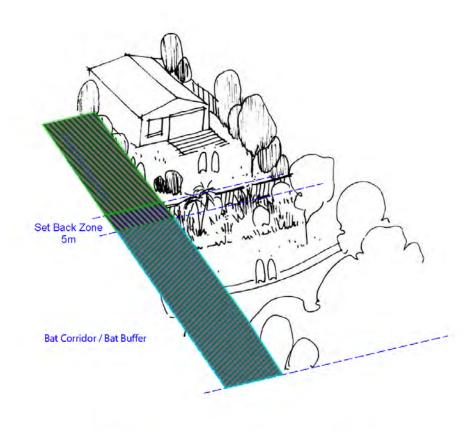


Figure 16a; Examples of the anticipated relationship of development adjacent to the tiered buffer zone

40 Peacockes Structure Plan Review July 2021

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Te kaunihera o Kirikiriroa



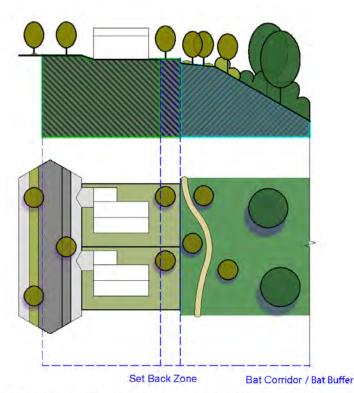


Figure 16b Examples of the anticipated relationship of development adjacent to the tiered buffer zone

Peacockes Structure Plan Review July 2021 41



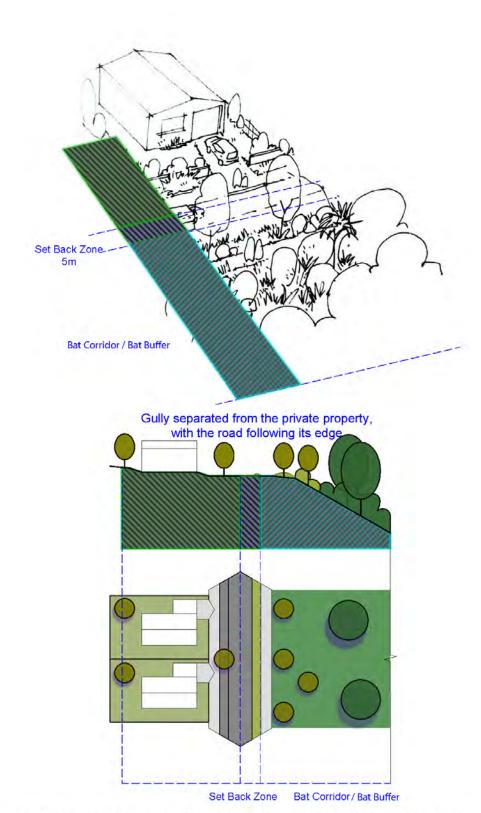


Figure 16c; Examples of the anticipated relationship of development adjacent to the tiered buffer zone

42 | Peacockes Structure Plan Review July 2021

Hamilton City Council

## 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* 

- 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

Peacockes Structure Plan Review July 2021 43



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

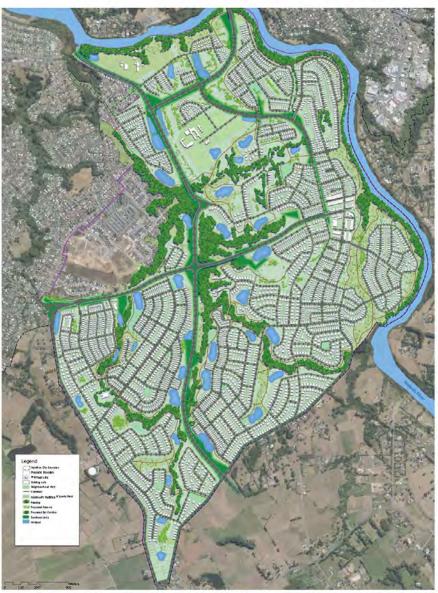


Figure 17, Developed Structure Plan consistent with the permitted yield expressed in the ODP;

44 Peacockes Structure Plan Review July 2021



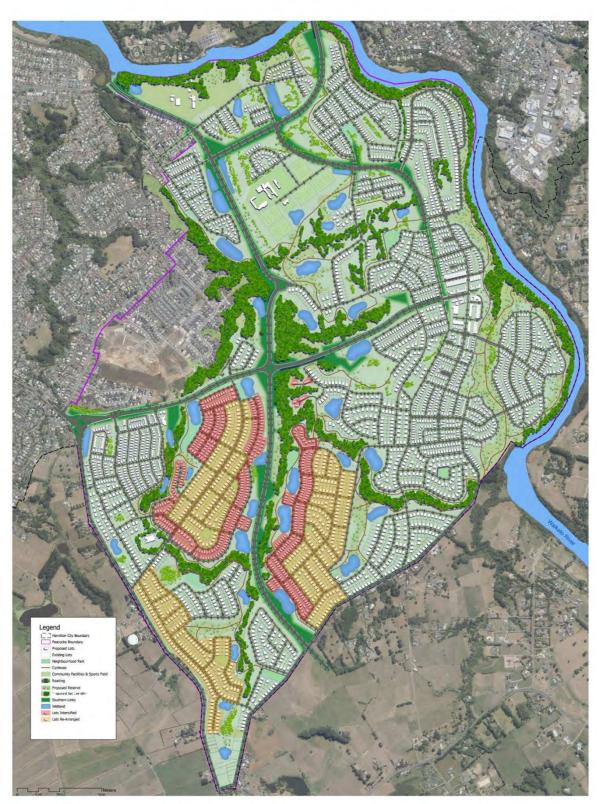


Figure 18a, Developed Structure Plan additionally applying the principles of intensification and rationalisation, areas highlighted;

Peacockes Structure Plan Review July 2021 45



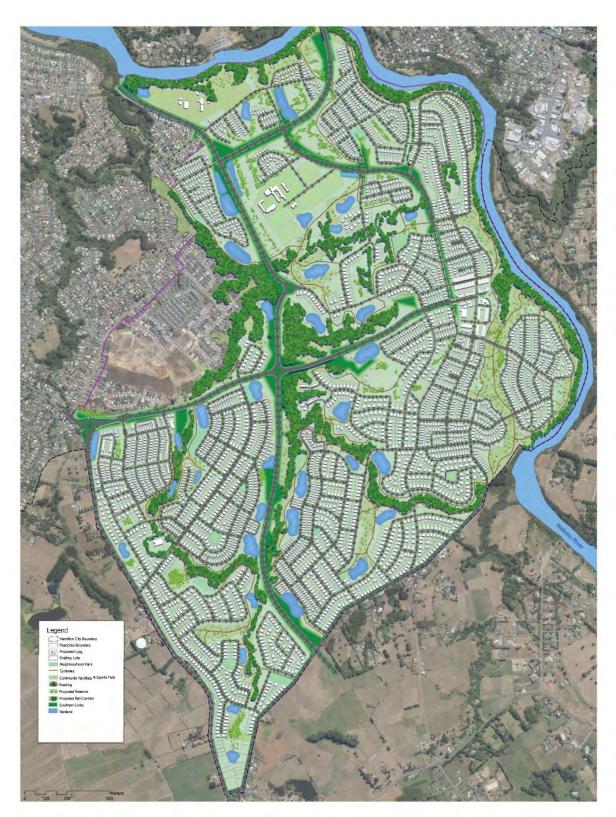


Figure 18b, Developed Structure Plan additionally applying the principles of intensification and rationalisation; highlight removed.

46 | Peacockes Structure Plan Review July 2021



# 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:

- Identification of Significant Ecological Habitat and Proposed Bat Corridor's
- Identification of significant areas of geotechnical hazard;
- 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 Significant 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

Peacockes Structure Plan Review July 2021 47



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 remnant 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.

48 | Peacockes Structure Plan Review July 2021



**APPENDIX P** 

**Hamilton** City Council

Plan Change 5 Peacocke Integrated Transport Assessment

**Hamilton City Council** 

ISSUE 1, 3 AUGUST 2021





# Plan Change 5 Peacocke Integrated Transport Assessment

**Hamilton City Council** 

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ISSUE 1, 3 AUGUST 2021

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Page 1488

Hamilton City Council
Te kaunihera o Kirikiriroa

# TABLE OF CONTENTS

1.	Introduction and Purpose	
1.1		
1.2		
1.3	3. Document Structure	
2.	Background	
2.1		
2.2		
2.3	B. Development Trends and Challenges	8
3.	Strategic Framework	
3.1		
3.2	Government Policy Statement on Land Transport 2021-2031 (GPS)	10
3.3	3. Vision Zero	11
3.4		12
3.5		
3.6		
3.7		
3.8		
3.9		
3.1		
4.	The Proposed Structure Plan	2
4.1	Integration with Land Use	2
4.2		
4.2		2
4.4		
2.00	4.4.1. Arterial Corridors.	
	4.4.2. Collector Corridors	
	4.4.3. Local Corridors	
4.5		
4.6		
4.7	7. Infrastructure and Staging	27
5.	Location Specific Assessments	
5.1		
5.2		
5.3	B. Hall Road Upgrade	30
6.	Proposed Objectives and Policies	3
6.1	ITA Requirements	3
6.2		3
6.3		
7.	Conclusion	33
Appe	endix 1: Hall Road Intersection	34

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#### 1. INTRODUCTION AND PURPOSE

#### 1.1. Purpose

Hamilton City Council (HCC) engaged Gray Matter to assess the transport impacts of the proposed Plan Change for the Peacocke Structure Plan area and to provide technical advice on transport related issues and provisions. Plan Change 5 (PC5) comprises a review of the current structure plan and the indicative transport network, increase in development density, a greater focus on mode shift to non-vehicular modes of transport, public transport and freight, and greater recognition of ecological and significant natural areas (SNAs).

This Integrated Transport Assessment (ITA) informs the proposed changes to the structure plan. Its purpose is to:

- Review transport policy and objectives in context of the District Plan and local, regional and national transport strategies;
- = Assess the likely transport effects; and
- = Review the Plan Change rules for practicability and effectiveness.

#### 1.2. Plan Change Overview

The outcome sought by the Peacocke Plan Change is a revised structure plan and district plan provisions that will assist in creating an attractive and sustainable community in Peacocke.

The project objectives are to

- Develop a revised structure plan and planning provisions that deliver on the relevant wider programme benefits.
- Develop the project outcomes in partnership with internal and external stakeholders and key land-owners.
- = Enhance the environment, specifically in relation to water quality and biodiversity outcomes that are consistent with the outcomes sought in the Mangakootukutuku ICMP and the draft Biodiversity Strategy.
- Increase public transport, cycling and walking modes as set out in Access Hamilton, including the ability to assist in achieving the following Access Hamilton KPIs:
  - o 20% of all trips are by Public Transport within 10 years.
  - 40% of all short trips (less than 2km) are by walking or cycling.
- = Develop a land use pattern that provides housing choice while creating accessible new community nodes.
- Ensure landscape and urban design excellence.

The transport mode shift objectives Access Hamilton are challenging.

#### 1.3. Document Structure

This report includes the following:

- = Background a summary of the current structure plan and Hamilton Southern Links.
- Strategic framework national, regional and local policy that impacts the transport network.
- Transport issues a description of current transport issues affecting the Peacocke area.

2021-08-03-Pc5-Peacocke-Ita-Issue1

Attachment 16

Hamilton City Council

- Proposal proposed structure plan details including discussion and assessment of the proposed transport network, hierarchy, cross-sections, and timing for construction of the strategic transport network.
- Specific assessments for the north-south arterial, traffic modelling and the SH3/Hall Road intersection.
- Proposed objectives and policies
- Conclusion and recommendations.

#### 2. BACKGROUND

### 2.1. Current Structure Plan

The current planned transport network for Peacocke includes a north-south major arterial corridor and minor arterial corridors in both the north-south and east-west directions. It aims to provide access to surrounding areas, with connections to the Waikato River for walking and cycling. The arterial network was determined through the Southern Links project and will not change. Parts of the transport network are currently being constructed to support growth in Peacocke.

The current transport related objectives specific to Peacocke and the citywide transport objectives and policies are set out below. They seek to integrate land use and transport through increasing density around nodes and transport corridors as well as reducing the dependency on the vehicle for travel. Many of these themes have been reinforced and further developed as part of the plan change. For example, reducing the dependency on the vehicle and encouraging travel by public transport has become stronger by prioritising walking, cycling and public transport over the private vehicle.

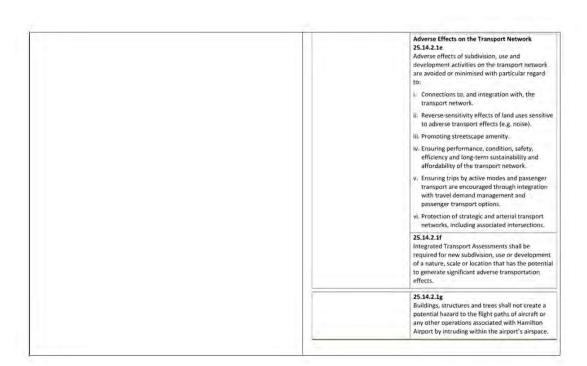
Objectives	Policies	Objective	Policies	
3.4.1.4 Integrate movement routes with surrounding neighbourhoods.	3.4.1.4a Extend existing primary movement routes into the growth cell and use new routes to 'stirch' these together. Use these routes to orientate the secondary street network.	Integrated Transport Network 25.14.2.1 An integrated multi-modal transport network that meets national, regional and local transport needs and is:	Land Use Integration 25.14.2.1a The transportation network and related infrastructure is planned, designed, constructed and managed in a manner that:	
	3.4.1.4b  Responsive  Create a high degree of connectivity both within  Efficient		<ol> <li>is consistent with and supports the land-use spatial framework for the City (Figure 2, 1a in Chapter 2).</li> </ol>	
		Safe	II. Promotes vibrant business centres.	
	3.4,1.4c Enable access to employment, entertainment, retail and recreation through the integrated	Accessible     Sustainable     Integrated with land use	Contributes to safe and efficient multi-modal transport corridors serving the Central City, business centres and other key destinations.     Contributes to a transportation network that A. Is accessible to all users, including transportation and advantaged and mobility impaired.	
	transport network.			
	3.4.1.4d Seek ways to reduce the impact of major			
	movement barriers such as major arterial roads, the Mangakotukutuku Gully and the Walkato River.		<ol> <li>Maximises apportunities for walking, cycling and passenger transport.</li> </ol>	
3.4.1.5 Ensure that higher density development is linked to social	3.4.1.5a Increase density around nodes, parks and riverfront areas.		residential areas, passenger tr services, schools, employment	C. Creates good connections between residential areas, passenger transport services, schools, employment nodes, recreation areas, shops and other
and natural amenity	3.4.1.5b Take advantage of areas of high amenity.		destinations.  D. Provides a choice of routes and transp	
	3.4.1.5c Intersect proposed passenger transport routes with nodes for critical mass of population and efficient interchange capabilities.		modes for travelling.  v. Bicognises the need for effective long-term solutions that are affordable and practicable.	
	3.4.1.5d  Encourage urban form that reduces dependency on the car by focusing on intensification and encouraging walking, cycling and the use of passenger transport.			

2021-08-03-Pc5-Peacocke-Ita-Issue1

2



3.4.1.6 Encourage an overlapping mix	3.4.1.6a Provide a wide variety of land use activities within	Transport Network 25.14.2.1b
of land uses.	comfortable walking distance of the highest population densities and amenity.	The transportation network and related infrastructure is planned, designed, constructed and managed in a manner that:
	3.4.1.6b Use mixed use planning rules to encourage a diverse and compatible range of activities, both vertically and horizontally.	Recognises the affordability of providing new public infrastructure and other actions to increase the capacity of the transport network to accommodate growth.
3.4.1.9 .ocate neighbourhood centres within walking distance to recreational areas.	3.4.1.9a  Development should be contained in distinctive neighbourhoods that are walkable and safe and linked by a high quality open space network.	<ol> <li>Enables flexible management of transport corridors to allow them to perform their function within the City's transport corridor hierarchy.</li> </ol>
		ill. Promotes energy conservation and efficiency.
		<ul> <li>iv. Promotes a safe and efficient transport network.</li> </ul>
		<ul> <li>Allows for network utility infrastructure, and streetscape amenity.</li> </ul>
		vi. Provides access to and has regard for the safety and needs of the mobility impaired, transport disadvantaged, cyclists, pedestrians, passenger transport users, and others using the transport corridor to move from place to place.
		vii, Contributes to the social, economic, cultural and environmental needs of current and futur users of the transport network.
		viii. Takes account of the whole of life operational and maintenance costs of the transport network.
		Adverse Effects of the Transport Network 25.14.2.1c Adverse effects of new transport infrastructure and changes to the existing transport network are minimised while recognising:
		Amenity values of adjacent activities,
		ii Cultural and heritage values, biodiversity, and
		ili. Safety, access and mobility of all users
		iv. The function and the location that that part of the transport network has within the transport corridor hierarchy.
		v. The character and purpose of the zone in which it is located.
		25.14.2.1d  The design, location and quantity of parking infrastructure is managed in a way that:
		<ol> <li>Provides for special design requirements of transport network users.</li> </ol>
		<ol> <li>Minimises adverse effects arising from an over- or under-supply of parking.</li> </ol>
		<ol> <li>Minimises adverse safety and efficiency effect on the transport network.</li> </ol>
		<ul> <li>iv. Maximises opportunities for the efficient use of existing parking infrastructure.</li> </ul>
		<ul> <li>Trips by active modes and passenger transpor are encouraged through integration with trave demand management and passenger transpor options.</li> </ul>



2021-08-03-Pc5-Peacocke-lta-Issue1

12 August 2021



The figure below shows the current structure plan staging and transport network.

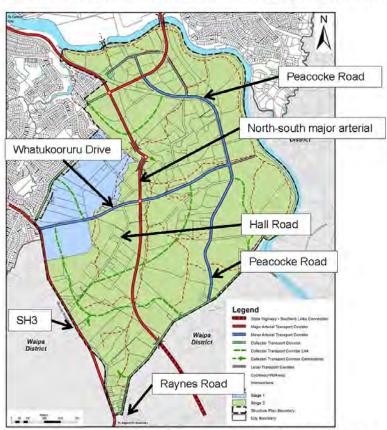


Figure 1: Current structure plan transport network<sup>1</sup> and key features

The key transportation features include2:

- Walkway and cycleway route linking all parts of Peacocke to the Central City via the Mangakootukutuku Gully and Waikato River corridor. Due to ecological reasons the provision of walking and cycling through the Mangakootukutuku Gully has been altered in favour of more accessible travel routes along the tops and edges of the gully network.
- = 'City Link' major arterial route which traverses through the central portion of Peacocke and links with Cobham Drive at the Cobham Bridge, to provide a direct route to the Central City and hospital.
- = 'Eastern Link' major arterial route which branches from the City Link route and crosses the Waikato River near Echo Bank Place linking with Cobham Drive and the Hamilton Ring Road, thus providing a direct route to the eastern side of the City.

2021-08-03-Pc5-Peacocke-Ita-Issue1

<sup>1</sup> https://www.hamilton.govt.nz/our-council/council-

publications/districtplans/ODP/appendix2/Pages/Peacocke-Structure-Plan.aspx

https://www.hamilton.govt.nz/our-council/council-publications/districtplans/ODP/chapter3/Pages/3-4-Peacocke.aspx

- 'City Link' major arterial route forms part of the 'Southern Links' network that will likely connect with Kahikatea Drive in the west, and the Waikato Expressway in the east which provides
- Minor arterial network that provides a link between the western and eastern sides of the growth cell, and the main north-south corridor for the eastern part of the growth cell.

strong connectivity in all directions (this link is shown on the figure in the following section).

= Collector road network that links individual residential neighbourhoods with each other and with the arterial roading network.

#### 2.2. Hamilton Southern Links

Southern Links is the state highway and local arterial road network in the southern part of Hamilton. The detailed objectives are described in the Notice of Requirement. They are summarised as:

- = Improve transport connections for strategic and economic growth, access to markets, transport efficiency and road safety;
- Develop and appropriate road hierarchy in the sub-region and recommendations for the periphery of the study areas
- = Improve options for public transport and walking/ cycling
- Improve amenity and safety through reduced conflict and crash potential along the existing SH1, SH3, SH21 and existing key arterial and collector roads within Hamilton City and key local roads.

When completed, the Southern Links network will:

- = Link SH1 from Kahikatea Drive in Hamilton City to Tamahere and the Waikato Expressway in the south;
- = Link SH3 from Hamilton Airport to central and east Hamilton;
- = Establish a key transport network within the Peacocke growth cell; and
- = Provide the building blocks for further urban development in the region.

Delivery of Southern Links will likely be influenced by the Hamilton-Waikato Metro Spatial Plan – Transport Programme Business Case which is expected to be complete in early/mid-2022.

2021-08-03-Pc5-Peacocke-Ita-Issue1



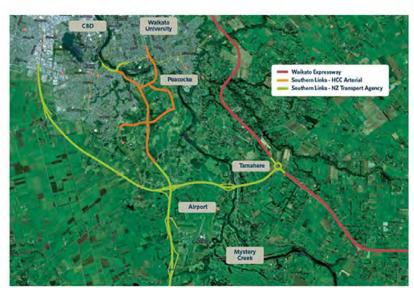


Figure 2: Southern Links Network<sup>3</sup>

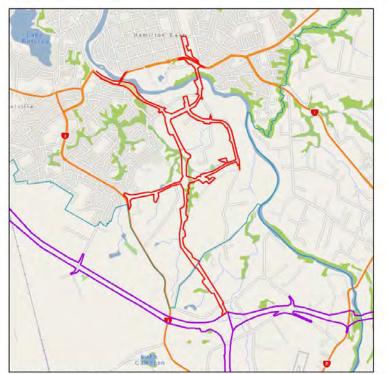


Figure 3: Southern Links Designation and the existing road network in relation to Peacocke.

2021-08-03-Pc5-Peacocke-lta-Issue1

<sup>3</sup> https://www.hamilton.govt.nz/our-city/regional-alliances/southernlinks/Pages/default.aspx



#### 2.3. Development Trends and Challenges

HCC's Access Hamilton Strategy aims to create a more accessible city with mode share for public transport, walking and cycling increased from 14% to 29% by 2028 and the percentage of short trips (<2km) undertaken by foot increased to 50%. This level of mode shift is unlikely to be achievable across the city due to existing constraints and separation of work, live and play functions. Therefore, growth areas such as Peacocke will need to achieve a greater than average mode shift for Hamilton to achieve its aims for mode share. Peacocke is well located (e.g. it is close to the CBD and destinations like the Waikato University, Hamilton Gardens and Hamilton International Airport) to drive this mode shift through integration of land use and transport, and promoting connectivity within the Structure Plan area and to neighbouring destinations.

The National Policy Statement on Urban Development (NPS-UD) recognises the national significance of having well-functioning environments that enable all people and communities to provide for their social, economic and cultural wellbeing, and for their health safety, now and into the future. It also recognises the national significance of providing sufficient development capacity to meet the different needs of people and communities. The policy requires all councils to plan well for growth and achieve a well-functioning urban environment for all people, communities and future generations.

For transportation this presents challenges:

- Increasing density through smaller lot sizes and different building typologies results in more frequent vehicle crossings increasing the risk of crashes between pedestrian, cyclists and manoeuvering vehicles.
- Duplex developments create wider, more frequent vehicle crossings. Terrance developments also have the potential to increase the number of vehicle crossings.
- The NPS-UD requirements to remove requirements for off-street parking will likely increase demand for on-street parking. On-site parking provided for development may reduce. Comprehensive Parking Management Plans are likely to be required in areas of high parking demand.
- Uncertainty over the quantity and locations for accessible parking. While the Building Code require accessible parking to be provided it is linked to minimum parking standards. This means there is the potential for no accessible parking to be provided.
- Narrower local streets and rear lanes present challenges to accommodate manoeuvering of larger vehicles such as buses, refuse trucks, moving trucks, deliveries and emergency vehicles. The ability to support other functions such as placement of refuse and recycling bins, provide for amenity, provide for stormwater management and provision of on-street parking can also be adversely impacted.
- Desire to provide step-free universal access for all users, including transport disadvantaged and mobility impaired, throughout the transport system. This may be challenging in some areas due to the topography with Peacocke.
- = Centralised collection of refuse and recycling for apartments and higher density developments can have an adverse impact on Council achieving its goals for sustainability if recycling is not collected separately and simply sent to the landfill.

2021-08-03-Pc5-Peacocke-Ita-Issue1



# 3. STRATEGIC FRAMEWORK

#### 3.1. Summary

The Peacocke transport network is supported by a framework of transport related strategies and policies seeking to meet national, regional and local objectives. This section provides an overview of relevant strategies and policies, along with a brief summary of how the Peacocke area and Plan Change objectives is influenced by or can support each policy. We have included:

- = Government Policy Statement on Land Transport 2021-2031;
- = Vision Zero;
- = Waka Kotahi Investment Proposal 2021-2031;
- = Waikato Regional Land Transport Plan 2021-2031;
- Waka Kotahi Keeping Cities Moving;
- = Hamilton-Waikato Metro Spatial Plan;
- = Access Hamilton; and
- Waipa District Council structure plans.

HCC has other strategies and plans in place for speed management, walking and cycling, and recently completed a Biking and Micro-mobility Programme Business Case.

The Transportation Network objectives of the Plan Change are set out below. The citywide transport objectives and policies (provided at Table 1) are applicable but are not changing so are not repeated here

Table 2 Proposed Transport Network Objectives

Reference	Objective	Relevant Policies
DEV01-PSP: O17	An integrated and efficient pattern of land use and transportation so as to sustainably manage the impact of development on existing and planned transport infrastructure.	DEV01-PSP: P40 DEV01-PSP: P41 DEV01-PSP: P42 DEV01-PSP: P43
DEV01-PSP: O18	The transport system in Peacocke provides a high level of connectivity within the structure plan area and to surrounding neighbourhoods.	DEV01-PSP: P39 DEV01-PSP: P40 DEV01-PSP: P42 DEV01-PSP: P43 DEV01-PSP: P49 DEV01-PSP: P51
DEV01-PSP: O19	The transport network reduces car dependency and encourages mode shift by:  1. Providing a well-connected transport network that prioritises walking and cycling.  2. Designing the transport network to provide safe, direct and universally accessible routes for people walking and cycling throughout the structure plan area.  3. Integrating with land use to support the provision of a frequent public transport service.	DEV01-PSP: P39 DEV01-PSP: P40 DEV01-PSP: P41 DEV01-PSP: P44 DEV01-PSP: P45 DEV01-PSP: P46 DEV01-PSP: P47 DEV01-PSP: P48 DEV01-PSP: P49 DEV01-PSP: P50 DEV01-PSP: P51 DEV01-PSP: P51

2021-08-03-Pc5-Peacocke-Ita-Issue1

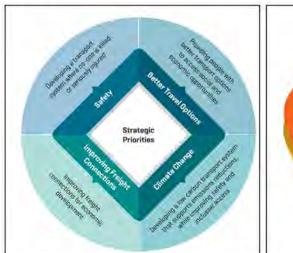
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Reference	Objective	Relevant Policies
DEV01-PSP:	The transport network is designed to be a high amenity	DEV01-PSP: P43
020	environment that incorporates stormwater management.	DEV01-PSP: P53

# 3.2. Government Policy Statement on Land Transport 2021-2031 (GPS)

HCC's, its neighbours and Waka Kotahi's objectives are underpinned by the Government Policy Statement on Land Transport. The GPS has four strategic priorities which are shown below along with the Transport Outcomes Framework.





Government Policy Statement 2021 (left = strategic priorities; right = Transport Outcomes Framework)

The transport objectives of the Plan Change are well-aligned with the GPS through the integration and land use and transport, supporting connectivity, reducing car dependency and encouraging mode shift. Development of the Peacocke structure plan area provides opportunity to support every GPS outcome above as discussed below:

Table 3 GPS Outcome and Peacocke support

GPS Outcome	Opportunity to Support	Proposed Transport Objectives, Policy
Inclusive access	Providing for and supporting a range of transport modes that meet the needs of everyone.  Requiring specific assessment demonstrating prioritising walking and cycling, universal access	Objective 25.14.2.1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O19 DEV01-PSP: P45 DEV01-PSP: P46 DEV01-PSP: P50
Resilience and security	Multiple transport links and mode choices, increasing ability of the network to recover from disruption and maintain an acceptable operational level of service.	Objective 25.14.2.1 Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: P51

2021-08-03-Pc5-Peacocke-Ita-Issue1

10



GPS Outcome	Opportunity to Support	Proposed Transport Objectives, Policy
Economic prosperity	Excellent multi-modal connections to transport nodes and surrounding areas.  Developing the network to encourage the right traffic on the right routes supporting freight movement on the arterial network	Objective 25.14.2.1 Policy 25.14.2.1a DEV01-PSP: O18 DEV01-PSP: P40
Environmental sustainability	Minimising effects on significant natural areas, except where crossed by the transport network.  Supporting the transition to less carbon emissions by providing for and encouraging zero-emission transport modes.	Objective 25.14.2.1 Policy 25.14.2.1c DEV01-PSP: O17 DEV01-PSP: P53
Healthy and safe people	Providing a safe transport network and supporting healthy travel choices.	Objective 25.14.2.1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O19 DEV01-PSP: P47 DEV01-PSP: P52

#### 3.3. Vision Zero

The national Road to Zero strategy for 2020-2030 outlines a plan to stop people being killed or injured on our roads It is based on the Vision Zero approach and supporting the GPS outcome seeking healthy and safe people.

As a city, Hamilton has a Vision Zero aspiration for road safety – "This means we will not accept the death of any person on our transport system. We will design and deliver infrastructure that recognises humans are fallible and that when we make a mistake, we should not pay for it with our life".

In accordance with Vision Zero principles and recognising that a safe transport system is vital to the success of the Peacocke Structure Plan area and the wider city, streets will be designed to protect pedestrians, cyclists and other vulnerable road users, and prevent death and serious injuries for all road users. This will lead to a more vibrant, healthy urban environment.

One of the main differences between the traditional approach to transport design and the Vision Zero approach is the reduced tolerance for death and serious injury resulting from the operation of the transport network. One of the main methods for achieving this is by designing roads so motorists will drive more slowly, i.e. survivable speeds. Some of the tools for achieving this include:

- Providing narrow carriageways.
- Providing narrow intersections: allow larger vehicles to use the whole intersection and cross the centreline or centre of the carriageway.
- = Limiting forward visibility, through geometry and/or planting.
- = Increasing side friction, through planted berms, kerb buildouts etc.
- = Using vertical deflection (raised crossings and raised tables).

2021-08-03-Pc5-Peacocke-Ita-Issue1

11

Page 1500

<sup>4</sup> Refer to Hamilton City Council Website: <a href="https://www.hamilton.govt.nz/our-services/transport/accesshamilton/Pages/default.aspx">https://www.hamilton.govt.nz/our-services/transport/accesshamilton/Pages/default.aspx</a>

Attachment 16

Hamilton City Council

Changes to the Peacocke Structure Plan better support Vision Zero through Objective O18 which states "Designing the transport network to provide safe, direct and universally accessible routes ..." and prioritise walking, cycling and public transport over the private vehicle (refer to Objectives O18, O19 and Policies P49, P50).

Development of an integrated walking and cycling network will separate vulnerable road users from vehicles on collector roads (e.g. Policy P52) making these modes safer and more attractive to support mode shift.

The proposed changes to the Structure Plan provide guidance on design speed, width of the carriageway and footpaths and introduce requirements separated cycleways on the collector network, guidance on the design of rear lanes and how the interact with the public transport network. Specific design of features such as intersections and pedestrian facilities will need to be considered during detailed design of individual developments.

## 3.4. Waka Kotahi Investment Proposal 2021-2031 (WKIP)

The Waka Kotahi Investment Proposal<sup>5</sup> sets out the programme of activities that they propose for inclusion in the National Land Transport Plan (NLTP). Waka Kotahi uses *Arataki: our plan for the land transport system 2021–31*, their 10-year view of what is needed across New Zealand's land transport system, to deliver the GPS priorities and the government's longer-term outcomes. It is framed by five step changes where there is a need for change. The step changes and how they relate to the Peacocke Structure Plan are outlined below:

Table 4 Waka Kotahi step changes / drivers, and Peacocke support

Waikato Context	Opportunity to Support	Proposed Transport Objectives, Policy
Improving safety	Building a safe transport network that is integrated with land use and deliver safe travel speeds	Objective 25.14.2.1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O19 DEV01-PSP: P47 DEV01-PSP: P52
Better travel options	Prioritises walking, cycling and PT by providing higher density around key transport corridors and activity centres.  Develops a well-connected network that is continuous and safe Design infrastructure that makes walking and cycling safe and attractive  Work together to develop travel options for the north-south arterial through the Metro Spatial Plan and Keeping Cities Moving	Objective 25.14.2.1 Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O18 DEV01-PSP: O19 DEV01-PSP: P41 DEV01-PSP: P45 DEV01-PSP: P46 DEV01-PSP: P48 DEV01-PSP: P50
Better freight connections	Provides efficient connections with the wider network through the Southern Links network. Develops the network to encourage the right traffic on the right routes, i.e. supporting freight movement on the arterial network	Objective 25.14.2.1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O18 DEV01-PSP: P40

https://www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/waka-kotahi-investment-proposal-2021-31/

2021-08-03-Pc5-Peacocke-Ita-Issue1

12

12 August 2021



Waikato Context	Opportunity to Support	Proposed Transport Objectives, Policy
Climate change	Supporting and encouraging environmentally friendly modes, protecting significant natural areas, reducing emissions by optimising transport and supporting low-emission travel options.	Objective 25.14.2.1 Policy 25.14.2.1b Policy 25.14.2.1c DEV01-PSP: O19 DEV01-PSP: P50
Working together	Implement a walking and cycling networks that link to the existing networks Work together through the Metro Spatial Plan to deliver infrastructure to support mode shift and development of Peacocke and Southern Links networks	Objective 25.14.2.1 Policy 25.14.2.1a DEV01-PSP: O17

The Peacocke Plan Change is well-aligned with the step-changes and drivers of the WKIP through a focus on integrating land use and transport to drive mode shift. However, only two projects related to Peacocke are included in the WKIP:

- Waka Kotahi's part of Hamilton Southern Links
  - Identified as contributing to the GPS priority of "Better Travel Options". The focus of this priority is to provide people with better travel options to access places for earning, learning and participating in society, measured through use of public transport, walking and cycling along with environmental indicators;
  - Investigation proposed for 2021-24; and
  - o Property purchase proposed for 2021-24, 2024-27 and 2027-31.
- = SH3/ Raynes Road intersection
  - Identified as contributing to the GPS priority of "Improving Safety". The focus of this
    priority is to develop a transport system where no-one is killed or seriously injured,
    measured by the number of deaths and serious injuries on our roads; and
  - o Implementation proposed for 2021-24.

#### 3.5. Waikato Regional Land Transport Plan 2021-2051

The Waikato Regional Land Transport Plan (WRLTP) 2021-2051 outlines the strategic direction for land transport in the Waikato Region. It describes what the region is aiming to achieve for the land transport system in the context of a growing Hamilton-Waikato metro-spatial area. The Regional Transport Committee endorsed the WRLTP in June 2021.

The Plan Change is well-aligned with the WRLTP as discussed in the following table.

Table 5 WRLTP Objectives and Peacocke support

WRLTP Objectives	Peacocke Response	Proposed Transport Objectives, Policy
An efficient and resilient land transport system that advances regional economic wellbeing, and facilitates the movement of people and freight on strategic corridors in the upper North Island.	Peacocke is consistent with Southern Links and provides an arterial network that provides for the movement of people and freight.	Objective 25.14.2.1 Policy 25.14.2.1a DEV01-PSP: O17 DEV01-PSP: O18

2021-08-03-Pc5-Peacocke-lta-Issue1



WRLTP Objectives	Peacocke Response	Proposed Transport Objectives, Policy
A planned transport response that supports liveable urban areas and future growth areas.	Peacocke is consistent with Southern Links and planned urban development Prioritises walking, cycling and PT by providing higher density around key transport corridors and activity centres. Design focus on providing low speed urban environments.	Objective 25.14,2 1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O18 DEV01-PSP: O19 DEV01-PSP: P44 DEV01-PSP: P46
A safe, accessible transport system in the Waikato region, where no one is killed or seriously injured.	Design focus that prioritises walking, cycling and PT in a low speed urban environment.	Objective 25.14.2.1 Policy 25.14.2.1a DEV01-PSP: O19 DEV01-PSP: P47 DEV01-PSP: P52
A transport system that provides an inclusive range of integrated, safe, accessible, quality travel choices for people to meet their social, economic and cultural needs.	Prioritises walking, cycling and PT by providing higher density around key transport corridors and activity centres.	Objective 25.14.2.1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O19 DEV01-PSP: P41 DEV01-PSP: P45 DEV01-PSP: P46 DEV01-PSP: P48 DEV01-PSP: P49 DEV01-PSP: P50
An environmentally sustainable, energy efficient and low-carbon transport system that delivers emissions reductions and enhances communities' long-term resilience to the effects of climate change.	Supporting and encouraging environmentally friendly-modes. Integrating with significant natural areas to protect their core functions. Reducing emissions by optimising transport and supporting low-emission travel options.	Objective 25,14,2.1 Policy 25,14.2.1c DEV01-PSP: O19 DEV01-PSP: P44 DEV01-PSP: P50
Collaboration around spatial and place-based planning results in a safe and efficient transport system that supports thriving and healthy urban and rural communities and economic wellbeing.	Prioritises walking, cycling and PT by providing higher density around key transport corridors and activity centres. Consistent with the Southern Links designation which means its consistent with regional objectives	Objective 25.14.2.1 Policy 25.14.2.1a DEV01-PSP: O17 DEV01-PSP: O18

2021-08-03-Pc5-Peacocke-Ita-Issue1



Table 6 WRLTP Policies relevant to Peacocke

WRLTP Objectives	Peacocke Response	Proposed Transport Objectives, Policy
Develop multi-modal transport solutions that support agreed national, regional and spatial planning outcomes for housing and growth.	Peacocke is consistent with Southern Links and provides an arterial and local transport networks that support planned urban development.	Objective 25.14.2.1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O18 DEV01-PSP: P44 DEV01-PSP: P45 DEV01-PSP: P46 DEV01-PSP: P47
Support key urban development projects that support Hamilton-Waikato metro spatial outcomes.	Consistent with development of infrastructure within Peacocke. Southern Links to be considered in Hamilton-Waikato Metro Spatial Plan Transport Programme Business Case.	Objective 25.14,2 1 Policy 25.14.2.1a DEV01-PSP: O18 DEV01-PSP: P39 DEV01-PSP: P40 DEV01-PSP: P51
Provide an inclusive transport system, including:  = public transport in and between centres.  = rapid and high frequency public transport on core corridors in greater Hamilton.  = passenger rail between Hamilton and Auckland  = alternative delivery modes to improve rural access.  = safe and accessible walking and cycling networks.	Prioritises walking, cycling and PT by providing higher density around key transport corridors and activity centres. Engagement with WRC has identified PT corridors and locations for proposed PT hubs and bus stops on minor arterials	Objective 25.14.2.1 Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O18 DEV01-PSP: O19 DEV01-PSP: P41 DEV01-PSP: P42 DEV01-PSP: P44 DEV01-PSP: P45 DEV01-PSP: P46 DEV01-PSP: P48 DEV01-PSP: P50 DEV01-PSP: P52
Promote initiatives that support travel behaviour change, mode shift and compact urban form	Prioritises walking, cycling and PT by providing higher density around key transport corridors and activity centres. Defines the PT network Directs development of continuous and safe walking and cycling network	Policy 25.14.2.1a DEV01-PSP: O17 DEV01-PSP: O19 DEV01-PSP: P41 DEV01-PSP: P42 DEV01-PSP: P44 DEV01-PSP: P48 DEV01-PSP: P49
Look for funding opportunities to advance access and mobility outcomes.	5	8
Uptake new technology to enhance transport outcomes.	Detailed design can implement measures such as PT priority at intersections	Policy 25.14.2.1b
Encouraging urban form that supports low carbon and low emission transport options.	Urban form locates density around collector corridors and activity centre to prioritise movement by walking, cycling and PT	DEV01-PSP: O17 DEV01-PSP: P39 DEV01-PSP: P40 DEV01-PSP: P41

2021-08-03-Pc5-Peacocke-Ita-Issue1

15



#### 3.6. Waka Kotahi Keeping Cities Moving

"Keeping Cities Moving" is Waka Kotahi's plan for mode shift. The objective is to grow the share of travel by public transport, walking and cycling in order to help cities thrive. The transport network needs to provide mode choices and help people move around easily.

Waka Kotahi's plan (page 6) looks to support thriving urban areas in three ways:

- = shaping urban form;
- making shared and active modes more attractive; and
- = influencing travel demand and transport choices.

The Peacocke Structure Plan provides opportunities to implement all three of the above methods to support a thriving urban area. The transport objectives of the Plan Change (i.e. O17, O18 and O19) are well-aligned with Keeping Cities Moving as they seek an integrated and efficient pattern of land use and transport, providing a high level of connectivity and reducing car dependence and encouraging mode shift.

The area specific plan for the Waikato (Hamilton-Waikato Regional Mode-shift Plan) lists Peacocke as a key area for the transport intervention "place shaping", or "ensuring layout and design of new urban areas supports the use of public transport, walking and cycling". As examples, the transport policies of the Plan Change direct:

- = connectivity and integration of transport and land use (P39 and P40);
- development of walkable neighbourhoods (P45);
- = delivery of high quality and accessible PT (P42 and P46);
- = a continuous and safe walking and cycling network (P45 and P49); and
- prioritises pedestrians and cyclists over vehicles (P50).

### 3.7. Hamilton-Waikato Metro Spatial Plan

The Hamilton-Waikato Metro Spatial Plan<sup>6</sup> has the vision for the Hamilton-Waikato metro area as "a place where our people can easily access employment, education and health facilities, serviced by reliable and efficient transport connections and great places." The plan's vision is supported by six transformational moves. These are listed below, along with the relevance of the Peacocke area.

Table 7 Metro Spatial plan

Transformational Move	Peacocke support	Proposed Transport Objectives, Policy
Waikato River: celebrating the Waikato River as the defining ecological feature connecting the metro area to the heart of a blue-green network supporting environmental and recreational use and creating a sense of place.	Multiple connections to the river and gully network for walking and cycling (although access to gully network is limited for ecological reasons). Stormwater devices integrated into a green network with pedestrian access	DEV01-PSP: O18 DEV01-PSP: O20 DEV01-PSP: P53

2021-08-03-Pc5-Peacocke-Ita-Issue1

16

<sup>6</sup> https://futureproof.org.nz/h2a/metrospatialplan/



Transformational Move	Peacocke support	Proposed Transport Objectives, Policy
A radical transport shift: a multimodal transport network, connecting the metro area and facilitating a radical shift to using public transport through the establishment of a rapid and frequent public transport network shaped around where and how our communities will grow.	Provides a multi-modal network, that prioritises public transport services and separates cyclists from vehicles. Higher development density supports use of alternative modes	Objective 25.14.2.1 Policy 25.14.2.1a Policy 25.14.2.1b DEV01-PSP: O17 DEV01-PSP: O18 DEV01-PSP: P44 DEV01-PSP: P49 DEV01-PSP: P50 DEV01-PSP: P52
A vibrant metro core and lively metropolitan centres: growing Hamilton central city as our civic, administrative, cultural and commercial metro core, alongside lively metropolitan centres, well connected by public transport and safe walking and cycling networks, where people can afford to live, work and play.	Reliable links to Hamilton city centre and the local centre within Peacocke. Arterial connections provide for vehicle connectivity with strong walking and cycling links provided	Objective 25.14.2.1 Policy 25.14.2.1a DEV01-PSP: O17 DEV01-PSP: O18 DEV01-PSP: P39 DEV01-PSP: P40 DEV01-PSP: P41
A strong and productive economic corridor: establishing an economic corridor that links the highly productive employment areas between Ruakura, Hamilton central city and north to Horotiu.	Peacocke arterial network connected to city wide and planned regional network supporting economic and movement functions.	Objective 25.14.2.1 Policy 25.14.2.1a DEV01-PSP: O18 DEV01-PSP: P40
Iwi aspirations: enhancing the environmental health and wellbeing of the Waikato River in accordance with the Te Ture Whaimana o Te Awa o Waikato – Vision and Strategy for the Waikato River, while supporting iwi in embracing social and economic opportunities within the metro area with a specific emphasis on Hopuhopu and Ruakura.	Protection of significant natural areas.	DEV01-PSP: O18 DEV01-PSP: O20 DEV01-PSP: P53
Thriving communities and neighbourhoods: enabling quality denser housing options that allow our natural and built environments to coexist in harmony increasing housing affordability and choice to meet the needs of growing and changing communities.	Efficient land use and transport network planning and integration.	Objective 25.14.2.1 DEV01-PSP: O17 DEV01-PSP: O19

# 3.8. Access Hamilton

Access Hamilton<sup>7</sup> was first developed in 2010 and was refreshed in 2018 to ensure the city can respond to higher than expected growth in the best way possible to achieve the following outcomes areas:

2021-08-03-Pc5-Peacocke-lta-Issue1

17

 $<sup>^{7}\ \</sup>underline{\text{https://www.hamilton.govt.nz/our-services/transport/accesshamilton/Pages/default.aspx}}$ 





**Access Hamilton Transport Outcome Areas** Figure 5:

Access Hamilton identifies investment opportunities in transport activities across a range of modes. It has a strong focus on improving accessibility for pedestrians and cyclists and public transport users and supporting new growth areas. Investment in the transport system aims to deliver a reduction in serious injuries by 30% by 2028 and 60% by 2048, with an overarching goal of zero deaths. It also aims to create a more accessible city with mode share for public transport, walking and cycling increased from 14% to 29% by 2028 and the percentage of short trips (<2km) undertaken by foot increased to 50%.

Key features of the programme are the removal of public transport congestion hotspots in the short term, the development of the Mass Transit Plan to improve public transport options and new infrastructure to support growth cells including Peacocke and Southern Links.

#### 3.9. Waipa District Council

Waipa District Council have structure plans in place that are likely to affect the Peacocke area. These are summarised, along with the potential impact on Peacocke, below:

Table 8 Waipa District Council Growth Areas

Name	Description	Relevance to Peacocke area
Houchens Road Structure Plan	Area of planned development west of Peacocke, on the western side of SH3.  Large lot residential subdivision	Access via Houchens Road/ Ohaupo Road intersection requires an upgrade Any change to access with SH3 will require Waka Kotahi approval
Airport – northern precinct	n current Northern Precinct to the and Airport	

2021-08-03-Pc5-Peacocke-Ita-Issue1



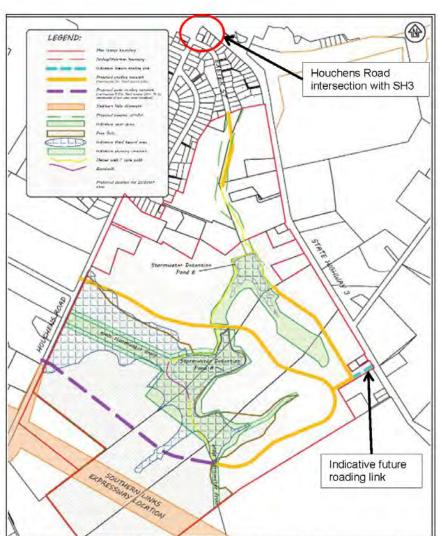


Figure 6: Houchens Road Structure Plan (Waipa District Plan, Appendix S13 -Houchens Road Structure Plan)

While the structure plan shows an indicative roading link to SH3, the assessment was based on an upgrade of the SH3/Houchens Road intersection and did not require a second access to SH3. This is reflected in the Waipa District Plan<sup>8</sup> which only describes mitigation at the SH3/ Houchens Road intersection. This intersection may only be practicable after constructing sufficient stages of Southern Links that allows revocation of state highway status from SH3/ Ohaupo Road.

2021-08-03-Pc5-Peacocke-Ita-Issue1

<sup>8</sup> Waipa District Plan, Rules 15.4.2.70 - 15.4.2.81



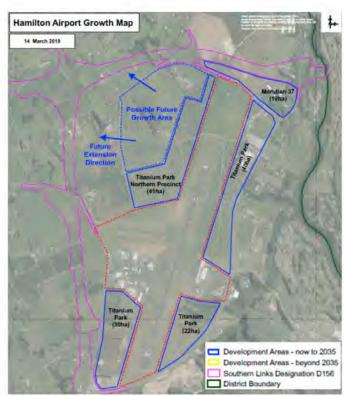


Figure 7: Airport (Waipa District Plan, Appendix S1 - Future Growth Cells)

#### 3.10. Summary

In summary, the Plan Change is well aligned with the national, regional and local strategic transport frameworks. These frameworks seek improvement access for all users, provide safe transport networks, provide for economic growth and environmental sustainability/ climate change.

The current transport provisions of the District Plan support the strategic framework, but the Peacocke Plan Change seeks to go further through the objectives and policy seeking integration of land use and transport with a focus on higher density development near key transport corridors and activities nodes along with prioritising pedestrians and cyclists over vehicles. The policy framework providing supporting detail including requirements for the transport network to provide for public transport services and infrastructure, separation of cyclists from vehicles on the collector network and providing a continuous and safe walking and cycling network.

2021-08-03-Pc5-Peacocke-Ita-Issue1

#### 4. THE PROPOSED STRUCTURE PLAN

#### 4.1. Integration with Land Use

The vision for the Peacocke area is that it will become a high-quality urban environment that is based on urban design best practice, social well-being, and environmental responsibility. It is important land development in the Peacocke area occurs in such a way that it takes advantage of its location, responds to and respects the important ecological values of the area and integrates with the transport network to ensure a high level of accessibility is maintained into and throughout the area.

The success of Hamilton's transport system relies on creating a new approach for multi-modal (different types of transport) movement. The Peacocke area will be developed in line with Hamilton's vision set out in Access Hamilton and consistent with Vision Zero. In a transport sense this means developing an integrated transport system that supports the proposed land use, comprising a multi-modal transport network that provides access to frequent public transport on key routes and a direct and accessible walking and cycling network, that is safe and enjoyable to use. The network will be constructed to meet best practice principles related to safety, coherence, directness, attractiveness and amenity which will assist in encouraging mode shift, in particular for shorter trips of less than 2km

Key transport features that distinguish Peacocke from the current District Plan provisions are:

- = Wider footpaths on local corridors;
- = Provided separated cycle lanes on the collector network;
- = Identification of public transport routes so that infrastructure can be provided at the time of subdivision;
- Bus stops are to be provided in-lane to minimise delays to the public transport services;
- = Provide for increased use of rear lanes for property access; and
- Provide for higher density along identified public transport corridors and around the local centre and other areas of activity/amenity to support public transport services.

The Transportation Network objectives of the Plan Change are set out in Section 3.1 above. DEV01-PSP-O17 specifically addresses integration with the objective of "An integrated and efficient pattern of land use and transportation so as to sustainably manage the impact of development on existing and planned transport infrastructure."

#### 4.2. Hierarchy and Layout

The key transport features of the proposed structure plan are well aligned with the current structure plan. The proposed transport network includes:

- = Major and minor arterial networks that align with the current structure plan and Hamilton Southern Links;
- Extending the minor arterial south of the Peacocke Local Centre through to the Peacocke Road/ Raynes Road intersection;
- = Revisions to alignment and location of the collector network; and
- More direction on public transport routes and locations for bus stops on the minor arterial network.

2021-08-03-Pc5-Peacocke-Ita-Issue1

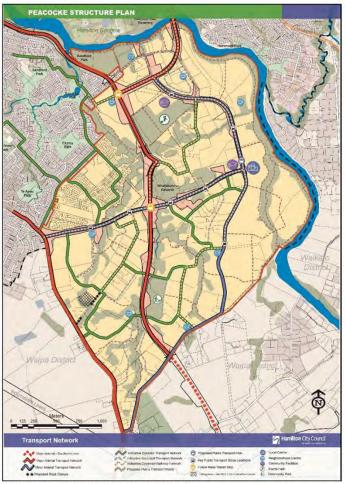


Figure 8: Proposed Structure Plan

#### 4.3. Speed Management

The principles of the HCC Speed Management Plan seek that:

- Where there are high numbers of people walking, biking and crossing the road the speed environment will be 30km/h;
- Residential local roads will be constructed for a 40km/h environment; and
- New roads will be constructed appropriate to the function and to create a safe and appropriate
  environment.

The proposed design speed environments are 30km/h on local residential corridors and 40km/h on the collector network. Peacocke has a lower design speed environment than other local roads to support mode shift and contribute to Vision Zero. These design speed environments are support by the cross-sections developed for Peacocke. The proposed structure plan is consistent with the principles of the HCC Speed Management Plan.

2021-08-03-Pc5-Peacocke-Ita-Issue1

# 4.4. Cross-Sections

#### 4.4.1. Arterial Corridors

The major and minor arterial corridors within the structure plan area were designated through the Hamilton Southern Links project, except for the proposed extension south of the Peacocke local centre. The design and construction of arterial corridors is led by HCC, and it is not necessary for details to be provided in this Structure Plan.

SH3 is a major arterial in the HCC transport corridor hierarchy and identified as a Regional Strategic corridor in the One Network Road Classification. The form and function of this corridor will likely be reviewed following construction of Southern Links.

#### 4.4.2. Collector Corridors

Collector corridors perform both a movement and property access function. Collector corridors connect local neighbourhoods and provides connections to the wider arterial network. Cycling and walking facilities within the collector corridor should be separated to ensure a safe and efficient pedestrian and cycling network that promotes active modes of transport. Property access is not restricted but will need to specifically consider inclusion of the separated cycle facilities to minimise disruption of cycle travel and improve road safety.

The proposed cross-sections depart from the District Plan standards (Appendix 15, Table 15-6a)ii)) due to the introduction of separated cycle lanes. The District Plan anticipate 1.5m wide on-road cycling, but the Structure Plan requires a 2m cycle lane with 0.6m buffer (2.7m total width) to the parking/ berm.

The Structure Plan specifically identifies the public transport corridors on some collector corridors as they require slightly wider movement lanes (3.4m). On other collectors 3.2m wide lanes are adequate.

The proposed cross-sections are shown below, noting that the 2.5m wide berm/ parking lane/ bus shelter will likely alternate along the road so that parking is provided on both sides.



Figure 9: Proposed Collector Cross-Section

2021-08-03-Pc5-Peacocke-Ita-Issue1



Figure 10: Proposed Collector Cross-Section for Identified PT Routes

#### 4.4.3. Local Corridors

The principal transport function of local corridors is to provide property access, with low traffic volumes and low vehicle speeds. Walking and cycling are prioritised as the fundamental units of movement, with through traffic discouraged. Movements by heavy vehicles are expected to by emergency vehicles, rubbish and refuse collection trucks and deliveries/ moving trucks, so the local corridors need to adequately provide for manoeuvering of these large vehicles. These local corridors also have an important function in enhancing the urban environment by providing amenity through landscaping and street trees, stormwater management and providing space for other infrastructure.

The District Plan (Appendix 15, Table 15-6a)ii)) currently provides for two different local corridor cross-sections, 16m where there are 10-20 lots and 20m where there are more than 20 lots. This Structure Plan simplifies this by providing a single cross-section standard to support transport functions. It acknowledges additional width may be required to provide for stormwater management and landscaping. The Plan Change supports the use of rear lanes which reduces the need for two local corridors standards. This simplification is supported by new subdivision standards that control block length and depth which support development of more walkable neighbourhoods. For example, the rules limit block length to 250m and block perimeter to 750m.

The proposed 16.8m width of local transport corridors within Peacocke departs from the District Plan standard for low volume local corridors by:

- Providing wider footpaths to support active modes. 1.8m width footpaths are required compared to the District Plan standard of 1.5m; and
- = Increasing the berm width from 2.0m to 2.1m to better accommodate parked cars.

2021-08-03-Pc5-Peacocke-Ita-Issue1

<sup>9</sup> Rule SUB-PREC1-PSP: R18 Block Structure and roading

12 August 2021





Figure 11: Proposed Local Corridor Cross-Section

#### 4.5. Rear Lanes

The Structure Plan promotes the use of rear lanes to provide an alternative for vehicle access to properties which minimises the number of vehicles crossings along pedestrian and cycling routes. This has significant benefits for pedestrians and cyclists by reducing the number of potential conflict points, this is especially important on collector corridors where separated cycle lanes are provided.

The Structure Plan adopts the District Plan standard for design of rear lanes and specifies a minimum width of 7m<sup>10</sup>. The subdivision rules<sup>11</sup> limit the maximum number of residential units served by a rear lane to 20 units.

In an ideal Vision Zero environment vehicle crossings across the separated cycle lane would be avoided. Design of the arterial network avoids direct property access where traffic volumes and speeds will be higher. However, this is not practicable for the collector network where a degree of property access is required. It is proposed to minimise the number of vehicle crossings through the separated cycle lanes through the proposed provisions which requires that "In the Peacocke Structure Plan area, on collector roads where a shared path or separated cycleway are provided, there shall be a minimum distance of 50m between vehicle crossings."

Where vehicle crossings are provided there are a number of ways to design the interface to prioritising pedestrians and cyclists over manoeuvering vehicles. The proposed assessment criteria <sup>13</sup> require that these crossings are "designed to maximise the safety of pedestrians and cyclists". The NACTO Urban Bikeway Design Guide provides the following guidance.

2021-08-03-Pc5-Peacocke-Ita-Issue1

<sup>10</sup> Rule 25.14.4.1h)vii)

<sup>11</sup> SUB-PREC1-PSP: R20 Provision of parking and access

<sup>12</sup> Rule 25.14.4.1a)v)

<sup>13</sup> Rule 1.33 P5 I) Subdivision in the Peacocke Structure Plan



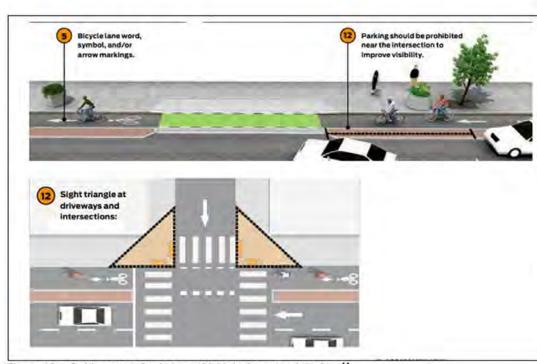


Figure 12: Guidance on Cycle Lane/ Vehicle Crossing Interface14

# 4.6. Public Transport

Public transport routes have been identified within the structure plan based on the development of a public transport network by Waikato Regional Council (WRC). These routes will be supported by enabling higher density development on these corridors, which will support the creation of a viable, frequent public transport service.

Engagement with Waikato Regional Council included discussion on:

- = Cross-sections for collector corridors;
- Location for proposed public transport hubs and bus stops on minor arterials;
- = Routes for key/ frequent services; and
- Routes for local services.

The proposed public transport network is shown below.

2021-08-03-Pc5-Peacocke-Ita-Issue1

<sup>14</sup> https://nacto.org/publication/urban-bikeway-design-guide/

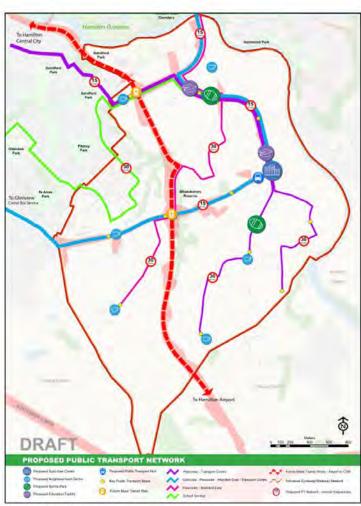


Figure 13: Public Transport Corridors

The introduction of separated cycle lanes and in-lane bus stops means it is challenging to retro-fit bus stop infrastructure, so it needs to be provided at the time of subdivision. It is proposed to identify the proposed collector road for public transport services within the District Plan to recognise that these corridors require a slightly wider movement space and specific design and construction of bus stop infrastructure at the time of subdivision.

The proposed policy and rule framework (SUB-PREC1-PSP: P8, P9 and P16, SUB-PREC1-PSP: R25) directing the provision of public transport infrastructure are supported by existing and proposed assessment criteria (for example criteria G1e) and P5m)).

# 4.7. Infrastructure and Staging

HCC is currently delivering much of the strategic transport infrastructure necessary to support the Peacocke Structure Plan through funding received from the Government's Housing Infrastructure Fund. Delivery of the north-south major arterial network is not funded in the 2021-2031 LTP.

The Plan Change provides a staging programme to ensure that urbanisation does not occur out of sequence with the delivery of key strategic infrastructure.

2021-08-03-Pc5-Peacocke-Ita-Issue1

27

This excludes delivery of the north-south arterial will be influenced by the Hamilton-Waikato Metro Spatial Plan – Transport Programme Business Case (PBC) which is expected to be complete in early/mid-2022.



Figure 14: 2018-2028 Peacocke Delivery<sup>15</sup>

2021-08-03-Pc5-Peacocke-lta-Issue1

<sup>15</sup> https://www.hamilton.govt.nz/our-city/city-development/peacocke/upcoming-works/Pages/default.aspx

#### 5. LOCATION SPECIFIC ASSESSMENTS

#### 5.1. North-South Major Arterial

The Southern Links north-south major arterial corridor was designated with width to support a four-lane road corridor. Currently there is no funding for construction of this corridor within HCC's LTP.

Through the current Peacocke Strategic Transport project HCC is working is establish a walking and cycling route along the designation. This will support HCC's objectives for mode shift by creating a dedicated walking and cycling corridor that provides a direct route from the centre of the structure plan area to the north. Waka Kotahi have indicated that financial assistance is unlikely. HCC have indicated that it is unlikely to be an investment priority for the Biking and Micro-mobility Programme. A walking and cycling connection may therefore not be realised before the north-south arterial is construction (more than 10 years away).

The long-term allocation of space in this corridor will be influenced by the Hamilton-Waikato Metropolitan Spatial Plan – Transport Programme Business Case which is due for completion in early/mid-2022. In the medium/ long-term, the priority is likely to shift towards providing for walking, cycling and public transport. For example, the four lanes could be allocated as two for public transport and two for general traffic.

The current structure plan indicates collector intersections with the north-south major arterial. The location of these connections has changed as a result of changes in the network layout. These interactions are not shown on the Southern Links designation. The form of any connection has not been determined and a wide range of options exist from full access (e.g. a roundabout) through to limited access via left-in/left-out arrangement, only providing access for walking and cycling, or no access.

The Structure Plan continues to provide for this major arterial transport corridor without constraining future decisions on the form or allocation of space.

#### 5.2. Southern Links Modelling

Development of this plan change has not included traffic modelling. Carrying out modelling of the network was not considered necessary as the arterial network was extensively modelled during investigation and designation of the Southern Links network. This modelling was based on a 2041 land use with 8,028 households and a population of 22,077<sup>16</sup>. It confirmed the location and form of the transport network as well as testing intersections on the arterial network.

Council's Detailed Business Case<sup>17</sup> supporting the application to the Housing Infrastructure Fund anticipated development of 8,400 homes over the next 30 years. This is approximately 5% more dwellings than modelled in the Southern Links investigation. More recently modelling has been completed to support implementation of strategic transport infrastructure for Peacocke and to refine design of the network and arterial intersections.

Due to changes in how the structure plan responses to issues related to ecology, significant natural areas (SNA) and stormwater requirements, the Plan Change anticipates that Peacocke will accommodate between 7,500 and 8,000 new homes. This is consistent with the Southern Links modelling. The reduction in developable area means that net density within Peacocke targets 20-50 dwellings per hectare, with higher density concentrated around nodes and public transport corridors.

2021-08-03-Pc5-Peacocke-Ita-Issue1

<sup>&</sup>lt;sup>16</sup> Southern Links Scheme Assessment, Appendix E: Transport

<sup>&</sup>lt;sup>17</sup> Hamilton – Peacocke Detailed Business Case, Housing Infrastructure Fund, November 2017



In summary, the expected population in Peacocke remains generally consistent with the earlier Southern Links modelling. The transport focus of the plan change is on integration of land use and transport to achieve mode shift to walking, cycling and public transport. This should mean that vehicular demand from the Structure Plan area is similar or less than originally planned for.

#### 5.3. Hall Road Upgrade

Hall Road is currently a local no-exit road that forms a T-intersection with Ohaupo Road (SH3). The current traffic volume is approximately 300veh/day with 15,300veh/day and 11% on Ohaupo Road. SH3 is a Limited Access Road<sup>18</sup>, meaning that any vehicle crossings or intersections to SH3 need to be authorised by Waka Kotahi.

The current District Plan shows Hall Road as a local corridor. The current structure plan identifies it as a collector with no direct connection to SH3, but connections to Whatukooruru Drive through Stage 1B, and to and across the north-south arterial.

Within an increase in traffic from development on Hall Road, there is a significant risk of an increase in crashes and delays at the intersection. Due to the topography, there are no practicable options to safety provide for more intensive use of the intersection. Therefore, development on Hall Road will need to either be delayed until other internal connections are provided, or alternative access is provided. For example, a left-in/left-out arrangement may be acceptable when a roundabout is in place at the SH3/ Raynes Road intersection.

The proposed infrastructure staging sets out that the Hall Road upgrade needs to be dealt with as part of developing Stages D, E and H. HCC does not deliver the collector network and the developer of these stages will need to investigate options and deliver the infrastructure are part of their development.

2021-08-03-Pc5-Peacocke-Ita-Issue1

<sup>18</sup> https://maphub.nzta.govt.nz/public/?appid=d4ae73824516451cbc9000850a9a1919



#### 6. PROPOSED OBJECTIVES AND POLICIES

# 6.1. ITA Requirements

The ITA requirements are to be expanded for development within the Peacocke Structure Plan area. Developments triggering an ITA (i.e. those generating more than 500veh/day or approximately 50 dwellings or providing a new transport corridor) will be required to prepare a Design Statement that provides specific consideration and assessment of matters including:

- How walking will be prioritised including assessment of block layouts, design speed, pointto-point walking distances and provision of on-street parking; and
- Universal design;
- = Refuse collection;
- How off-street parking is to be provided; and
- = How on and off-street parking is to be designed to create a safe environment.

Assessment of these additional matters is required to ensure that development promotes mode shift and integrates with land use to prioritise walking, cycling and public transport.

Other matters such as refuse collection and on-street parking are necessary to address issues that are currently arising within medium density development in the city and are expected to become more complex with more intensive development in parts of Peacocke.

#### 6.2. Active Modes and Universal Access

The proposed transport related objectives and policies support the vision for Peacocke to be a high-quality urban environment that is based on urban design best practice, social well-being, and environmental responsibility. By providing a high level of connectivity that prioritises walking and cycling, the structure plan area can make a meaningful contribution to HCC's aim to create a more accessible city with a high degree of mode share for public transport, walking and cycling. The Integration of land use and transport by providing higher density around key transport corridors and activity centres supports prioritising walking, cycling and PT especially for short trips (<2km).

The Plan Change prioritises walking and cycling as the primary units of movement within the structure plan area. This can be achieved through design that minimises wait times for pedestrians at intersections, and gradients and changes in grade are minimised so that access to the transport network is improved for the transport disadvantaged and less mobile users.

# 6.3. Accessible Parking

The Plan Change removes minimum parking requirements for residential activities in the structure plan area. HCC is preparing a city-wide separate plan change to address wider removal of parking standards.

The NPS-UD allows minimum requirements for accessible parking to be retained. The District Plan<sup>19</sup> currently applies NZS4121<sup>20</sup> for accessible parking which is identified as an acceptable solution under the Building Act. However, it only requires accessible parking where other parking is provided. This restricts access for less mobile users in developments where parking is not provided.

2021-08-03-Pc5-Peacocke-Ita-Issue1

31

<sup>&</sup>lt;sup>19</sup> Volume 2, Appendix 15, Table 15-1d

<sup>&</sup>lt;sup>20</sup> NZS 4121:2001 Design for access and mobility - Buildings and associated facilities

Attachment 16



The NPS-UD Car Parking Factsheet<sup>21</sup> indicates that accessible parking could be required based on GFA, but does not provide any further guidance.

The proposed approach is to require that accessible car parking be provided for non-residential uses. The ratios have been calculated by using the current minimum parking standard for retail activities (one space per 20sq.m) to determine the equivalent GFA of the car park thresholds set in NZS4121.

Table 9 Proposed Accessible Parking Standard

GFA of building	Minimum number of accessible car park spaces for disabled users
0 - 400m²	1
400 – 1000m²	2
For every additional 1,000m <sup>2</sup>	1 additional

### Alternatives considered included:

- Relying on developers to provide on-site parking triggering the requirements of NZS4121. This was not preferred as it presents a risk of excluding less mobile users from accessing non-residential uses where developers do not provide parking.
- = Relying on accessible parking to be provided on-street as part of subdivision and managed by Council bylaws. Providing on-street accessible parking requires specific design to ensure that 3.5m wide parking bays and accessible routes are provided as required by NZS4121. Providing parallel parking wider than 2.1m will require compromises in the form of the transport corridor and is undesirable. On-street parking can be more difficult for less mobile users to access safely and it is preferred to require on-site accessible parking.
- = Relying on assessment criteria to determine the effects of not providing accessible parking for non-residential activities. This was not preferred as it would not provide certainty that accessible parking would be provided.

There is a risk that the proposed approach will require every non-residential development up to 400sq.m GFA to provide an accessible park even though no other parking is provided. This means the site will need an on-site manoeuvering area and a vehicle crossing for this one accessible space. While this outcome is consistent with NZS4121 which requires any retail development above 20sq.m to provide an accessible space, it may not be in keeping with the intent of the NPS-UD in contributing to "well-functioning urban environments". This could potentially be avoided by having a minimum GFA at which accessible parking is required, and the District Plan being clear that accessible parking could be provided on-street (rather than on-site).

2021-08-03-Pc5-Peacocke-Ita-Issue1

32

<sup>21 &</sup>lt;a href="https://environment.govt.nz/publications/national-policy-statement-on-urban-development-2020-car-parking-fact-sheet/">https://environment.govt.nz/publications/national-policy-statement-on-urban-development-2020-car-parking-fact-sheet/</a>



# 7. CONCLUSION

The success of Hamilton's transport system relies on creating a new approach for multi-modal (different types of transport) movement. The Peacocke area will be developed in line with Hamilton's vision for accessibility set out in Access Hamilton and is consistent with Vision Zero. In a transport sense this means providing a multi-modal transport network that provides access to frequent public transport on key routes and a direct and accessible walking and cycling network, that is safe and enjoyable to use. The network will be constructed to meet best practice principles related to safety, coherence, directness, attractiveness and amenity which will assist in encouraging mode shift, in particular for shorter trips of less than 2km.

The hierarchy and layout of the transport features of the proposed structure plan are well aligned with the current structure plan. Changes are proposed to the cross-section standards to better support a multi-modal network that prioritises active modes and is safe and enjoyable to use.

Key transport features that distinguish Peacocke from the current District Plan provisions are:

- = Designing the transport system to prioritise pedestrians and cyclists over vehicles;
- = Increased density around key transport routes and activity centres;
- = Wider footpaths on local corridors;
- = Separated cycle lanes on the collector network;
- Identification of public transport routes so that infrastructure can be provided at the time of subdivision; and
- Bus stops are to be provided in-lane to minimise delays to the public transport services;

The current transport provisions of the District Plan support the strategic transport framework, but the Peacocke Plan Change seeks to go further through the objectives and policy seeking integration of land use and transport with a focus on higher density development near key transport corridors and activities nodes along with prioritising pedestrians and cyclists over vehicles. The policy framework provides supporting detail including requirements for the transport network to provide for public transport services and infrastructure, separation of cyclists from vehicles on the collector network and providing a continuous and safe walking and cycling network. Alternatives to the proposed approach for accessible parking and access to Hall Road may merit reconsideration following submissions.

Hamilton City Council

# APPENDIX 1: HALL ROAD INTERSECTION

# **Existing Intersection**

The existing Hall Road intersection joins Ohaupo Road where there is a southbound passing lane and a 100km/h speed limit. Waka Kotahi's MegaMaps (Edition 3) show the safe and appropriate speeds on both SH3 and Hall Road as 80km/h. The vertical and horizontal geometry of both roads restrict sight distance for drivers using the intersection.

We have completed a search of NZTA's Crash Analysis System (CAS) for crashes at the Hall Road/SH3 intersection for the period from 2016-2020. There have been four non-injury crashes at the intersection. The collision diagram is shown below.

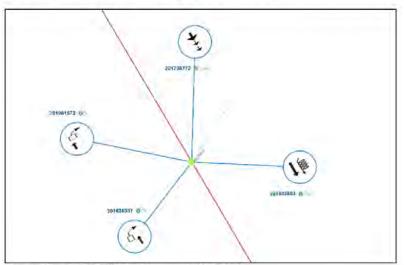


Figure 15: CAS Collision Diagram 2016-2020

Austroads Guide to Design Part 4A – Signalised and Unsignalised Intersections provides guidance on Safe Intersection Sight Distance (SISID)<sup>22</sup>. For a 110km/h design speed 285m SISD is required, this reduces to 214m for a 90km/h design speed. As illustrated below, complying sight distance is not provided at the intersection.

2021-08-03-Pc5-Peacocke-Ita-Issue1

34

<sup>&</sup>lt;sup>22</sup> Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections, Table 3.2



Figure 16: SISD Hall Road (left photo, visibility to the left, right photo visibility to the right)

While the Hall Road approach to Ohaupo Road is relatively straight, the limit line is located west of a crest curve which restricts visibility to the limit line. For a 90km/h design speed, Austroads requires Approach Sight Distance (ASD) of 139m. This is not achieved at the existing intersection.

In summary, the existing intersection does not provide the required SISD or ASD. Within an increase in traffic from development of the Peacocke Structure Plan, there is a significant risk of an increase in crashes and delays at the intersection. Due to the topography, there are no practicable options to safety provide for more intensive use of the intersection.

# Options for Relocated Intersection

Relocating the Hall Road intersection provides an opportunity for the realigned Hall Road to be aligned with a future access to the Houchens Road Structure Plan which shows an "indicative future roading link" just north of the water reservoir. HCC has plans to develop a second reservoir adjacent to the current reservoir which may impact on the location of any relocated intersection.

A relocated intersection may only be practicable after constructing sufficient stages of Southern Links that allows revocation of state highway status from SH3/ Ohaupo Road. The Houchens Road Structure Plan assessment was based on an upgrade of the SH3/Houchens Road intersection and did not require a second access to SH3.





Figure 17: Houchens Road Structure Plan "indicative future roading link"

For the purpose of this assessment we have identified two locations for relocating Hall Road to a new intersection with SH3. Option A is to locate Hall Road to create a cross-roads intersection that could ultimately be formed as a roundabout also serving the Houchens Road Structure Plan. This option has a significant impact on the dwelling on the eastern side of SH3.

Option B is shown approximately 150m south of Option A and generally located near the access to the water reservoir. While Option B maximises the available sight distance for the realigned Hall Road and avoids the existing dwelling, it does not present the same opportunities for integration with the Houchens Road Structure Plan. Option B may need to be located further south to avoid HCC's proposed second reservoir.

Depending on the timing of development and future boundary relocations, there may be an opportunity to shift the Hall Road intersection further south of Option B to avoid the existing dwellings and create a roundabout south of the reservoir.

Our analysis has considered the following alternatives in a high-level assessment against road safety, efficiency and cost:

- Option 1: Priority controlled with a right turn bay;
- Option 2: Left-in/left-out intersection; and
- Option 3: Roundabout.

2021-08-03-Pc5-Peacocke-Ita-Issue1

36



Option	Safety	Efficiency	Cost	Location: Option A vs Option B	Summary
No connection while SH3 remains state highway	No intersection = no safety concerns	No intersection = no impacts on through traffic	• N/A	• N/A	Preferred while SH3 is state highway
Connection once Southern Links is complete	Introduces new intersection and conflict points     Reduce likelihood of crashes if lower volume and lower speeds	Disruption to through traffic on a local arterial. Lower traffic volumes reduces the impact.     Scale of effect depends on form of connection	Depends on form of connection – see options below	Provides flexibility	May be acceptable if connection to Houchens Structure Plan is desirable and form/ function of SH3 is changed.  Direct connection not shown on current structure plan.
Option 1: Right Turn Bay	Allows space for northbound vehicles to wait for gaps to right turn.     Does not change the number of conflict points.     High speeds on the approaches remain.     Risk of right-out crashes remains     Difficult to provide safe access to properties on west side of SH3	Minimal disruption to through traffic.  May be difficult to find gaps during peak periods to right turn in and out of Hall Road, resulting in long delays.	Relatively low costs for pavement widening and remarking     Property impacts could be limited to within Peacocke Structure Plan	Option A could result in a crossroads intersection that would need upgrading     Option B would result in head-to-head right turn bays, Concerns that sight distance would be obstructed by turning vehicles.  Impacts on properties on west side of SH3.	Not preferred. Safety concerns remain for right turns in and out of side road and properties on west side of SH3. The right turn bay would minimise delays to through traffic by allowing right turning traffic to wait for gaps.
Option 2: left-in/ left out only	Reduces the number of conflict points at the intersection. Will require a median island/ barrier on Ohaupo Road to prevent right turns. Introduces risk of u-turns elsewhere.	Minimal disruption to through traffic.  Will require longer diversions for right turning traffic (e.g., via roundabout at SH3/Whatukooruru Drive).  May only be practicable after constructing sufficient stages of Southern Links to allow revocation of state highway status from SH3/Ohaupo Road.	Relatively low costs for pavement widening and remarking plus costs for barrier treatment Property impacts could be limited to within Peacocke Structure Plan.	Could be implemented at both locations as an interim option. Both would impact on properties on west side of SH3. Ultimately could result in head-to-head right turn bays	May be acceptable as interim if roundabout at SH3/ Raynes Road Restricting right turns at the intersection minimises conflict points.  This option would require either wire rope barrier or a solid median on SH3 to ensure vehicles do not right turn in or out of Hall Road, This option will result in diversions/ u-turns which may need to be specifically accommodated.

2021-08-03-Pc5-Peacocke-lta-Issue1

Attachment 16



Option	Safety	Efficiency	Cost	Location: Option A vs Option B	Summary
Option 3: Roundabout <sup>23</sup>	Minimises the number of conflict points for a crossroads intersection     Potential conflict speeds will be lower.	Imposes delays for through traffic     Reduced delays for vehicles on Hall Road     May result in three roundabouts located within 2.4km <sup>28</sup> of each other which may be undesirable for the function of SH3.	Is likely to be the most expensive option Likely to require land to accommodate an Austroads compliant roundabout	Better suited to Option A     Option B would not allow good integration with Houchens Road Structure Plan and potentially clashes with proposed reservoir	Preferred if connection to Houchens Structure Plan is desirable and form/ function of SH3 is changed. A roundabout is the most desirable solution to provide safe access Peacocke. Could be developed to provide access to Houchen Road development.

38

<sup>&</sup>lt;sup>23</sup> Austroads Guide to Road Design Part 4B: Desirable for 90km/h design speed = 22m central island and 6.2m circulating. Inscribed circle diameter = 56.4m <sup>24</sup> The distance between the roundabout at Whatukooruru Drive and the Raynes Road intersection is 2.4km <sup>2021-08-03-Pc5-Peacocke-Ita-Issue1</sup>

12 August 2021



The current speed limit is 100km/h. In 2020 Waka Kotahi consulted the community on potential changes to the speed limits on SH1, SH3 and SH26 in Hamilton<sup>25</sup>. This included the potential for an 80km/h speed limit on Ohaupo Road (SH3) from south of the new SH3 Ohaupo Road / Whatukooruru Drive roundabout (new speed limit change point) to 330m north of Rukuhia Road and a variable 60km/h speed limit at the SH3/ Raynes Road intersection. To date, no changes have been implemented. Any speed limit review is likely to be influenced by the implementation of Waka Kotahi's planned safety improvements at the SH3/ Raynes Road intersection. Lowering the speed limit on SH3 to 80km/h would be consistent with the Safe and Appropriate Speed and lower the minimum design standards (e.g. sight distance, roundabout diameter) for any works at a new intersection.

The long-term preferred option is a single roundabout that provides safe access to both the Peacocke and Houchens Road Structure Plans as it would minimise the number of intersections on this major arterial corridor. However, the timing for development within the Houchens Road Structure Plan area is uncertain. The final form and location for realignment of Hall Road and new intersection with SH3 will be led by the developer so that it integrates with the adjacent residential development. Consultation with and approval from Waka Kotahi will also be required.

An interim arrangement for the realignment of Hall Road could be constructing a left-in/left-out intersection. This relies on an internal connection being provided between Hall Road and Whatukooruru Drive (east-west minor arterial) to allow trips to the north. Access for northbound vehicles would either be through u-turns at the Whatukooruru Drive roundabout or from Raynes Road (this assumes that a connection is provided between Raynes Road and Hall Road).

The proposed infrastructure staging sets out that the Hall Road upgrade needs to be dealt with as part of developing Stages D, E and H. HCC does not deliver the collector network and the developer of these stages will need to investigate options and deliver the infrastructure are part of their development.

# Conclusion

As part of future development within the Peacocke Structure Plan Hall Road will need to be upgraded to a collector transport corridor and the current intersection with SH3 to be closed as it does not meet the required design standards. Due to the topography, there are no practicable options to safety provide for more intensive use of the existing intersection.

2021-08-03-Pc5-Peacocke-Ita-Issue1

39

<sup>&</sup>lt;sup>25</sup> https://www.nzta.govt.nz/projects/hamilton-city-speed-review/

Attachment 17

# **APPENDIX Q**



MEMO

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Project: PEACOCKE STRUCTURE PLAN AREA CHANGE

LDP Ref: 21-0018-001A

Subject: BAT SENSITIVE LIGHTING RULES

Organisation HAMILTON CITY COUNCIL

Attention: Jamie Sirl Date: 07/07/2021

Email: Jamie.Sirl@hcc.govt.nz

From: John Mckensey Signed:



This technical memo has been prepared at the request of Hamilton City Council (HCC), in conjunction with a long-tailed bat report (4Sight Report) prepared by 4Sight Consulting (4Sight), to inform bat sensitive lighting rules for a proposed plan change to the Peacocke Structure Plan Area (PSPA).

# 1.0 INTRODUCTION

The PSPA is known to contain habitat used by the national critically endangered New Zealand long-tailed bat (LTB). While there is a lack of literature available regarding lighting effects on the LTB, 4Sight are of the opinion that a conservative approach is warranted and that the LTB should be assumed to be light sensitive.

Hence, HCC consider it would be appropriate to establish a set of bat sensitive lighting rules for the PSPA.

# 2.0 PROPOSED METHODOLOGY

In the absence of useful research regarding lighting effects for the LTB, we have agreed with 4Sight that the most appropriate guide currently available would be the publication jointly produced in 2018 by the (UK based) Bat Conservation Trust (BCT) and the (UK based) Institution of Lighting Professionals (ILP) – "Guidance Note 08/18: Bats and artificial lighting in the UK" (GN 08/18).

# INDEPENDENT ELECTRICAL & ILLUMINATION ENGINEERS

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488321-8 (LDP Memo re Lighting - Peacocke Structure Plan [21-0018-001A]).docx

page 1 of 6





GN 08/18 recommends various physical mitigation measures in relation to separation and screening. Matters such as these have been addressed in the 4Sight Report.

In terms of lighting, GN 08/18 recommends consideration of the following potential measures to mitigate effects;

- Avoid lighting key habitats
- Set acceptable lux limits with ecologist guidance
  - Complete darkness could be considered as 0.2 lux horizontal or 0.4 lux vertical NOTE: In our opinion, a practical interpretation would be "a limit of 0.3 lux in the vertical plane at 1m above ground"
  - Relevant luminaire features;
    - Use warm white LED luminaires, aimed down and emit zero direct upward light
    - Use a warm colour temperature preferably no more than 2700K
    - The LED spectral peak should be higher than 550nm and lack UV NOTE: White LED sources do not emit any significant amount of UV. Also, LED sources with a colour temperature of 3000K or less invariably have a spectral peak higher than 550nm. Therefore, a warm white LED with a colour temperature no higher than 3000K will usually automatically address both the UV and spectral peak recommendations
    - · Minimise luminaire mounting height to minimise visibility and light spill
    - · External security lighting on motion sensors with a short duration (1 minute)
    - Consider the type and location of interior lighting to minimise spill light and glare, where adjacent glazing faces directly toward bat habitat – refer to GN 08/18 for further guidance
  - Consider dimming or part night switching

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488321-8 (LDP Memo re Lighting - Peacocke Structure Plan [21-0018-001A]).docx

page 2 of 6





NOTE: Provided the lux limit and luminaire features described above are achieved, there would be no additional benefit in these measures and they could potentially give rise to unwanted effects such as increased crime. Hence, while such measures may be considered if believed to provide sufficient net benefit, we do not recommend mandating such measures. Further guidance is given in GN 08/18.

# Demonstrate compliance with lux limits

The BCT website advises that they are looking to update GN 08/18 and anticipated doing so by the end of 2020. However, that does not appear to have occurred as yet, so GN 08/18 is currently considered best practice.

In addition, as discovered during the recent Amberfield (Weston Lea) Environment Court hearing, while 2700K luminaires are obtainable for commercial luminaires (e.g. roadway lights), residential outdoor luminaires are invariably available with a minimum of 3000K colour temperature. We believe that the rationale for 2700K emanates from a desire to minimise the 'blue' content and there are only a few percentage points difference in that regard between 2700K and 3000K. Therefore, we propose that the 'permitted activity' for residential lots mandate 3000K, but include a preference for 2700K in the Guidance notes.

The foregoing measures are given as a range of possible measures to consider. They are not necessarily all required. We are of the opinion that it would be practical to achieve sufficient control with a limited portion of these measures set as compliance standards. An additional set of guidance notes could be provided to assist in achieving best practice outcomes.

# 3.0 RECOMMENDED RULES

Based on the foregoing, we recommend the following rules;

# PSPA BAT SENSITIVE LIGHTING - STANDARDS

The Peacocke Structure Plan Area contains habitat used by the New Zealand long-tailed bat which is a national critically endangered species and believed to be light sensitive. The following standards and guidance notes are intended to minimise potential loss of habitat.

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488321-8 (LDP Memo re Lighting - Peacocke Structure Plan [21-0018-001A]).docx

page 3 of 6





Where the term "land adjoining" is used, it includes all land uses, including but not limited to, building lots, public roads, private roads, access ways and reserves.

The terms "artificial outdoor lighting" and "fixed lighting source" include all static lighting fixed to a permanent structure (e.g. building, lighting column, fence). They exclude mobile vehicle or mobile machinery mounted lighting (e.g. headlights, navigation lights, hazard warning lights, working lights).

### Permitted Activities

Artificial outdoor lighting on land adjoining bat habitat, which satisfies the following requirements, will be a Permitted Activity;

- Added illuminance must be no greater than 0.3 lux in the vertical plane at 1m above ground at the bat habitat boundary.
- Luminaires using warm white LED, emitting zero direct upward light. Luminaires must be installed with the light emitting surface facing directly down and be mounted as low as practical.
- A maximum of 3000K colour temperature, for land with a residential use and 2700K for all other uses (e.g. all roads, access ways, commercial lots, reserves, etc), and
- Exterior security lighting controlled by a motion sensor with a short duration timer (1 minute)

# Restricted Discretionary Activities

The following are restricted discretionary activities;

 Artificial exterior lighting within a bat habitat for the express use of providing emergency lighting for an essential public service that could require unavoidable maintenance at night – e.g. a waste water pumping station. The lighting must be white LED with a maximum 2700K colour temperature, installed with the light emitting surface facing directly down, emit zero direct upward light and be mounted as low as practical.

## Non-complying Activities

# INDEPENDENT ELECTRICAL & ILLUMINATION ENGINEERS

488321-8 (LDP Memo re Lighting - Peacocke Structure Plan [21-0018-001A]),docx

page 4 of 6





The following are non-complying activities;

 Exterior lighting for a multi-storey building, on an elevated balcony, elevated open walkway, stairwell or other building feature with external openings positioned on a building face adjacent to a bat habitat

# **Prohibited Activities**

The following are prohibited activities;

- Artificial exterior lighting within a bat habitat, other than emergency lighting for an essential public service, and
- Any lighting adjoining bat habitat that does not satisfy the Permitted Activity requirements.

# 4.0 RECOMMENDED GUIDANCE NOTES

In addition to the above rules, we recommend the following guidance notes;

# PSPA BAT SENSITIVE LIGHTING - GUIDANCE NOTES

To assist in minimising potential adverse lighting effects to the New Zealand long-tailed bat, the following publication provides further guidance that may prove helpful;

Guidance Note 08/18: Bats and artificial lighting in the UK
 (https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/)

In addition the following notes may be helpful;

- The UK document recommends no more than 2700K adjacent bat habitat, so that is the
  preferred upper limit. The permitted activity rules for residential use require a maximum of
  3000K as that is typically the lowest available for residential grade lights. If 2700K or lower
  can be obtained, it would be preferable.
- The use of a maximum of 3000K with zero direct upward light is encouraged for locations beyond those adjoining the bat habitat as bats in flight will see a vista greater than just the immediate area.

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488321-8 (LDP Memo re Lighting - Peacocke Structure Plan [21-0018-001A]).docx

page 5 of 6





- Limiting the height of luminaires can be helpful. The New Zealand long-tailed bat has a tendency to fly near the top of trees and the upper outer tree canopy edges. Hence, any lighting more than a few metres high may become directly visible to the bat in flight.
- 4. Bats tend to fly near tree tops and near the outer edges of foliage canopies. Where a multi-storey building is proposed adjacent to a bat habitat, features such as an elevated open walkway or open stairwell requiring exterior lighting should be placed on a face of the building other than the building face adjacent to the bat protected area. Since some such features may require lighting, where this is the case they should be located in a part of the building which does not face the bat habitat.
- In the case of a building lot immediately adjacent a bat habitat, a minimum building setback
  of 5m with a solid 1.5m high boundary fence (i.e. impervious to light passing through),
  together with sensible lighting design, is capable of achieving compliance.

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488321-8 (LDP Memo re Lighting - Peacocke Structure Plan [21-0018-001A]).docx

page 6 of 6



# APPENDIX R

# **PLAN CHANGE 5**

# PEACOCKE STRUCTURE PLAN

# RESIDENTIAL YIELD ASSESSMENT

March 2021





# **DENSITY ANALYSIS**

#### Residential Environment

The majority of the Peacocke residential zone will be managed by a Medium Density Zone. This will provide for a range of housing typologies and densities, establishing a mix of housing tenure and a diverse community. It is anticipated that the topography of the area will influence the development of houses and the density will vary according to constraints of the site. Medium density development also provides other benefits, such as, more efficient use of land and infrastructure and the ability to foster walkable communities, which provide for access to services, jobs and daily needs within a walkable or cyclable distance.

Increased density supports public transport and viable commercial centres, increasing the number of people within a walkable catchment. It also provides more housing options, such as one or two person homes, smaller families and opportunities for retirees to downsize. For this reason, the Peacocke includes a high density overlay which is located within walkable distances from the suburban centre, identified public transport routes and areas of amenity including the river and gully network, parks and community facilities. This overlay enables the delivery of higher density housing and in combination with the objectives and policies of the plan, will create a walkable environment that provides ease of access to facilities and amenities and public transport.

In order to ensure a pleasant living environment, it is important that higher density housing is well designed. This is because, when compared to lower density housing, there is less space to provide on-site and streetscape amenity. For this reason, council reserves discretion over the development of multi-unit housing including duplexes, terraced apartments and apartments throughout the zone.

# **Definition - Dwelling Density**

Dwelling density is the number of dwellings per hectare of developable area within a subdivision.

The developable area includes roads and reserves, but excludes undevelopable areas (e.g. wetlands or geotechnically/topographically constrained areas) or major infrastructure corridors and large known land uses such as sports parks and education facilities.

It is important that the densities are calculated based on the total developable area (as outlined above) rather than the area net of roads and reserves (i.e. the final saleable land parcel area). This is because of the share of land that is removed for roads and reserves is not constant and instead differs by the development density. Areas of higher density have a greater share of land removed for roads and reserves, with correspondingly lower shares removed within lower density developments.

As an example, a density of 17 dwellings per hectare would equate to a site size of around 400m2 per dwelling.

At this density, 33% of the developable land area would be removed for roads and reserves for this density. This leaves around  $6,700m^2$  of land per hectare upon which to divide into saleable lots. At 17 dwellings per hectare, this equates to  $400m^2$  per site (i.e.  $6,700m^2/17 = +/-400m^2$ ).





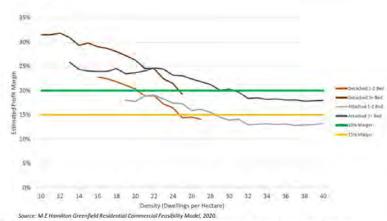
Page 2

<sup>1</sup> Market Economics Consulting - Greenfield Housing Policy Options Assessment for Hamilton - Dwelling Demand and Feasibility Assessment - 2020 Fig 20

# Hamilton City Council

# Medium-Term (2020-2030) Development Feasibility by Dwelling Type and Size:

Greenfield Housing Policy Options Assessment for Hamilton - Dwelling Demand and Feasibility Assessment M.E. Containing - 2020



It is estimates that it will become feasible to construct 3+ bedroom detached dwellings at up to 24 dwellings per hectare in the medium term (2020 - 2030). At the highest density end of this range, this equates to an average site size of around 270m² per dwelling, close to the highest density modelled.

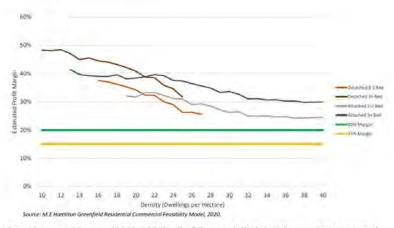
It is also projects that a greater range of attached 3+ bedroom dwellings will become commercially feasible to construct. It estimates that it will be feasible to construct these dwellings at densities up to 30 dwellings per hectare, which equates to site sizes of around 200m<sup>2</sup> per dwelling unit.

In the next ten years it is projects that it will become feasible to construct 1-2 bedroom detached dwellings. These are projected to become feasible at a dwelling density of up to 20 dwellings per hectare. The feasibility of smaller dwellings is likely to increase into the future, reflecting growth in the relative proportion of smaller households. Growth in demand for smaller dwellings is also seen in the range of 1-2 bedroom attached dwellings that are projected to occur in the marginal feasibility (15-20%) range in the medium-term. At the higher densities, these also have site sizes of around 200m² per dwelling unit.

#### PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT

# Long-Term (2020-2050) Development Feasibility by Dwelling Type and Size:

Greenfield Housing Policy Options Assessment for Hamilton-Dwelling Demand and Feasibility Assessment M.E. Coroulling - 2020



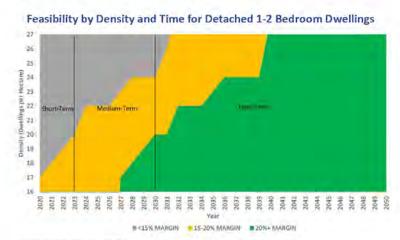
Over the next 30 years (2020-2050), all of the modelled development options and densities are projected to become feasible in Peacocke (see above). Three or more bedroom dwellings have higher modelled margins than smaller dwellings, reflecting historic patterns of higher demand for dwellings with a greater number of bedrooms.

As sites become smaller, the modelling suggests that it becomes relatively more feasible to construct attached dwellings than detached dwellings. Within each dwelling size group (1-2 bedrooms vs. 3+ bedrooms), the modelled margins of attached dwellings begin to exceed those of detached dwellings at densities of 30 dwellings per hectare or greater. This equates to a site size of around 300m² or smaller.

Page 3

# Hamilton City Council

#### PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT

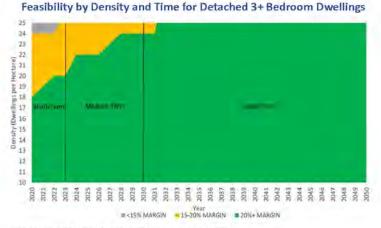


Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

For 1-2 bedroom detached dwellings in Peacocke it is suggests that these typologies are projected to become feasible with a 20% or greater margin midway through the medium-term (2002 - 2030). In the short (2020 - 2023) and medium-terms, a range of density is projected to be within the 15 - 20% margin for this development option. These equate a range of smaller site sizes (around 270 -  $400\text{m}^2$ ) $^1$ .

The feasible density of this development option increases through time. The maximum modelled densities are projected to become feasible with a 20% or greater margin midway through the long-term (2020 - 2050). These are modelled at 27 dwellings per hectare, which equates to a small standalone dwelling (around 100-110m² floorspace) on a small site area (around 230m²). While this density may be projected to become feasible, the market may deliver dwellings at a different density within the feasible range, depending upon the scale of demand and market preferences that emerge in the long-term.

1 Market Economics Consulting - Greenfield Housing Policy Options Assessment for Hamilton - Owelling Demand and Feasibility Assessment - 2020, pg 28



Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

For 3+ bedroom detached dwellings in Peacocke it estimates that they are currently feasible to construct with a 20% or greater margin. It is estimated that it is currently feasible to construct dwellings on minimum site sizes similar to those in the General Residential Zone (400m²) that is applied across much of Hamilton's residential area<sup>2</sup>.

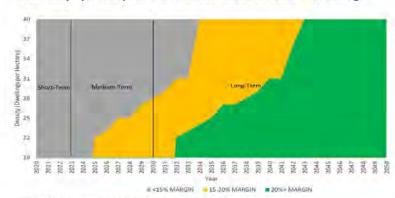
In the short-term (2020 -2023) the feasible density is projected to increase to around 20 dwellings per hectare, equating to site sizes of around 330m² per dwelling. These site sizes are not currently seen in the Hamilton market within the outer areas of greenfield growth. However, this is likely to be influenced by the existing General Residential Zone 400m² minimum site size requirement for single dwellings. We note that 3+ bedroom detached dwellings are currently being delivered at these smaller site sizes in the greenfield growth areas of other similar urban economies.

The full modelled range of densities for detached 3+ bedroom dwellings is projected to become feasible (at a 20% or greater margin) shortly into the long-term (around 2031-2032). This equates to a density of 25 dwellings per hectare, with a site size of around 250m² per dwelling.

2 Market Economics Consulting - Greenfield Housing Policy Options Assessment for Hamilton - Dwelling Demand and Feasibility Assessment - 2020 pg 26

Page 4

#### Feasibility by Density and Time for Attached 1-2 Bedroom Dwellings



Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

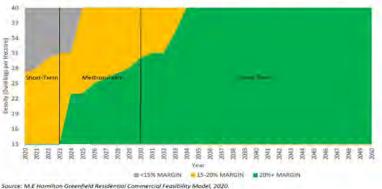
The feasibility through time of attached 1-2 bedroom dwellings shows a range of density is from 19 dwellings per hectare up to 40 dwellings per hectare, equating to a site size range of around 150m2 to 350m2.

The modelling projects that attached 1 - 2 bedroom dwellings are more likely to become feasible at a margin of 20% or greater in Peacocke during the long-term (2020-2050). It is not projected to achieve a 15-20% margin till the medium-term (2020-2030). Long-term demand for these types of smaller dwellings are likely to correspond to patterns of greater growth in smaller household types seen in the demand assessment3.

Current market analysis suggests that these types of smaller, attached dwellings are currently being delivered within Hamilton. Although, these are typically occurring within more central areas of higher amenity, while outer greenfield areas have a greater propensity to develop as larger detached dwellings on larger sites. However, the establishment of a centralised node of higher amenity within the Peacocke area may increase the viability of these types of smaller higher density dwellings. While there are currently some attached dwellings being developed within Peacocke tage 1, these are generally 3+ bedroom attached dwellings.

#### PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT

#### Feasibility by Density and Time for Attached 3+ Bedroom Dwellings



For attached 3+ bedroom dwellings in Peacocke it is projected to become feasible at a 20% or greater margin in the medium-term (2020-2030), with the full range of modelled densities becoming feasible at this margin part way through the long-term (2020-2050)4.

In the short-term (2020 - 2023), attached 3 bedroom dwellings are estimated to have a margin of 15-20% with a density range of between 13 to 27 dwellings per hectare, increasing up to 31 dwellings per hectare in the long-term. At the highest density, this corresponds to a site size of 230m2 currently, decreasing to 200m2 in the shortterm. This development option at this higher density (230m<sup>2</sup> site size) reflects a small share of the development that is currently occurring within Peacocke stage 1.

While it is estimated that attached 3 bedroom dwellings are likely to be feasible at lower densities in the medium-term, it is less likely that attached dwellings will be delivered by the market at this density range. The reason is twofold. Firstly, at these larger site sizes (13 to 15 dwellings per hectare - 450m2 to 530m2 site sizes), the market is easily able to deliver standalone dwellings, which typically have a higher level of demand. Secondly, if attached dwellings are constructed, then they are more likely to be constructed at a higher density to increase the total dwelling yield, and therefore, net profit, of the subdivision.

Page 5

A Market Economics Consulting - Greenfield Housing Policy Options Assessment for Hamilton Dwelling Demand and Feasibility Assessment - 2020, pg 27

<sup>4</sup> Market Economics Consulting - Greenfield Housing Policy Options Assessment for Hamilton Dwelling Demand and Feasibility Assessment - 2020, pg28



# Density (Units per Ha)

Typologies		Short Term (2020-2023)	Medium Term (2023-2029)	Long Term (2030-2050)
Data should 2 2 Realise and Davidles	15-20% Margin	17 - 20	20 - 24	24-27
Detached 1-2 Bedroom Dwelling	20%+ Margin	Not Feasible	16 - 20	20 - 27
Detached 3+ Bedroom Dwelling	15-20% Margin	24 - 25	25	25
	20%+ Margin	17 - 20	20 - 24	24 - 25
W 1 14 3 B 1 B 1 B	15-20% Margin	Not Feasible	19 - 28	28 - 40
Attached 1-2 Bedroom Dwelling	20%+ Margin	Not Feasible	Not Feasible	19 - 40
Attached 3+ Bedroom Dwelling	15-20% Margin	26 - 30	30 - 40	40
	20%+ Margin	Not Feasible	13 - 31	31 - 40

# Average Site Size

Typologies		Short Term (2020-2023)	Medium Term (2023-2029)	Long Term (2030-2050)
Data de da A A A de de com De allino	15-20% Margin	400m <sup>2</sup> - 330m <sup>2</sup>	330m <sup>2</sup> - 270m <sup>3</sup>	270m <sup>2</sup> - 230m <sup>2</sup>
Detached 1-2 Bedroom Dwelling	20%+ Margin	Not Feasible	400 m <sup>2</sup> - 330 m <sup>2</sup>	330m <sup>2</sup> - 230m <sup>2</sup>
Datashad 2: Badasaa Duallina	15-20% Margin	270m <sup>2</sup> - 250m <sup>2</sup>	250m <sup>2</sup>	250m <sup>2</sup>
Detached 3+ Bedroom Dwelling	20%+ Margin	400m <sup>2</sup> - 330m <sup>2</sup>	330m <sup>2</sup> - 270m <sup>2</sup>	270m <sup>3</sup> - 250 m <sup>3</sup>
Attached 4.2 Dadasan Danillian	15-20% Margin	Not Feasible	340m <sup>2</sup> - 220m <sup>2</sup>	220m <sup>2</sup> -150m <sup>2</sup>
Attached 1-2 Bedroom Dwelling	20%+ Margin	Not Feasible	Not Feasible	340m <sup>2</sup> - 150m <sup>2</sup>
	15-20% Margin	240m <sup>2</sup> - 210m <sup>2</sup>	210 m <sup>2</sup> - 160 m <sup>2</sup>	160m <sup>2</sup>
Attached 3+ Bedroom Dwelling	20%+ Margin	Not Feasible	530 m <sup>2</sup> - 200 m <sup>2</sup>	200m <sup>2</sup> - 160 m <sup>2</sup>

# Modelled Average Land Parcel Site Size per Dwelling by Dwelling Type

Density (Dwellings	Ave	erage Site Size p	er Dwelling (m.	2)
per Hectare)	Detached 1-2 Bed	Detached 3+ Bed	Attached 1-2 Bed	Attached 3+ Bed
10		730	7	
11		650		
12		590		
13		540		530
14		490		490
15	1	460		450
16	420	420		42
17	400	400		39
18	370	370		37
19	350	350	340	34
20	330	330	320	330
21	310	310	300	31
22	300	300	290	29
23	280	280	270	28
24	270	270	260	26
25	250	250	250	250
26	240		230	24
27	230		230	23
28	1.00		220	220
29			210	210
30			200	21
31			200	20
32			190	19
33			180	19
34			180	18
35			170	18
36			170	170
37			160	17
38			160	16
39			160	160
40			150	160

Source: M.E Hamilton Greenfield Residential Commercial Feasibility Model, 2020.

Page 6



# Slope Analysis Legend 15.11 - 25 Greater than 25 Degrees

# **Topography**

The Peacocke area contains extensive areas of gently undulating to rolling landform particularly in the southern areas. Development on sloping sites provides desirable vistas and over look, however current residential developments seeks level building sites and outdoor space which may compromise density due to requiring large sections.

Gradients in excess of 10 Degrees (20%) are typically unsuitable for the contemporary residential development approach, and are likely to require specific design approaches for residential development. The topography found within Peacocke will require high density development to undertake substantial earthworks which may be uneconomical to some developers thus impacted the anticipated dwelling density for the area.



Page 7

Item

12



# Hamilton City Council Te kaunihera o Kirikiriroa

### PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT



Page 9







Page 10

# **Density Example**

# **Hobsinville - Auckland**

# Zoning

The site is zoned (Auckland Unitary Plan)

· Mixed Housing Urban Zone.

# **Development Yields**

Development neids	
Total Area	9.69 ha
Open Space	0.11 ha
Roading	3.56 ha
Joint Access Lanes	0.53 ha
Residential Area	5.49 ha
Non-Residential area	43.3%
Total number of section	212
Average section size	259m²
Dwelling Density	39 units per ha

Dwelling denisty = Number of sections/Total area Average sectons size = (Residential area \*10 000)/Number of sections



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# **Density Example**

# Stonefields - Auckland

# Zoning

The site is zoned (Auckland Unitary Plan)

- · Housing and Apartment Zone,
- · Mixed Housing Suburban Zone, and
- Mixed Housing Urban Zone

# **Development Yields**

Total Area	9.59 ha
Open Space	0.30 ha
Roading	3.95 ha
Joint Access Lanes	0.25 ha
Residential Area	5.09 ha
Non-Residential area	46.9%
Total number of section	173
Average section size	294m²
Net Density	34 units per ha

Dwelling denisty = Number of sections/Total area
Average sectons size = (Residnetial area\*10 000)/Number of sections

Page 11

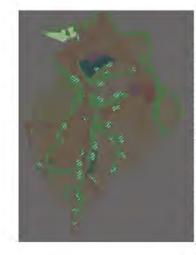


# Non-residential Land Use

# Transport network

The existing transport network within peacocke is made up of the following:

Total	90.2 ha
Existing road network	16.2 ha
Southern Links designation	74 ha



# Natural open space and gully network

The proposed and existing natural open space in Peacocke consists of the existing open space identified in the ODP and the proposed gully network and Waikato River edge, both of which have been defined by topography and ecological important. Along with the open space a number of stormwater wetlands have been identified in the structure plan to manage stormwater.

The Plan Change proposes a 20m buffer between the areas of ecological significancne and future development.

Total	165.3 ha
Stormwater wetlands	22.6 ha
Existing reserve area	8.3 ha
Proposed reserve (Gully & River)	134.4 ha



# Peacocke stage 1

stage 1 of Peacocke is the first stage of development within Peacocke and was opened up for development in 2010 ollowing the development of the first Structure Plan

Peacocke stage 1	51 ha
Total	51 ha

stage 1 has been substantially development with a remain capacity for approximately 243 additional residential sites.

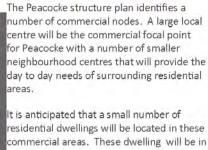


Proposed sports park
The Peacocke structure plan identifies a large sports and recreational park that will provide a community facility to both Peacocke and the wider Hamilton community. The site is currently in the process of being designated.

Total	18.8 ha
Community Park	5 ha
Sports park	13.8 ha

Page 12

# **Proposed Commercial centres**



It is anticipated that a small number of residential dwellings will be located in these commercial areas. These dwelling will be in the form of apartments above commercial activities.

Total	8.3 ha
Neighbourhood centres	2.1 ha
Local centre	6.2 ha

# Proposed education facilities

The Peacocke structure plan identifies two sites for education purposes. These sites are intended to meet the educational needs of Peacocke. These site are expected to be designated by the Ministry of Education

Total	8.2 ha
Education facility-south	4.0 ha
Education facility- north	4.2 ha

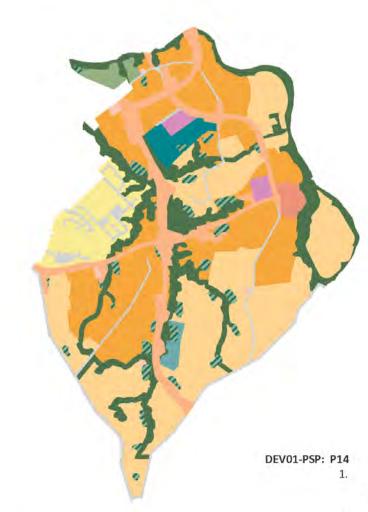
# Non Residential Area = 341.8 ha



Page 13



PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT



Page 14

# **PLAN CHANGE**

LAND USE	AREA		
Total Area	745 ha		

# **Existing and Planned**

Infrastructure				
Strategic Roading Network	74 ha			
Proposed Open Space	142.7 h			
Proposed Wetland Area	22.6 ha			
School Sites	8.2 ha			
Sports Fields	18.8 ha			
Commercial	8.3 ha			
Existing Roads	16.2 ha			
Total	290.8 ha			

# **Existing and Planned Development**

51 ha
51 ha

#### Residential areas

Hedracitat at eas	
Peacocke Medium Density Residential Zone	219,6 ha
Peacocke High density Residential Overlay Area	183.6 ha
Total	403.2 ha

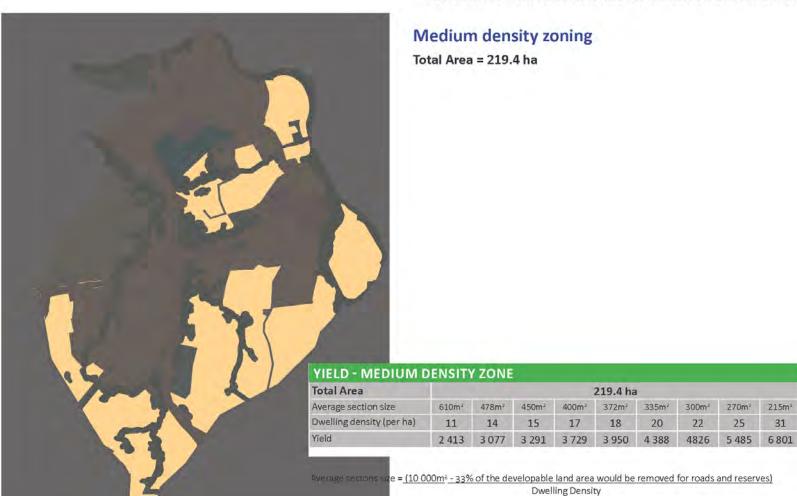
Development of the Peacocke Structure Plan achieves:

An minimum overall net residential density (excludes roads and open space) of 20 - 30 dwellings per hectare within the Peacocke Medium Density Precinct.

An minimum overall net residential density (excludes roads and open space) of 35 - 50 dwellings per hectare within the Peacock High Density Overlay.



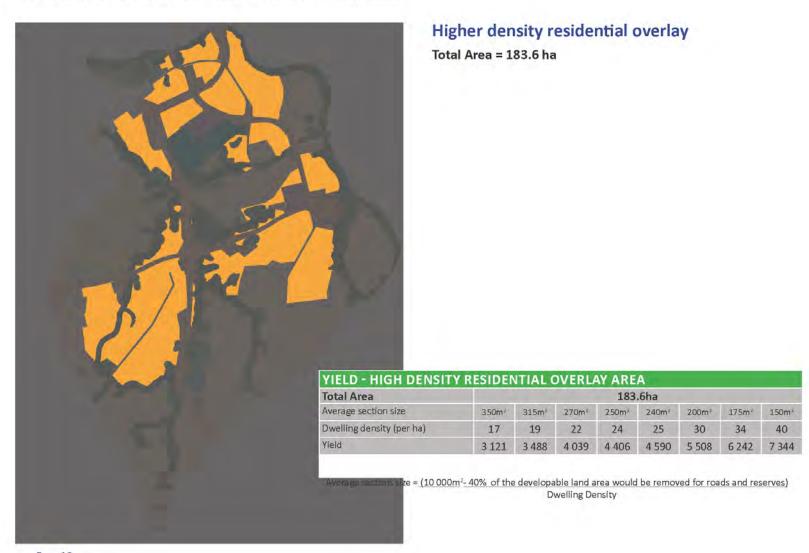




Page 15



PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT



Page 16

Low Yield	Average Lot Size	Dwelling density	
Medium Density Zone	475m²	14	3 077
High Density Residential Overlay Area	280m²	22	4 039
			7 116
High Yield	Average Lot Size	Dwelling Density	-
Medium Density Zone	330m²	20	4 388
High Density Residential Overlay Area	200m²	30	5 508
Total Yield			9 896
Estimated Plan Change Yields	Average Lot Size	Dwelling Density	
Medium Density Zone	450m²	15	3 294
High Density Residential Overlay Area	250m <sup>2</sup>	25	4 590
Total Yield			7 884

Average sectons size = (10 000m2 - 33% of the developable land area would be removed for roads and reserves).

Dwelling Density

Estimated residential dwelling yield for Peacocke = 7 884



PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT



Page 18

LAND USE	AREA		
Total Area	745 ha		

# Existing and Planned Infrastructure

Strategic Roading Network	74 ha
Proposed Open Space	142.7 ha
Proposed Wetland Area	22.6 ha
School Sites	8.2 ha
Sports Fields	18.8 ha
Commercial	8.3 ha
Existing Roads	16.2 ha
Total	290.8ha

# **Existing and Planned Development**

Peacocke Stage 1	51 ha
Total	51 ha

# Residential areas

Peacocke Medium Density Residential Zone	168.7ha	
Peacocke High density Residential Overlay Area	149.8ha	
Amberfield Development	71.5ha	
Northview Development	13.2ha	
Total	403.2 ha	



Total Area Average section size	168.7 ha								
	610m <sup>2</sup>	515m <sup>2</sup>	478m²	400m <sup>3</sup>	350m <sup>2</sup>	335m <sup>2</sup>	300m <sup>2</sup>	270m	215m
Dwelling density (per ha)	11	13	14	17	19	20	22	25	31
Yield	1855	2 193	2 362	2 867	3 205	3 374	3 711	4.217	5 229

Total Area	149.8ha								
Average section size	350m²	315m	270m=	260m²	240m²	200m²	175m²	150m	
Dwelling density (per ha)	17	19	22	23	25	30	34	40	
Yield	2 546	2 846	3 295	3 445	3 745	4 494	5 093	5 992	

PROPOSED YIELD RANGE							
Proposed Pan Change Yields	Average Lot Size	Dwelling density	Low Yield	Dwelling density	High Yield		
Medium Density Zone	335m²	14	2 362	20	3 374		
High Density Residential Overlay Area	200m <sup>2</sup>	22	3 295	30	4 495		
			5 657		7 869		

Existing Development	Average Lot Size	Dwelling Density	Low Yield	High Density	
Amberfield development	400m²	17	1265	1265	
Northview develpment	315m <sup>2</sup>	19	250	250	
Total Consented			1 515	1 515	- 1
Total Developable Area			5 657	7 869	
Total Yield			7 172	9 384	

Average sectons size =  $\frac{(10\,000\text{m}^2 - 33\% \text{ of the developable land area would be removed for roads and reserves)}{\text{Dwelling Density}}$ 

Page 19

Attachments

**Item 12** 

PLAN CHANGE 5 - PEACOCKE STRUCTURE PLAN - RESIDENTIAL YIELD ASSESSMENT

Page 20



# APPENDIX S

# Community Infrastructure in Peacocke Analysis of current citywide infrastructure and discussion of how this will be impacted by growth September 2019

The purpose of this analysis is to ...

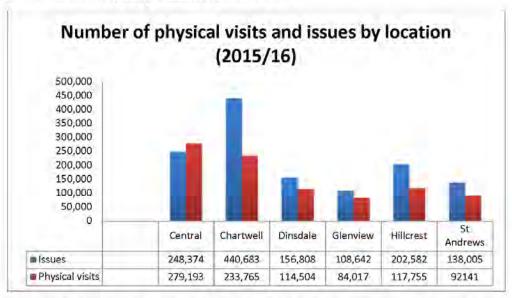
- Provide a high-level summary of current HCC provision of community infrastructure (libraries, aquatic facilities, indoor recreation facilities, and Community Centres/Halls
- Guide how community infrastructure should be provided to meet the needs of Peacocke
- Guide how community infrastructure should be provided for as part of the proposed Peacocke Structure Plan Change

# 1. Libraries

# 1.1 Current situation

Hamilton currently has a network of six libraries – the Central Library in Garden Place supported by neighbourhood libraries in Hillcrest, Glenview, Chartwell, Dinsdale and St Andrews. There are currently over 900,000 visits to these six libraries annually.

The Southwest of the city is currently serviced by Glenview Library on MacDonald Road. Glenview currently has the lowest number of visitors per year of any library in Hamilton and has potential to accommodate an increased population in the short term.



The Libraries Strategic Plan (2015) has an aim to move Libraries to a "Community Hub" model over time, so that libraries are seen more as focal points for community connections with people, information and different spaces.



# 1.2 Citywide needs

Hamilton's current network provides reasonable access to libraries across the city (see catchments from 500m-2km; Fig.1). The Hamilton Libraries Facilities Plan (2017) indicates that Rototuna, Fairfield, Enderley and Nawton are areas not well serviced by current library location. Demand on the East side of the city will be partially addressed through a new library to be built as part of the Rototuna Town Centre development in 2022.

Level of service??

Currently 50% of growth is infill – how much of this are we seeing in the Southwest?

# 1.3 Meeting future demand in Peacocke

Based on population projections of 12,000-20,000 residents in Peacocke

There is currently no planned provision for a new library in Peacocke, and subsequently no funding for the provision of land or construction of a library in Peacocke.

It is anticipated that short to medium term demand for library services in Peacocke could be met through current services at Glenview Library. In order for Glenview to be a realistic location for Peacocke residents, strong transport links through Peacocke to the library will be required. This includes roading and public transport, as well as safe and easy access through active transport such as cycling. Hillcrest Library will also be more accessible to the Southwest Hamilton community following the construction of a new bridge in 2024 to access Peacocke. Both libraries have potential to be redeveloped and expanded to meet future growth demands.

Longer term needs could be met through a new library and community hub, however land is not specifically set aside to do this and would need to be purchased by council. This could potentially be part of a new Town Centre, but at this time there is no funding in place to do this as part of the 2018-28 10-Year Plan.



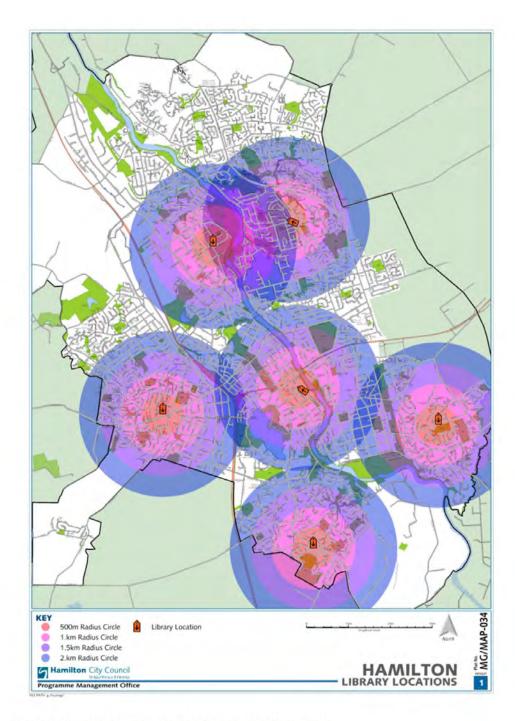


Figure 1 - Current Library locations and catchments (500m-2km)



# 2. Aquatic Facilities

#### 2.1 Current situation

South Hamilton is currently well served in terms of access to pools. Gallagher's Aquatic Centre (GAC) is next to Melville High School on Collins Road. It is one of two public pools owned and operated by Council. It is open 7 days a week and offers the following facilities and services:

- 25m lane swimming pool
- Learn to Swim and toddler pool
- Learn to Swim programme
- Outdoor Playground
- Barbeque area

GAC serves as a smaller but critical pool that complements Hamilton's premier aquatic facility at Waterworld. GAC is currently not operating at full capacity, meaning there is space to accommodate more swimmers as the city grows in the short to medium term.

#### 2.2 Citywide needs

The Waikato Regional Aquatics Strategy 2017 (WRAS) provides a detailed analysis of service and facilities in the Waikato Region. In terms of Hamilton, key findings include:

- There is currently a deficit in aquatic facilities in Hamilton, based on current facilities and the
  recommended "pools per head of population" ratio. This despite GAC not at full capacity –
  its southern location means it is not a realistic destination for large parts of the Hamilton
  population. This ration deficit will be partially addressed by a new pool being constructed at
  the Rototuna Town Centre in 2022.
- There is currently a lack of recreational aquatic facilities in Hamilton.
- It is projected that there will be an increase in the number of older people and people with disabilities in the future, and this will see a rise in demand for hydrotherapy facilities.

It is worth noting that public pools are also supported by a network of partner pools in Summer, as well as commercially owned pools that increase the network of aquatic facilities across the city, particularly in Summer. However, not all of these are accessible to the general public for a variety of reasons.

#### 2.3 Meeting future demands in Peacocke

There is currently no land set aside in Peacocke for a new aquatic facility to be developed.

The location of GAC means that the population in Southwest Hamilton is currently well served for pool space. The WRAS provides approximate driving time that most residents are prepared to travel to access facilities:

- National / Regional Facility 90 mins
- Sub-regional facility 30 mins
- Local facility 20 mins
- Learn to swim 15 mins

Attachment 19

This would indicate that a future Peacocke population will largely be within the catchment area of the existing facility at GAC. However, to ensure GAC is able to fully meet the needs of Peacocke residents in the medium to long term, certain factors will need to be considered:

- A potential expansion of GAC to include additional facilities and accommodate increased
  patronage due to growth in Peacock. Currently, land owned by the Ministry of Education
  (MoE) sits adjacent to GAC and could be used for expansion. This would require detailed
  conversations between Council and MoE to ensure a mutually beneficial outcome could be
  found to expand the facility.
- Strong transport links through Peacocke to GAC will be required. This includes roading and public transport, as well as safe and easy access through active transport such as cycling.



## 3. Indoor Recreation

#### 3.1 Current situation

There is currently no indoor recreation centre in the Southwest of Hamilton. However, its location is close to other recreation centres, particularly the YMCA in the central city.

Hamilton currently has a number of indoor recreation facilities throughout the city. Hamilton City Council owns the Te Rapa Sportsdrome in Pukete, as well as providing capital funding and an annual operation grant to "The Peak" in Rototuna to ensure it provides space for community sport and recreation. Council's facilities are supported by a network of privately owned or school halls which are used for community sports.

# 3.2 Citywide needs

As the city's population grows, there will be an increasing need for additional facilities, particularly in the West of the city. Council has committed to a partnership with the University of Waikato (see below) to partially address this need, and a further facility at Hamilton Girls High School is also in the planning phase.

The Sport NZ Indoor Recreation Strategy (2013) suggests that there should be a provision of one court per 9,000 people, meaning that Hamilton needs around 18 courts to meet this based on current population.

## 3.3 Meeting future demands in Peacocke

There is currently no planned provision for indoor recreation in Peacocke. Short term provision will continue to be met through existing facilities in the central city, and through other facilities in the wider Hamilton network.

In the medium term, Council has committed funding to work in partnership with the University of Waikato on the development of a new indoor recreation centre on their Hillcrest campus. Once the connecting bridge from Peacocke is complete in 2024, this will be a relatively accessible location.

The cost to build and maintain an indoor recreation centre would be significant. MoE has indicated that it will not be building a new high school in Peacocke and meeting existing needs at Melville High School. There may be opportunities to partner with MoE on an indoor recreation centre in a similar model to The Peak at Melville High School, or at a new High School should this position change. No conversation has been held with MoE on this point.

It is possible that land designated for a sports park could be used as the location of an indoor recreation facility if it was deemed this was the most appropriate community use.



# 4. Community Centres/Halls

#### 4.1 Current situation

There are currently 27 community halls and centres throughout Hamilton, split evenly between council and private ownership.

There are three centres in the Melville/Glenview area - none of which are owned by council. These are:

- · Glenview Community Centre Tomin Rd, Glenview
- Te Whare Kokonga, Bader St, Melville
- Shama Ethnic Women's Centre, Beatty Ave, Melville

# 4.2 Citywide needs

Community centres play an important role in building strong communities, providing local services and information. Hamilton is well served through a network of Community centres and houses throughout the city.

There is no established or recommended level of service for community centre or houses in Hamilton.

# 4.3 Meeting future demands in Peacocke

There is no space set aside specifically for a Community Centre in Peacocke. In the short-medium term, it is anticipated that existing centres could meet the needs of a growing community in Peacocke.

It is possible that any future Library build will incorporate aspects of a Community Hub (see Libraries section above), which could meet this need. It is also possible that the Council could work alongside interested sections of the community to develop a stand alone community centre. However, any funding for such projects would be the decision of future councils.



# 5. Peacocke Structure Plan and proposed plan change

Given the information outlined in this report, there are some options related to how community infrastructure needs are addressed in the Peacocke

#### Options

1. Request that land is zoned for community facilities as part of the plan change

## Pros

- Provide greater certainty on land provision
- Likely result in lower purchase price

#### Cons

- · Very little flexibility as zone boundaries are fixed
- · Would constrain the use of private land
- Would require sound evidence base to justify and could be appealed
- 2. Request that the neighbourhood centre and/or suburban centre provision of the PPC provides for community facilities

## Pros

- Ensures that the plan provides for the activity
- Provides flexibility on location, size and whether you even provide
- Requires less evidential basis for land requirements

# Cons

- · Provides less certainty than zoning land
- Potentially higher purchase price

#### .

#### Recommendation

## 1.3 Peacocke Structure Plan and proposed plan change

- No requirement to provide for a specific location through zoning land for Community Facilities
- Ensure transportation network provides strong links to existing Community Facilities.



# **APPENDIX T**

**Hamilton City Council** 

# Peacocke Structure Plan Review: Recommendedations

Final report

Prepared for: Hamilton City Council

Prepared by: MRCagney Pty Ltd, Auckland, New Zealand



Final Report

# Document Information

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Attachment 20

Peacocke Structure Plan Recommendations Final Report

# Quality Assurance Register

Issue	Description	Prepared by	Reviewed by	Authorised by	Date
1	Final Report	BB	SC	ВВ	10 March 2020
				1	
		-			

**MRC**agney

15

Final Report

# Contents

1	Introd	luction	·	4
	1.1	A note	about change	4
2	Struct	ture Plan F	Recommendations	5
	2.1		ives and policies	
	2.2	Develo	pment assessment criteria and incentives	6
		2.2.1	Proactive pre-design forums	7
		2.2.2	Incentivising good practice	7
		2.2.3	Community inclusive access audits and safe system audits	8
3	Regio	nal Infrast	tructure Technical Specifications	14
4	Sumn	nary and C	Onclusions	15



3

Attachment 20

Hamilton City Council
Te kaunihera o Kirikiriroa

Peacocke Structure Plan Recommendations Final Report

# 1 Introduction

The Peacocke growth area in Hamilton City is subject to a Structure Plan Review. Hamilton City Council (HCC) commissioned MRCagney to provide advice to promote outcomes of inclusive access, mode shift goals, and Vision Zero principles in the Peacocke Structure Plan Review. This work builds on previous community engagement, including a workshop in December 2019 exploring what 'good community' looks like in Hamilton. Specifically, the work aims to identify rules, incentives, and planning processes that can be changed or introduced to achieve this 'good community' as the Peacocke growth area is developed.

This report describes in general terms recommended changes and additions to two separate but related documents or sets of documents. First, Structure Plan provisions are recommended that are aimed at aligning with the desired outcomes. Second, changes and additions to the Regional Infrastructure Technical Specifications are recommended, to ensure that technical standards and design guidance supports rather than undermines the intent and policies of the Structure Plan as well as broader Hamilton City District Plan objectives.

Comments are also made in each section about the design, application and approval processes that is a prerequisite to development. This is because integrating inclusive access, mode shift goals, and Vision Zero principles and translating these to actual built form on the ground will require a paradigm change in street design: from the conventional vehicle focused engineering design and approval processes that typically result in 'Austroads minimum standards' consistent geometric designs to maximise speed profiles, to a people centred approach<sup>1</sup> to street design where the safety and access needs of the most vulnerable road users are considered as a higher priority.

Non-Council developers and their designers, who are designing development for an area or precinct, also need to understand the new approach and need to have certainty that:

- the Council approval processes are open to and encourage people-centred design;
- the Council approval processes support the intent of and objectives included in the structure plan provisions; and
- unconventional designs are supported by Council technical standards.

Developers will then have confidence that their plans will be approved by the Council planners and development engineers as part of the regulatory processes.

Recommendations are listed in bold italics below each section heading.

# 1.1 A note about change

Recommendation: Establish and maintain open co-design process for the Peacocke Structure Plan with HCC elected members, staff, and stakeholders

The overarching purpose of this work is to provide a means for developers to build streets and places in Peacocke that are most likely to deliver HCC outcomes for community. In doing so, the work acknowledges that there is a disconnect between current outcomes Hamilton seeks, and new infrastructure that falls short of meeting those objectives. Thus, this report recommends change. Change comes with risk; it takes effort to

The Vision Zero principle is that it is not eltically acceptable that people are falled on sensually injured when nowing within the road transport system, and this applies to all road users







Final Report

work differently, and to challenge preconceived beliefs about what 'best practice' really looks like, and how it is delivered.

To mitigate risk associated with change, open and continuous dialogue between all stakeholders is recommended, as early as possible. Elected members, HCC staff, the development community, professional planners and transportation engineers, and community representatives themselves can all be involved at various stages in developing specific improvements to policy, rules, and process that support the outcomes laid down in local and national policy documents. Early, authentic, and open co-design with stakeholders is the best way to 'de-risk' the change process for HCC.

# 2 Structure Plan Recommendations

# 2.1 Objectives and policies

Recommendation: Provide strong Structure Plan Objectives and Policies, aimed at achieving the outcome of 'good community', emphasising people centred design, and aligning with the Outcome Areas for Access Hamilton (Safe; Smart; Choice; Growth).

An effective structure plan has strong objectives, policies, and assessment criteria. The structure plan objectives and policies should aim to achieve the broader HCC Operative District Plan (ODP) objectives, but be articulated to address the specific environmental outcomes sought within the structure plan area. In the case of the Peacocke Structure Plan Area, we think the outcomes related to 'good community' will require greater emphasis on people centred design to be included in the objectives and policies. Examples of this emphasis could be that the policies reference new or different street design standards that more explicitly promote connectivity and inclusive access above ease and efficiency of motor vehicle movement. HCC could develop their own specific standards to be appended to the ODP, and/or reference other design guidance (such as the Auckland Transport Urban Street and Design Guide<sup>2</sup>).

The purpose of any specific structure plan objectives and policies is to communicate to developers that the focus in the Peacocke Structure Plan Area is on connectivity and safety for walking, cycling, and public transport, ahead of provision for private cars, albeit that car will be accommodated. Explicit emphasis of that objective is important as it represents a shift in focus from development that has previously occured in the City, which tends to provide for motor vehicle efficiency before considering other modes which deliver more effectively on Access Hamilton objectives.

The ODP objectives and policies relevant to delivering good community outcomes are summarised in the following excerpts:

1. Policy: Transport Network 25.14.2.1b

Objective: Integrated Transport Network 25.14.2.1: An integrated multi-modal transport network that meets national, regional and local transport needs and is: • Responsive • Efficient • Affordable • Safe • Accessible Sustainable • Integrated with land use

Policy: The transportation network and related infrastructure is planned, designed, constructed and managed in a manner that: ... ... iii. Contributes to safe and efficient multi-modal transport corridors serving the Central City, business centres and other key destinations.; iv. Contributes to a transportation network that:

- A. Is accessible to all users, including transport disadvantaged and mobility impaired.
- B. Maximises opportunities for walking, cycling and passenger transport.

7 https://gi.gov/.ny/media/1790685/urban-sheel-ang-read-design-gungapaf



5



Final Report

- C. Creates good connections between residential areas, passenger transport services, schools, employment nodes, recreation areas, shops and other destinations.
- D. Provides a choice of routes and transport modes for travelling.
- 2. Policy: Transport Network 25.14.2.1b [transport]
- vi. [Transport] Provides access to and has regard for the safety and needs of the mobility impaired, transport disadvantaged, cyclists, pedestrians, passenger transport users, and others using the transport corridor to move from place to place.
- 3. 25.15 Urban Design: 25.15.1 Purpose
- d) Quality urban design assists to enhance environmental, social, cultural and economic wellbeing by establishing urban environments that:
- i. Are competitive, thrive economically and facilitate creativity and innovation.
- ii. Provide a choice of housing, work and lifestyle options.
- iii. Are healthy and assist to sustain people and nature.
- iv. Are inclusive and offer opportunities for all citizens.
- v. Are distinctive and have a strong identity and sense of place.
- vi. Are well governed and have a shared vision and sense of direction.
- vii. Are well connected and accessible for a range of users.

# 2.2 Development assessment criteria and incentives

Recommendation: Proactive engagement with the land development community is essential to promoting good process, particularly when expectations for design have changed. Offer open, early, informal engagement to work alongside the land developers, highlighting the outcomes sought from the Peacocke Structure Plan area, and any new processes and tools available to promote those outcomes.

Recommendation: Introduce incentives or guidance for developers to design best-practice streets and communities through exemplar street and community design templates (developed specifically for the Peacocke structure Plan Area, or through reference to other design guidance such as the AT Urban Street and Road Design Guide); and/or require developers to design best practice streets through performance-based criteria that require developments meet Hamilton's objectives for transport.

Recommendation: Include community inclusive access audits (incorporating walking, cycling, and micromobility permeability) as an information requirement of development applications for the Peacocke Structure Plan area, alongside routine safety audit requirements during each phase of design.

The ODP promotes good principles for design but provides limited tools for council to promote best-practice development. Transport design review is limited to the recommendations arising from Integrated Transport Assessments. Such assessments rarely consider the overall impact of a development on Hamilton's District Plan objectives for healthy, environmentally sustainable and accessible communities, largely because there are no agreed mechanisms to assess those outcomes. This problem is not unique to Hamilton City Council. Throughout planning documents review from around New Zealand, there is a lack of a consistent and coherent thread in District Plans that carries through the objectives, policies and assessment criteria that would induce or require a designer / engineer to design for the outcomes sought.



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Final Report

An example of the disconnect between ODP policies and assessment mechanisms is related to design that promotes opportunity for walking and cycling. In general in New Zealand, data linking potential walking and cycling volumes, for example, to health benefits and good design is limited. Trip generation calculations for development are biased towards vehicle movements, because there is good data about vehicle trip generation, but a lack of data available about the potential for walking and cycling in well-designed New Zealand communities. Therefore, transport planners and engineers rely on 'best practice' assessment of motor vehicle traffic flows and trip generation. The outcome can be over-reaction to predicted traffic delays and queues arising from a development, which are then 'mitigated' during the design process with wider intersections and more road space dedicated to motor vehicles. Without tools to promote the value of road space or 'green corridors' dedicated to active travel, outcomes (i.e., car-centric development) can conflict with ODP objectives and policies.

There are three ways that Hamilton City could strengthen the criteria, compared with current District Plan assessment mechanisms:

- Proactive pre-design forums for land developers to meet with HCC staff to discuss the outcomes sought from Peacocke, and any new processes or tools intended to support delivery of those outcomes (could occur in the form of preapplication meetings)
- Incentivise (or require) good practice through promotion of principles and process, and performance-based development assessment criteria
- Introduce community inclusive access audits alongside a strengthened safe system audit process, to promote Vision Zero, mode shift, and inclusive access principles throughout

# 2.2.1 Proactive pre-design forums

Delivering on HCC objectives for land development requires change from development practices of the past. HCC can 'de-risk' the design process by being proactive about meeting with potential site developers before they begin design. Sharing the vision and desired outcomes for Hamilton generally, and the Peacocke growth area in particular can lead into conversations about new or amended processes, incentives, and rules so that developers are on-board from the start.

Engagement can be in the form of drop-in coffee sessions with HCC staff, where potential design exemplars and visualisations of potential development scenarios can be presented.

# 2.2.2 Incentivising good practice

Incentivising good development practice works by fostering partnership between Council and Developers. Partnership can mean providing exemplar designs that address multiple objectives. Examples include local street cross-sections that promote walking, cycling, and micromobility, as well as inclusive access and designing for low speeds through appropriate street network form and road geometry, while reducing car dependence; and permeability tools such as multi-functional green corridors that combine water and walking/cycling paths through subdivisions.

The implicit incentive for good practice is an overall increase in community amenity for developments, leading to higher profit for developers. Promoting access for walking and cycling, and connectivity to local public transport translates into narrower streets and smaller intersections, increasing the proportion of land in a development available for residential and commercial uses. Incentives for developers to proactively engage with pre-application meetings could be prioritised consent processing.



7



Final Report

The precise nature of incentives, and of designs that promote best practice should be worked through with Council and stakeholders, to provide the greatest chance of success. We recommend that HCC requires minimum levels of connectivity through improved technical specifications (and/or links to specifications from outside of the Waikato Region), drawing on examples of development that promotes permeability and connection (see for example the Waikato District Plan for the Pokeno Structure Plan (Figure 1)). Individual developments must also align with the context of the Peacocke area as a whole, so the design templates should provide for consistency between different developments.

# 2.2.3 Community inclusive access audits and safe system audits

To promote Access Hamilton outcomes of mode shift and safety, routine safe system audits should be provided (as is usually the case and required by the ODP). The audits should be completed alongside a new community inclusive access audit.

Safe system audits should be required at each stage of design. The outcomes should be articulated alongside design exemplars provided as part of incentivising good practice, so that the story of overarching outcomes is threaded through each stage of the development process. Safe system audits critique a development from the perspective of minimising risk of road death and serious injury.

To promote mode shift and inclusive access, it is recommended that a bespoke community inclusive access audit is also conducted. The purpose of the community audit is to assess the extent to which the design promotes relevant structure plan objectives, thereby carrying them through the design phase and testing development to promote the outcomes intended by the overarching policies:

ODP Policy: Transport Network 25.14.2.1b:

The transportation network and related infrastructure is planned, designed, constructed and managed in a manner that...

- A. Is accessible to all users, including transport disadvantaged and mobility impaired.
- B. Maximises opportunities for walking, cycling and passenger transport.
- C. Creates good connections between residential areas, passenger transport services, schools, employment nodes, recreation areas, shops and other destinations.
- D. Provides a choice of routes and transport modes for travelling.

While the new (or referenced) technical design guidance will likely limit risk that designs do *not* provide for inclusive access for all modes, there will remain opportunities for improvements at the design stage, that should be included to avoid costly retrofit post-construction, and to avoid a sub-optimal street layout being established.



8



**Final Report** 

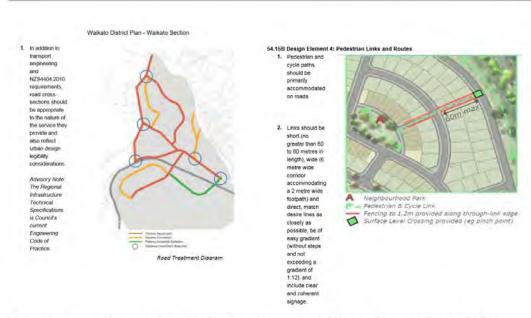


Figure 1: Excerpts from Waikato District Plan, Section 54.15B Design Element 3: Roads and Accessways



9

Attachments



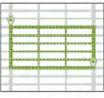
# Block size

Block sizes have a large influence on the walkability of neighbourhoods. Small blocks offer more route choices and greater ability to filter through built-up areas. Block sizes should be small and designed to absorb a variety of building and housing types. Block sizes in centres and commercial areas should support a variety of land uses

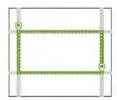
and a walkable public realm. Permeability for pedestrians can be made higher than for cars by having mid-block alleys or covered arcades specifically for people on foot.

Blocks that are longer northsouth than east-west may provide better for solar access. Mid-block rear lanes may be particularly useful in supporting higher density housing types and other types of land uses.

Smaller block sizes and rear lanes may require a larger investment in linear roadway. This increased length of streets (and associated paths and lanes) can be offset in overall road reserve area by utilising a diversity of street types, including narrow streets.







Pedestrian options for different block size

#### Intersections and intersection density

Intersection density (which is related to block size) may be the most important predictor of walkable neighbourhoods and increased public transport use. Intersection density reflects the ease of moving around and the options that people have for doing so.

Cross (+) type, or four-way intersections, are also associated with high levels of walkability. Four-way intersections are associated with grid-shaped street networks and their utility reflects the ease for pedestrians to cross the street, and the likelihood (if associated with short blocks) for lower vehicles speeds.







1500 Intersections/2.6 km²

150 Intersections/2.6 km²

15 Intersections/2.6 km²

Figure 2 Block size and intersection density to promote access (from Auckland Transport Urban Street and Road Design Guide)



10



## Permeability vs. connectivity

Street networks with a high intersection density and short block lengths have high levels of connectivity, as there are many route options. As street connectivity increases, there are more opportunities to manage permeability differently for vanious transport modes. Filtered permeability can retain high connectivity, while creating environments that achieve their strategic objectives.

Strategies can be developed that prioritise desired modes along direct routes. For instance, Local Paths (also known as Greenways or Bicycle Boulevards) can prioritise walking and cycling by having walking- and cycling-only links or by restricting vehicle traffic by filtering. Similar techniques can be deployed for public transport routes, where new or designated routes allow for public transport vehicles only. These designs favour the

public transport routes with more direct journeys.

The Local Path Design Guide describes how neighbourhood street networks can be retrofitted to prioritise walking and cycling. These same strategies can be applied to greenfield neighbourhoods.

The diagram below illustrates how multiple networks overlap, creating corridors with focuses on different modes.

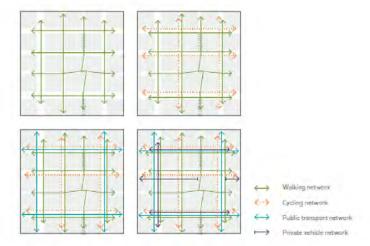


Figure 3 Permeablity and connectivity, from (Auckland Transport Urban Street and Road Design Guide)





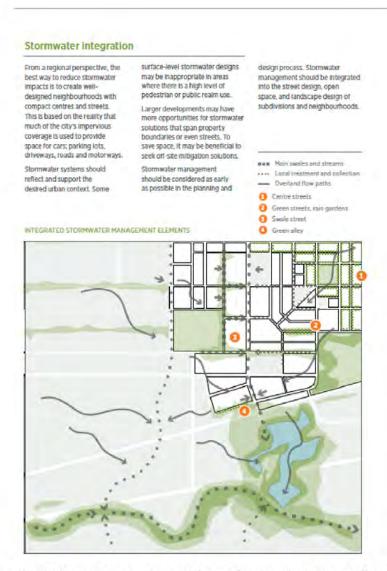


Figure 4 Stormwater management for good community outcomes, from Auckland Transport Urban Street and Road Design Guide



12





Centre streets



Green streets, rain gardens



Swale street



Green alle

Figure 5 Incorporating green corridors and stormwater management into street design, from Auckland Transport Urban Street and Road Design Guide





# 3 Regional Infrastructure Technical Specifications

Recommendation: More explicit emphasis of universal design and provision for walking, cycling, and micro-mobility should be included in the RITS. For the Peacocke Structure Plan Area, specific specification details that could be reviewed are listed, in advance of a more comprehensive review of RITS that incorporates best-practice design.

There is opportunity to improve the design guidance provided in RITS to better align with the outcomes sought from the ODP and Access Hamilton. It is noted that although the RITS is a document that sits outside the District Plan and the ODP takes precedence, nonetheless developers rely on standards and guidance in the RITS when designing new development. The Council development engineers also rely on the standards of the RITS to approve detailed designs of infrastructure to confirm it is of an adequate standard to be transferred to public ownership, i.e. to ensure it meets the minimum levels of performance and durability so that it will not be a liability for the Council in the future due to excessive maintenance or replacement requirements.

Some the technical outcomes are linked to ODP criteria, which in some cases promote poor environments in a Vision Zero context. Examples that should be changed include:

 Conflict between 'minimum sight distance from vehicle crossings' and safe streets for people (See ODP Page 25-122).

Minimum sight distance on a 60km/h arterial road is 150m which encourages high speeds. Note distances are based on Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections (Equation 1 and 2).' Recent design guidance produced in response to Vision Zero shows that design speed for any street where a significant number of pedestrians cross the road should be no greater than 30km/h. Auckland Transport street design guide suggests a main street arterial should have a speed of less than 30 km/hr, and a mixed use arterial should have a speed of 30-40 km/h in centres (with access limited). The limit on streets without accesses or pedestrians could be 50 km/h. Limits of 60-80km/h should be reserved for peri-urban areas with no accesses and very few pedestrians.

Minimum parking requirements (Table 15-1a, appendix 15 of Volume 2 of the ODP)

There are no reasonable objectives and policies that can support minimum parking requirements. These should be removed from district plans.

Some generic themes from the RITS should be changed, as follows:

3) RITS Section 3.3.2.1; Collector road intersection

A Collector Road in a residential area does not need to be navigable by a 19m semi-trailer without crossing a centreline. In preference, the occasional articulated truck in a residential area can use both lanes to navigate intersections, with a pilot vehicle where necessary.

RITS section 3.3.9.1:Kerb radii

To promote ODP objectives, Vision Zero, and inclusive access, the specifications for kerb radii should be amended to promote low speed environments. For example, the statement "All road intersections in residential areas should have a kerb radius at intersections of 4m to 6m. An alternative and reduced kerb radius may be considered to enhance pedestrian facility in low speed environments, and shall be subject to the approval of Council." In this case the assumption should be the other way around, i.e. low kerb radii should be promoted



14



Final Report

by default, not by exception. Low kerb radii promote connectivity, low speeds, attractive environments for walking and cycling, and low overall crash risk.

Table 1: Technical specifications recommended for review, from Waikato Regional Infrastructure Technical Specifications

RITS Ref	Description	Recommendation				
P40-41: Section 1.13.8	Details rules for 'Cyclists and Pedestrjans' at works sites:	Engagement with Hamilton's disability sector suggests that current industry delivery of temporary traffic management is not always inclusive of all people and modes. Strengthen works site audit processes above and beyond current requirements (i.e., more comprehensive and more regular audits of works)				
P91: Note Section 3.2.4.5	Maximum walking distances from a Lot to a collector or Arterial Road'	Recommend new criteria to promote walking, cycling, and micromobility permeability above motor vehicle access				
P91/92: Section 3.2.5	Audit procedures	Recommend 'Community inclusive access' audit as standard				
P92: Section 3.2,6	Design and Access Statement	Include more specific requirements for inclusive access for walking, cycling, and micromobility				
P109/110: Section 3.3.16.3	Pedestrian Accessways	Add to clause 3.3.16.3, 'Barriers should not be installed on slopes' due to difficulty negotiating manual wheelchairs and other large mobility devices.				
P110: Section 3.3.17						
P179	9 As-built data checklist Include checklist criteria for footpath width, grade, and crossfal channel measurements to ensure universal access					
P195 D3.1.3 / Drawing 3-4	Footpath location, width, crossfall, and grade	Recommend footpath crossfall of 1%, no greater than 2%				
P253 D3,10.3 / Drawing 3-62	Paved raised pedestrian ramp	Recommend only smooth (asphaltic concrete or concrete) surfaces for all pedestrian areas				

# 4 Summary and Conclusions

The recommendations arising from a review of planning process within Hamilton and in other places in Australasia are summarised in the timeline below. It is concluded that there are gaps between the vision and outcomes sought by the HCC ODP, and associated strategy documents that are intended to guide investment in a growing city. Mechanisms to bridge those gaps require change. The risk associated with that change is best managed with open and authentic dialogue between HCC and all other stakeholders.



15



Final Report

# **Table 2: Summary of Recommendations**

Reference in this Scope of Description recommendation			
1 Introduction	Peacocke Structure Plan area	Establish and maintain open co-design process for the Peacocke Structure Plan with HCC elected members, staff, and stakeholders	March 2020
2.1 Objectives and policies	Peacocke Structure Plan area	Provide strong Structure Plan Objectives and Policies, aimed at achieving the outcome of 'good community', emphasising people centred design, and aligning with the Outcome Areas for Access Hamilton (Safe; Smart; Choice; Growth).	March 2020
22 Development assessment criteri.a and incentives	Peacocke Structure Plan area	Proactive engagement with the land development community is essential to promoting good process, particularly when expectations for design have changed. Offer open, early, informal engagement to work alongside the land developers, highlighting the outcomes sought from the Peacocke Structure Plan area, and any new processes and tools available to promote those outcomes.	April 2020
		Introduce incentives or guidance for developers to design best- practice streets and communities through exemplar street and community design templates (developed specifically for the Peacocke structure Plan Area, or through reference to other design guidance such as the AT Urban Street and Road Design Guide); and/or require developers to design best practice streets through performance-based criteria that require developments meet Hamilton's objectives for transport.	April 2020
		Include community inclusive access audits (incorporating walking, cycling, and micromobility permeability) as an information requirement of development applications for the Peacocke Structure Plan area, alongside routine safety audit requirements during each phase of design.	April 2020
3 Regional Infrastructure Technical Specifications	Peaccoke Structure Plan area / City wide	More explicit emphasis of universal design and provision for walking, cycling, and micromobility should be included in the RITS. For the Peacocke Structure Plan Area, specific specification details that could be reviewed are listed, in advance of a more comprehensive review of RITS that incorporates best-practice design.	June 2020





Ian Wallis Associates Ltd

# **APPENDIX U**

# **South Hamilton and Peacockes public transport review**

**Working paper** 

Prepared by Adam Lawrence lan Wallis Associates Ltd adam@ianwallis.org

9 April 2020

Attachment 21



lan Wallis Associates Ltd

# **Contents**

1.	Intr	oduction	3
2.	Вас	kground	3
	2.1.	Current network	3
		2.1.1. Overview	
		2.1.2. Performance criteria	
	2.2.	Peacockes Structure Plan	6
		2.2.1. Background	
		2.2.2. Local road network and bus stop locations	
		2.2.3. Population catchment estimates	
		Regional Public Transport Plan future network concept	
3.		es and opportunities	
		Existing urban area	
		Future urban area (Peacockes)	
4.	Fut	ure network concept for south Hamilton	12
	4.1.	Proposed network structure	12
	4.2.	Supporting public transport infrastructure	15
		4.2.1. Glenview Shops interchange	
		4.2.2. Amberfield Shops Interchange	
		4.2.3. Peacockes School interchange	
		4.2.4. Recommended Activity Centre	
		4.2.6. Wairere Drive interchange	
		4.2.7. Bus priority measures.	
	4.3.	Peacockes arterial roads	
		4.3.1. Completion of Ring Road extension (2023)	
		4.3.2. Role of East/West Arterial (2025/26)	. 20
		4.3.3. Limited access North/South Arterial (2030+)	
	4.4.	Other options considered	20
5.	Pot	ential staging plan	21
	5.1.	Stage 1 – Basic service enhancements including Peacockes stages 1a/1b and Amberfield	
		commencement	
		5.1.1. Stage 1a – Basic service enhancements and Peacockes stages 1a/1b	
		5.1.2. Stage 1b – Weekend service enhancements and extension to Amberfield Shops	. 23
	5.2.	Stage 2 – Services extended to Amberfield south and improved access to University and Hamilton East	24
	5.2	Stage 3 – Services extended along East/West Arterial	
		Stage 4 – Services extended to Peacockes south and East/West Arterial service enhancements	
		Stage 5 – Services extended to Ruakura employment area and weekend service enhancements	
6.		ting and funding	
0.		Gross operating cost estimates	
		Passenger demand and net cost estimates	
_		Funding implications	
7.		clusion	
		x A Peacockes population catchment estimates	
App	endi	x B Other options considered	32

N283 South Hamilton PT review working paper Final 20200409.docx

Page 2 of 35



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# 1. Introduction

The purpose of this review is to identify options to improve existing public transport services in south Hamilton and to support the development of the Peacockes structure plan area. This includes options for combining the Comet and Fitzroy bus routes and for utilising a new river crossing connecting to the Cobham/Wairere Drive interchange.

# 2. Background

The study area includes the residential area south of Waikato Hospital (i.e. Mahoe, Glenview, Fitzroy) and the Peacockes Structure Plan area south of the Waikato River.

# 2.1. Current network

#### 2.1.1. Overview

The current network relevant to the study area is made up of three bus route as set out below and shown in Figure 2.1 on page 4. There are no services within the Peacockes Structure Plan as this area is still undeveloped, with development to occur over the next 10-30 years (refer section 2.2).

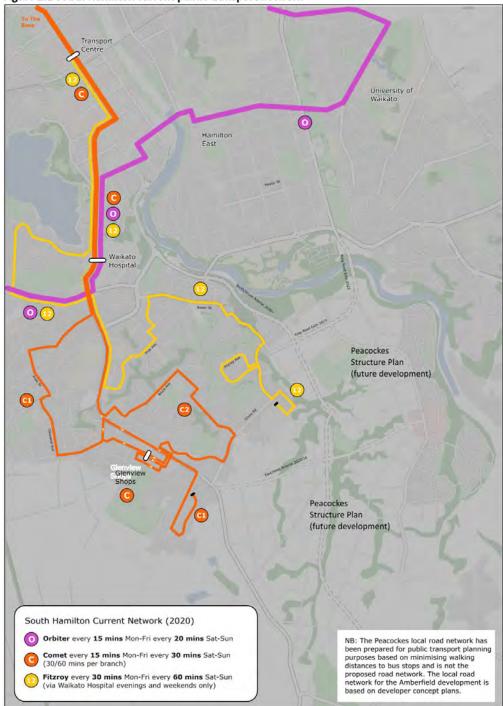
- Comet (route C) is a *Frequent* route between Waikato Hospital and The Base, with two branches extending south to Mahoe (C1) and Glenview (C2).
  - Route C operates every 15 minutes weekdays (30 minutes per branch) and every 30 minutes evenings, weekends and holidays (60 minutes per branch).
- Fitzroy (route 12) is a Connector route between Fitzroy and the Transport Centre via Bader St and Pine Ave. The route operates via Lake Crescent weekdays and via the Hospital evenings, weekends and holidays.
  - Route 12 operates every 30 minutes weekdays and every 60 minutes evenings, weekends and holidays.
- Orbiter (route 0) is a Frequent route that provides east/west connections for passengers transferring at Waikato Hospital but otherwise does not directly serve the study area.
  - Route O operates every 15 minutes weekdays and every 20 minutes evenings, weekends and holidays.

The Orbiter is not part of the current review, but this route has been included due to its important role as part of the core public transport network. It also provides east/west connections for people living in the study area and is a useful comparator for any changes to the Comet or other services. The Peacockes Structure Plan provides an opportunity for additional east/west services (via the south) as part of an expanded core public transport network.

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Figure 2.1 South Hamilton current public transport network



N283 South Hamilton PT review working paper Final 20200409.docx

Page 4 of 35



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# 2.1.2. Performance criteria

A summary of selected service monitoring performance criteria is provided in Table 2.1. The Comet and Fitzroy routes combined carry approximately 15% of passengers within the Hamilton urban area.

Both the Comet and Fitzroy routes are well utilised with an average of 0.9 to 0.7 passenger boardings per service-km in 2018/19. The commerciality ratio (farebox recovery) for the Comet and Fitzroy routes combined is 38.2%, compared to 36.2% for the Orbiter and 31.1% for the Hamilton urban network.

Table 2.1 Route statistics for Comet, Fitzroy and comparator routes for 2018/19

					Hamilton
2018/19	Comet*	Fitzroy	Subtotal	Orbiter	Urban
First boardings	344,597	87,466	432,063	803,826	2,733,915
Transfer boardings	80,430	20,318	100,748	120,008	754,369
Total passenger boardings	425,027	107,784	532,811	923,834	3,488,284
Number of vehicle trips operated	34,428	15,264	49,692	39,132	354,300
Passenger boardings per vehicle trip	12.3	7.1	10.7	23.6	9.8
Service-kms operated	496,488	155,280	651,768	1,339,488	4,953,433
Passenger boardings per service-km	0.9	0.7	0.8	0.7	0.7
Average passenger trip length(c)	Unknown	Unknown	Unknown	Unknown	8.4
Total passenger-kms	-	-	-	-	29,301,586
Passenger-kms per service-km	-	-	-	-	5.9
Gross operating cost (excl. GST)	\$1,584,859	\$495,675	\$2,080,535	\$4,344,591	\$15,972,232
Fare revenue (including substitutes) (excl. GST)	\$621,436	\$172,804	\$794,240	\$1,571,013	\$4,960,477
Net operating cost (excl. GST)	\$963,423	\$322,872	\$1,286,295	\$2,773,578	\$11,011,755
Fare revenue per passenger journey	\$1.80	\$1.98	\$1.84	\$1.95	\$1.81
Subsidy per passenger journey	\$2.80	\$3.69	\$2.98	\$3.45	\$4.03
Commerciality ratio	39.2%	34.9%	38.2%	36.2%	31.1%

#### Notes:

- (a) Comet figures are 12-month estimate based on the first 10 months of operation.
- (b) Transfer boardings have been estimated based on reported Hamilton Urban ratio of first boardings to transfer boardings
- (c) Passenger trip length data is not collected at route level

A breakdown of the average number of passengers boarding per day within the study area is given in Table 2.2. This shows a large proportion of Comet passengers travel to or from destinations north of the Transport Centre. South of Waikato Hospital the two Comet branches (Mahoe and Glenview) each have just over 300 boardings per day and the Fitzroy route around 200 boardings per day.

Weekend demand is approximately two-thirds of weekday demand. The Fitzroy route has a higher ratio of 77% of weekend to weekday demand. This is despite operating every 60 minutes weekends which is half the weekday frequency. During weekends the Fitzroy route does not service Lake Cres and takes a more direct route via the hospital which may contribute to a relatively high ratio of weekend to weekday demand.

Table 2.2 Passenger boardings per day on Comet and Fitzroy routes

	Weekday (WD)			Weekend (WE)			WE:WD
Aug/Sep 2019	Comet	Fitzroy	Total	Comet	Fitzroy	Total	ratio
South of Hospital							
Route C1 (Mahoe)	340	-	340	209	-	209	61%
Route C2 (Glenview)	302	-	302	175	-	175	58%
Route 12 (Fitzroy)	-	194	194	-	149	149	77%
Study area total	643	194	837	384	149	533	64%
Hospital - Transport Centre	407	247	655	275	153	428	65%
Transport Centre - The Base	550	-	550	424	-	424	77%
Total	1,600	441	2,041	1,083	302	1,386	68%

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Page 5 of 35

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# 2.2. Peacockes Structure Plan

#### 2.2.1. Background

The Peacockes Structure Plan covers an area of approximately 750 hectares and has been designated as an area to provide for Hamilton's future urban growth. The indicative business case to the housing infrastructure fund in March 2017 identified two key stages:

- Stage 1 has an initial capacity of 850 dwellings (Stage 1a 500 lots, Stage 1b 350 lots) before
  significant infrastructure improvements are required. Investments to upgrade and/or build
  further three waters infrastructure are scheduled in the Hamilton City Council 10-Year Plan
  2015-2025 for the Stage 1 area. An upgrade to the SH3 and Dixon Road intersection has also
  been scheduled in the current 10-Year Plan; this is a precondition to release the entire Stage
  1 area. With these investments, and subject to development timing the remainder of Stage 1
  will have the necessary infrastructure in place by 2025.
- Stage 2 has an expected capacity for 7,500 dwellings. The development timing of Stage 2
  would be brought forward if the necessary strategic infrastructure and transport networks
  are constructed in advance of the timeframes identified by the Hamilton City Council.

Stage 1a south of Dixon Road is largely complete and the upgrade of the SH3 intersection is currently underway which will enable Stage 1b to commence. Stages 1a and 1b can be served with relatively small changes to existing bus services.

The requirements for Stage 2 are significantly greater. The grade separation of Wairere Drive and Cobham Drive is currently underway with completion of a new river crossing and ring road extension is expected by 2023. The east/west arterial is expected to open by 2025/26 and the north/south arterial after 2030.

These roading developments will see improved access to Hamilton East and provide opportunities for Peacockes Stage 2 from 2023. A proposed future school location has been identified near the existing Peacockes Road/Peacockes Lane intersection and a masterplan has already been developed for the Amberfield area along the western bank of the Waikato River. But there is no information on how the wider road network might be developed and therefore how public transport services could service the area in the future.

To enable the design of a future public transport network a future road network and population catchments have had to be defined. This has been undertaken based on the following information:

- Peacockes Structure Plan in the Operative District Plan (Hamilton City Council, Jul 2012)
- Peacockes strategic transport projects (Hamilton City Council, 2019)
- Hamilton City Road Hierarchy Plan in the Operative District Plan (Hamilton City Council, Jul 2012)
- Amberfield Masterplan (https://amberfield.co.nz/whats-planned/, Jan 2020)

The approach taken to defining a road network for public transport service planning purposes and the estimation of public transport population catchments is set out below.



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## 2.2.2. Local road network and bus stop locations

The Peacockes Structure Plan provides information on arterial road connections and an indication of land uses but does not include a proposed local road network. The connectivity of the local road network is a key factor in the effective and efficient operation of public transport services and therefor it was necessary to design an indicative local road network to support public transport service planning as shown in Figure 2.2 on page 8. This was a desktop exercise based on the information identified above and the following design principles:

- Ensure the local road network supports fast and direct public transport routes that connect to activity centres including retail, employment and school activities. Deviations or indirect routes should be avoided where possible.
- Ensure a connected local road network that maximises the number of people within 400m of a potential bus stop. This requires side streets to be located at least every 400m with corresponding bus stops to maximise catchment areas perpendicular to public transport routes. The use of cul-de-sacs should be minimised.
- Minimise road connections across the green network. The green network primarily follows gullies and natural features such as waterways. This can be excellent for recreation purposes, but the gradients and distances can act as a barrier for access to public transport.
- 4. Ensure road connections for a major school assumed to be located at northern end of Peacockes Road (north of Peacockes Lane intersection). Road connections need to ensure bus routes can service the school with minimal diversions to support direct services to other destinations such as the CBD and University.
- Assume that the Ring Road Extension planned for 2023 and the North/South Arterial planned for 2035+ will be limited access and therefore not suitable for bus stops or for passengers to access public transport services.
- 6. Assume that the East-West Arterial planned for 2025/26 will support significant development along its length and will be well integrated into the local road network. If the East/West Arterial is limited access, then an alternative direct route will be required for public transport services.

NB: The local road network has been prepared for public transport planning purposes and is not the proposed road network. The local road network for the Amberfield development along the western bank of the Waikato river is taken from developer concept plans.

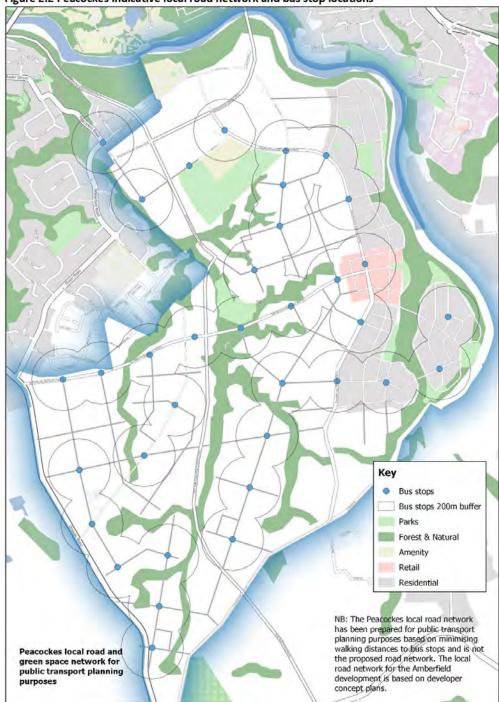
#### 2.2.3. Population catchment estimates

The local road network and bus stop locations were then used to derive population catchment estimates to estimate future demand for public transport. The population catchment estimates are covered in Appendix A.

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Figure 2.2 Peacockes indicative local road network and bus stop locations



N283 South Hamilton PT review working paper Final 20200409.docx

Page 8 of 35



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# 2.3. Regional Public Transport Plan future network concept

The Waikato Regional Public Transport Plan 2018-2028 (PT Plan) sets out the priorities for public transport over the next 10 years. The PT Plan includes seven objectives, with the first three being:

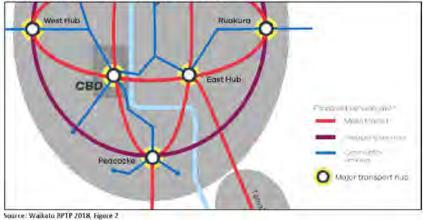
- Objective 1: Deliver a layered network of public transport services that meets a diverse range of travel needs.
- Objective 2: Transition to a mass transit oriented network over time.
- Objective 3: Provide the infrastructure necessary for an accessible, effective and efficient public transport network.

Delivering a layered network (Objective 1) means providing the most appropriate transport solution for each community while ensuring all services are connected to create an integrated network for the region. The following service layers are identified in the PT Plan:

- Mass transit: High capacity, high quality mass transit services on core corridors with high quality infrastructure, limited stops and dedicated right-of-way.
- Frequent: High capacity, high quality and direct services on core corridors with high quality infrastructure and extensive priority measures.
- Connector: Regular, high quality and direct services connecting key destinations and residential areas with high quality infrastructure and targeted priority measures.
- Coverage: Basic level of service that maximises coverage and accessibility with high quality stops and shelters.
- Targeted: Range of targeted services including school transport, public ride-share, community transport, special events and Total Mobility services.

Objectives 2 and 3 also support an aspirational future Hamilton network concept that is defined in the PT Plan and intended to guide the development and evolution of the public transport network, with Figure 2.3 showing how south Hamilton and Peacockes fit within this aspirational future network. The future Hamilton network concept includes Mass transit services between Peacockes, the CBD and East Hamilton and Frequent services to the west and east (West Hub and Ruakura). Connector services provide regular public transport services to communities in south Hamilton and Peacockes. Coverage and Targeted services are not shown but would be provided in areas of lower demand.

Figure 2.3 Future Hamilton network concept



N283 South Hamilton PT review working paper Final 20200409.docx

Page 9 of 35

Attachment 21



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The standard service levels identified in the PT Plan for each network layer are shown in Table 2.3 and have been used to inform the network concepts for south Hamilton.

Table 2.3 Standard service levels for Hamilton city



Source: Waikato RPTP 2018, Table 3.1

# 3. Issues and opportunities

This section provides an overview of some of the issues and opportunities identified through the review. These factors have been considered in developing the future public transport network concept set out in section 4.

# 3.1. Existing urban area

The following issues have been identified for bus services within South Hamilton's existing residential areas:

- The Lake Crescent diversion prevents the Fitzroy route from serving the hospital and adds approximate 4-minutes to the travel time for approximate 90% of Fitzroy passengers
- The two Comet branches (C1 and C2) have a complex interaction around Glenview Shops due to road network constraints and direction of travel on the C2 branch.
- There is no bus service for the new residential areas south of Dixon Road.
- Reduced weekend frequency on both Comet and Fitzroy services despite weekend demand being around two-thirds of weekday demand.

The following opportunities have been identified:

 Remove services from Lake Crescent due to very low demand (approx. 12 boardings per day) and proximity of other services (Orbiter). Alternatively, a separate standalone route could provide limited services to Lake Crescent.

N283 South Hamilton PT review working paper Final 20200409.docx

Page 10 of 35



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- Consider adding the Fitzroy route as a third branch of the Comet services allowing a 10minute frequency between Waikato Hospital and The Base. Will require removal of Lake Crescent diversion.
- Consider replacing the Fitzroy route with service from Fitzroy Ave via Summerset,
  Briannarose Drive and Dixon Rd as third branch of the Comet. A new route could serve the
  remainder of the current Fitzroy route catchment (e.g. along Bader St) and extend into the
  Peacockes Structure Plan area including the potential future Peacockes School.
- Adjust Comet branch C2 (Glenview) to operate in the opposite direction to reduce complex interaction around Glenview Shops. This would best be considered as part of moving Glenview Shops bus stops onto SH3/Ohaupo Rd.
- Moving Glenview Shops bus stops onto SH3/Ohaupo Rd adjacent to the signalised pedestrian crossing to better service Glenview Shops, improve legibility and improve the effectiveness and efficiency of bus services.

# 3.2. Future urban area (Peacockes)

Some of the key issues and opportunities regarding the Peacockes Structure Plan include:

- Ensuring enough density to support high frequency and high-quality public transport services.
- Ensuring the road network supports effective and efficient public transport services, including the ability to provide direct services along key corridors and between key activity centres while maximising the catchment area.
- Ensuring integration with the existing bus network and connecting to destinations that people want to travel.
- Staging of the development to support public transport services as soon as possible to build sustainable travel habits and reduce car dependency.
- Ratepayer cost for providing additional bus services. Bus services are subsidised due to fare
  revenue not covering the full cost of public transport services. This means that new bus
  services in the area will require increased public subsidy, noting this will be offset at least in
  part by additional rates income from new households.

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# 4. Future network concept for south Hamilton

A future network concept for south Hamilton has been developed taking account of the PT Plan aspirations identified in section 2.3 and the issues and opportunities identified in section 3. The future network concept for south Hamilton is intended to help guide the development of the Peacockes structure plan area over time.

# 4.1. Proposed network structure

The proposed network structure provides a "blueprint" for public transport based on the Peacockes Structure Plan being fully developed. The public transport network structure is also based on significant assumptions as to the future road network and form of development, including the proposed future Peacockes School which is a key factor driving the proposed network structure.

The proposed network structure is aligned with the PT Plan layered service approach and the aspirational future Hamilton network concept and will need to be staged (refer section 5 for potential staging plan). The proposed network structure is shown in Figure 4.1 on page 14 and includes the following key features:

- a) Core network of *Frequent* services connecting major population and activity centres with high capacity, high quality and direct services:
  - a) Route C (Comet) continues to provide Frequent north/south services between Hospital, CBD and The Base. The base frequency is increased to every 10 minutes Mon-Sun with three branches at 30 minutes per branch (C1, C2, C3); currently every 15-minutes Mon-Fri and every 30 minutes Sat-Sun with two branches (C1, C2). Provision for layover will be required at the northern terminus to maintain reliability, due to the three branches in the south.
  - b) Route P (Peacockes) provides Frequent south/east services along the East/West Arterial serving Glenview Shops, Amberfield Shops, potential future Peacockes School, Hillcrest Shops, University of Waikato to the future Ruakura employment area (assuming access through the university grounds). The base frequency is every 15 minutes Mon-Fri and every 20 minutes Sat-Sun. Connections to the existing network are available at Glenview Shops (Route C) and Hillcrest Shops (Route O).
  - c) Route P2 (Bader St/Amberfield) replaces part of the Fitzroy route with direct Connector services linking Amberfield, potential future Peacockes School, Bader St, Waikato Hospital and CBD. The base frequency is every 15 minutes Mon-Sun providing a frequency of 30 minutes on each of branches P2a and P2b.
  - d) Route O (Orbiter) continues to provide Frequent east/west services between Waikato Hospital and Hamilton East and beyond. No change to the base frequency; currently every 10 minutes Mon-Fri and every 20 minutes Sat-Sun. Connections are available at Waikato Hospital (Route C) and near Hamilton East (Route P).
  - e) **Route M** provides an indicative future mass transit service along north/south corridor with interchange facilities at the recommended activity centre on the East/West Arterial.
- b) Supporting network of Connector services connecting key destinations and residential areas with high quality and direct services:
  - a) Route C1, C2, C3 branches of the Comet continue to provide Connector services for Mahoe and Glenview and now also Fitzroy with changes as follows:
    - i) Route C1 (Mahoe) branch remains the same. The base frequency remains at 30 minutes Mon-Fri but is increased to 30 minutes Sat-Sun (currently 60 minutes) to align with *Connector* service levels.

N283 South Hamilton PT review working paper Final 20200409.docx

Page 12 of 35



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- ii) Route C2 (Glenview) branch is changed to replace part of the Fitzroy route (Urlich Ave/Pine Ave/Willis St) and for outbound services to stop at Glenview Shops before serving the residential catchment in order to improve legibility and simplify the scheduling of departures from Glenview Shops while also supporting the creation of new routes (C3 and P2). The base frequency remains at 30 minutes Mon-Fri but is increased to 30 minutes Sat-Sun (currently 60 minutes) to align with Connector service levels.
- iii) Route C3 (Fitzroy) branch is a new route serving Fitzroy Ave, Summerset Village, Briannarose Drive/Dixon Rd (Peacockes Stage 1a) with an extension at school times to the potential future Peacockes School. The base frequency is every 30 minutes Mon-Sun to align with Connector service levels.
- b) Route P3 (Peacockes South) is a Connector service providing access to the southern end of Peacockes and improving access for areas within central Peacockes that are more remote from Frequent service corridors (e.g. due to terrain). The base frequency is every 30 minutes Mon-Sun to align with Connector service levels.

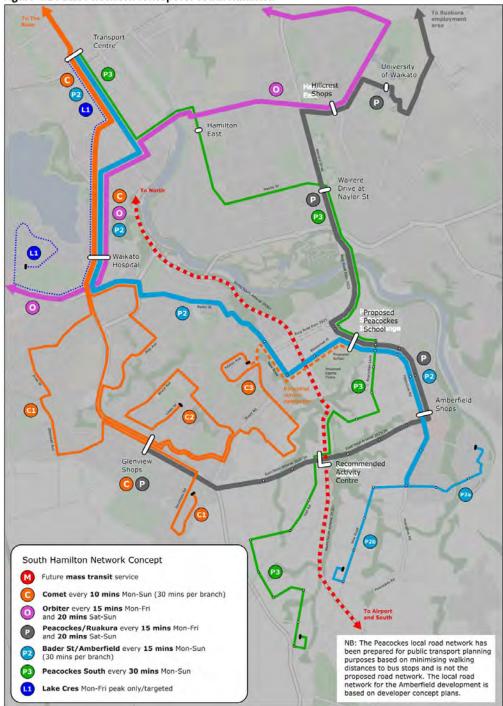
#### c) Targeted services for areas of low demand

- a) Route L1 (Lake) replaces the Lake Cres portion of current Route 12 (Fitzroy) and is a *Targeted* service due to very low demand and proximity to alternative *Frequent* services (up to 10-minute walk). Limited services will operate Mon-Fri peak only with the potential for additional targeted services. For modelling purposes base frequency is every 120 mins Mon-Fri but services are likely to be limited to school and peak commute times only with the potential for the route to be deleted altogether due to very low demand (around 10-15 boardings per day).
- b) Demand responsive services could also be considered in place of some regular services, particularly prior to development being completed.

The above future network concept has been developed after considering several different options as discussed in section 4.4. It is noted that the proposed network concept is a concept only and should be tested through stakeholder and public engagement.

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Figure 4.1 Future network concept for south Hamilton



N283 South Hamilton PT review working paper Final 20200409.docx

Page 14 of 35



#### 4.2. Supporting public transport infrastructure

The future network concept for south Hamilton requires supporting public transport infrastructure (in addition to standard bus stops). The following supporting infrastructure requirements are discussed below:

- Glenview Shops interchange
- Amberfield Shops interchange
- Peacockes School interchange
- · Recommended activity centre
- Hillcrest Shops interchange
- · Wairere Drive interchange
- Bus priority measures

The Glenview Shops interchange is recommended for immediate consideration as this would provide benefits to existing public transport services. The other supporting infrastructure can be considered as part of the Peacockes Structure Plan development and staging.

#### 4.2.1. Glenview Shops interchange

The future network concept includes a new Glenview Shops interchange located on SH3/Ohaupo Road as shown in Figure 4.2. This interchange will replace stops on Macdonald Rd and provide the following benefits:

- More direct for passengers for example passengers travelling on route C1 from north of Saxbys Rd can access Glenview shops without first looping around Acacia Crescent.
- More legible for passengers the bus currently has to loop around multiple different roads
  in each direction which is difficult to show in bus timetables and can be confusing for
  passengers. Moving the interchange to SH3/Ohaupo Rd will provide a single consistent route
  with all buses heading north on one side of the road and all buses heading south on the
- Improved bus stop infrastructure provides an opportunity for enhanced passenger waiting facilities more in keeping with the role of Glenview Shops as a transport interchange.
- More efficient bus operations the removal of the additional turns allows more efficient through routing of bus services and will be less confusing for drivers. Provision is still required for buses to turn and to layover off SH3.
- Support additional Comet branch (Route C3) and future Frequent bus services to Peacockes (Route P).

#### 4.2.1.1. Bus stop changes

The SH3 interchange location will require the removal of bus stops on Macdonald Rd which will have an impact on several residents. A proposed bus stop on Saxbys Rd near the Macdonald Rd intersection is proposed to mitigate this. It is also recommended that the Glenview Shops Interchange accommodate a minimum of three buses in each direction to support future growth and maintain service flexibility.

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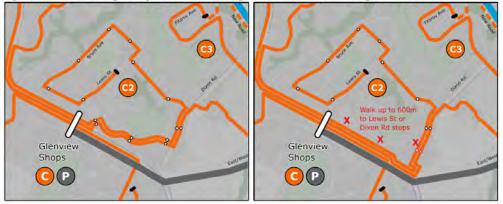
Figure 4.2 Glenview Shops current bus stop and proposed interchange



#### 4.2.1.2. Garden Heights/SH3 intersection

The right turn from Garden Heights to SH3 can be difficult due to traffic conditions. This would be resolved if the intersection was signalised or traffic volumes reduced sufficiently. Bus services could avoid the Garden Heights/SH3 intersection as shown in Figure 4.3 but this would result in the three bus stops being deleted in each direction and removal of service along Pelorus Street. This will require people living along Pelorus Street to walk up to an additional 600m to access bus services. Due this impact the preferred option is to signalise the Garden Heights/SH3 intersection as part of the project to relocate the Glenview Shops interchange to SH3.

Figure 4.3 Route changes required to avoid a right turn from Garden Heights to SH3



N283 South Hamilton PT review working paper Final 20200409.docx

Page 16 of 35



#### 4.2.2. Amberfield Shops Interchange

There are existing development plans for Amberfield, including the Amberfield Shops as shown in Figure 4.4. The proposed public transport network structure includes a core *Frequent* service along the East/West Arterial and passing through the Amberfield Shops on Peacockes Rd. A second *Connector* service also operates along Peacockes Rd to the south.

It is important that the Amberfield Shops Interchange be located on Peacockes Rd within a block where these multiple routes can all utilise the same bus stops, particularly for travel in the same direction to facilitate passengers transferring between services with as few steps as possible.

Figure 4.4 Amberfield Shops Interchange



#### 4.2.3. Peacockes School interchange

The Peacockes Structure Plan includes provision for a school near the current intersection of Peacockes Rd and Peacockes Lane. School travel is one of the main generators of public transport demand in Hamilton and therefore it is important to ensure the bus network provides effective and efficient school connections.

The proposed location for Peacockes School is ideal in supporting an effective and efficient public transport network. This will be an important public transport hub central to the wider public transport network concepts which have been specifically designed to service the proposed school location as follows (refer Figure 4.5):

- Peacockes School Interchange is located on Peacockes Rd between Westbrook Place and Peacockes Lane. This location enables all bus routes to stop at the school while avoiding diversions for passengers travelling to other destination. The interchange will require high quality bus stops and a focus on student safety when crossing the road.
- Westbrook Place is shown as extending south under the North/South Arterial with through connections to Bader St and Waterford Rd via New Road. This is a critical link for retaining flexibility for future bus services and provides an opportunity for some school stops to be located off the main Peacockes Rd.
- The dotted red line in Figure 4.5 shows how Westbrook Place is required for a potential
  alternative route to be able to both serve the school and provide direct connections through
  to Hamilton East via the new river crossing. This is a viable route option that will likely be
  considered in the future but would not be possible without Westbook Place connecting
  south under the North/South Arterial.

The bus infrastructure requirements for the Peacockes School interchange will be similar to other important hubs in the network. Key requirements include:

 Bus stops suitable for school and public services with capacity for at least three vehicles to stop in each direction.

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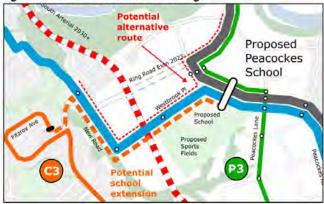
Page 17 of 35

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- Suitable waiting areas and shelter for large numbers of school children
- · Safe crossing facilities (likely controlled crossing) for school children

The detailed design will also need to consider the potential alternative route identified above. This may require the hub to be located closer to Westbrook Place with crossings possibly incorporated as part of the Westbrook Place/Peacockes intersection design. The location of the school entrance will also be a critical consideration.

Figure 4.5 Peacockes School interchange



#### 4.2.4. Recommended Activity Centre

The future network concept includes a recommended activity centre on the East/West Arterial as shown in Figure 4.6. This is not a core requirement of the proposed network but the interaction of Route P (Peacockes) and Route P3 (South Peacockes) indicates a potential transfer location for passengers and given the nearby connections with the North/South Arterial may be a natural location for more intensive development. It will be important to avoid low density or non-pedestrian oriented activities in this area, for example big bulk retail or petrol stations would not be conducive to public transport usage.

Figure 4.6 Recommended Activity Centre



N283 South Hamilton PT review working paper Final 20200409.docx

Page 18 of 35



#### 4.2.5. Hillcrest Shops interchange

Hillcrest Shops will be a key location for transfers between Route P (Peacockes) and Route O (Orbiter) as shown in Figure 4.7 as well as other Hamilton East bus services. This is a good location for an interchange as it is an activity centre and passengers can transfer between services going in the same general direction without crossing the road.

The existing bus stops on Clyde St (Hillcrest Warehouse) would need to be upgraded with shelters and bus stops extended to allow two buses to stop at the same time in each direction. It is recommended that any changes to the Hillcrest Shops stops be considered further as part of any review of Hamilton East bus services.

Figure 4.7 Hillcrest Shops interchange

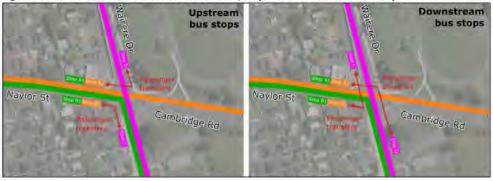


#### 4.2.6. Wairere Drive interchange

Bus stops are required on Wairere Drive at Naylor St to support access to Hamilton East. Route P3 provides access from parts of Peacockes but does not directly service Amberfield or Glenview Shops. Route P serves these other areas but operates along Wairere Drive to Hillcrest Shops, University and Ruakura employment area.

Bus stops on Wairere Drive at Naylor St will allow passengers to transfer between Peacockes routes and other frequent Hamilton East routes providing access to a wider range of destinations. Potential bus stop locations for Wairere Drive/Naylor St intersection are shown in Figure 4.8. The upstream bus stops option is preferable as this minimises the number of road crossings required for transferring passengers. It is recommended that the location and design of bus stops on Wairere Drive be considered further as part of any review of Hamilton East bus services.

Figure 4.8 Potential locations for Wairere Drive/Naylor St intersection bus stops



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Page 19 of 35

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#### 4.2.7. Bus priority measures

Bus priority has not been considered as part of this report. Bus priority, which may include bus lanes and signal pre-emption, is recommended on *Frequent* service corridors. Bus priority could potentially provide travel time benefits along SH3/Ohaupo Road and along the East/West Arterial and Ring Road extension depending on expected levels of congestion.

#### 4.3. Peacockes arterial roads

The future network includes several assumptions discussed below regarding the following planned Peacockes arterial roads:

- Completion of Ring Road extension (2023)
- Role of East/West Arterial (2025/26)
- Limited access North/South Arterial (2030+)

A potential staging plan taking account of the staged delivery of the Peacockes arterial roads is provided in section 5.

#### 4.3.1. Completion of Ring Road extension (2023)

The Ring Road extension is required for the future network concept, although changes to Route C are possible without any additional road connections in which case Route P2 could potentially terminate at Norrie Street using the Norrie Street loop to turn.

#### 4.3.2. Role of East/West Arterial (2025/26)

The East/West Arterial has an important role in supporting *Frequent* services. As noted in section 2.2.2 it is assumed that the East/West Arterial will support significant development along its length and will be well integrated into the local road network. This is required to provide sufficient catchment and demand to support Route P (Peacockes) operating as a *Frequent* service along the East/West Arterial as this corridor is the primary catchment for this route.

If the design of the East/West Arterial does not support significant development along its length and is not well integrated into the local road network, then it is unlikely that the proposed network structure can be supported. This will require the frequency of services to be reduced which in turn will be less attractive to passengers.

#### 4.3.3. Limited access North/South Arterial (2030+)

The North/South arterial is assumed to be a high-speed limited access road and therefore is not required to support the proposed network structure, noting that the Route P3 *Coverage* service uses a section of this link to connect different catchments.

#### 4.4. Other options considered

Several options were considered and have been refined while developing the future network concept for south Hamilton. These have not been fully documented due to the iterative nature of the process and the need to identify a future network concept that could support the further work on the Peacockes Structure Plan. Some of these alternative options are discussed in Appendix B.



#### 5. Potential staging plan

The section outlines how the future network concept for south Hamilton set out in section 4 could be staged over time as road connections within the Peacockes Structure Plan are completed and development progresses. The following potential stages have been identified, with a summary of the routes and services levels for each stage provided in Table 5.1.

- Stage 1 Basic service enhancements including Peacockes stages 1a/1b and Amberfield commencement
  - Stage 1a Basic service enhancements and Peacockes stages 1a/1b
  - Stage 1b Weekend service enhancements and extension to Amberfield Shops
- Stage 2 Services extended to Amberfield south and improved access to University and Hamilton East
- Stage 3 Services extended along East/West Arterial
- Stage 4 Services extended to Peacockes south and East/West Arterial service enhancements
- Stage 5 Services extended to Ruakura employment area and weekend service enhancements

Table 5.1 Potential staging plan service levels

	Stage 1a	Stage 1b	Stage 2	Stage 3	Stage 4	Stage 5
Weekday		•		•		
C - Comet	10 mins	10 mins	10 mins	10 mins	10 mins	10 mins
c - comer	(30 mins/	(30 mins/	(30 mins/	(30 mins/	(30 mins/	(30 mins/
	branch)	branch)	branch)	branch)	branch)	branch)
O – Orbiter	15 mins	15 mins	15 mins	15 mins	15 mins	15 mins
P – Peacockes/Ruakura	-	-	30 mins <sup>(a)</sup>	30 mins <sup>(a)</sup>	20 mins <sup>(a)</sup>	15 mins
			15 mins	15 mins	15 mins	15 mins
P2 - Bader St/Amberfield	30 mins(b)	15 mins(b)	(30 mins/	(30 mins/	(30 mins/	(30 mins/
			branch)	branch)	branch)	branch)
P3 – Peacockes South	-	-	30 mins <sup>(c)</sup>	30 mins <sup>(c)</sup>	30 mins	30 mins
L1 - Lake Cres	Peak only	Peak only	Peak only	Peak only	Peak only	Peak only
Weekend (and evening)	"	•	l	•	1	
C - Comet	20 mins	10 mins	10 mins	10 mins	10 mins	10 mins
C - Comet	(60 mins/	(30 mins/	(30 mins/	(30 mins/	(30 mins/	(30 mins/
	branch)	branch)	branch)	branch)	branch)	branch)
O – Orbiter	20 mins	20 mins	20 mins	20 mins	20 mins	20 mins
P – Peacockes/Ruakura	-	-	60 mins <sup>(a)</sup>	60 mins <sup>(a)</sup>	30 mins <sup>(a)</sup>	20 mins
			30 mins	30 mins	30 mins	15 mins
P2 - Bader St/Amberfield	30 mins(b)	30 mins(b)	(60 mins/	(60 mins/	(60 mins/	(30 mins/
			branch)	branch)	branch)	branch)
P3 – Peacockes South	-	-	60 mins <sup>(c)</sup>	60 mins <sup>(c)</sup>	60 mins	30 mins
L1 - Lake Cres	-	-	-	-	-	-

#### Notes:

- a) Route P Stage 2 operates between Amberfield Shops and University only. Route P Stages 3 and 4 operate between Glenview Shops and University only.
- b) Route P2 Stage 1a operates along the existing Peacockes Rd to Ring Road only. Route P2 Stage 1b operates to Amberfield Shops only.
- c) Route P3 Stage 2 operates between the Future Peacockes School and Transport Centre only (providing transfer access to Hamilton East). Route P3 Stage 3 operators between the Recommended Activity Centre and Transport Centre only.

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Page 21 of 35

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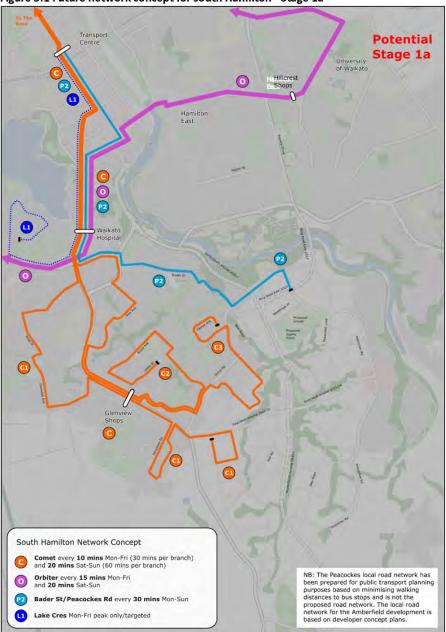
# 5.1. Stage 1 – Basic service enhancements including Peacockes stages 1a/1b and Amberfield commencement

This stage has been split into two substages with stage 1a possible now (with the exception of the Route C1 extension) and stage 1b once the Amberfield development commences

#### 5.1.1. Stage 1a - Basic service enhancements and Peacockes stages 1a/1b

The potential Stage 1a provides basic service enhancements and extends service to Peacockes stages 1a/1b, as shown in Figure 5.1. Routes P2, C3 and L1 replace the current Route 12 (Fitzroy).

Figure 5.1 Future network concept for south Hamilton - Stage 1a



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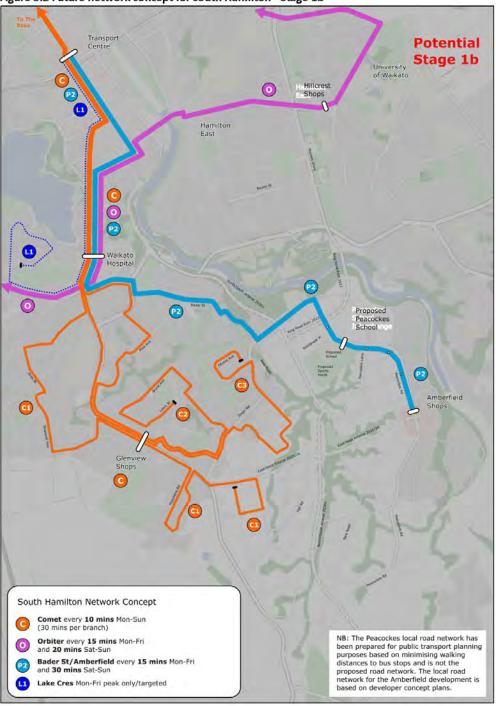
Page 22 of 35



#### 5.1.2. Stage 1b - Weekend service enhancements and extension to Amberfield Shops

The potential Stage 1b provides weekend service enhancements and includes service extension to Amberfield Shops as shown in Figure 5.2. Route P2 frequency increases to 15 minutes weekday and route C weekend frequency increases to 10 minutes (30 minutes per branch)

Figure 5.2 Future network concept for south Hamilton - Stage 1b



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Page 23 of 35

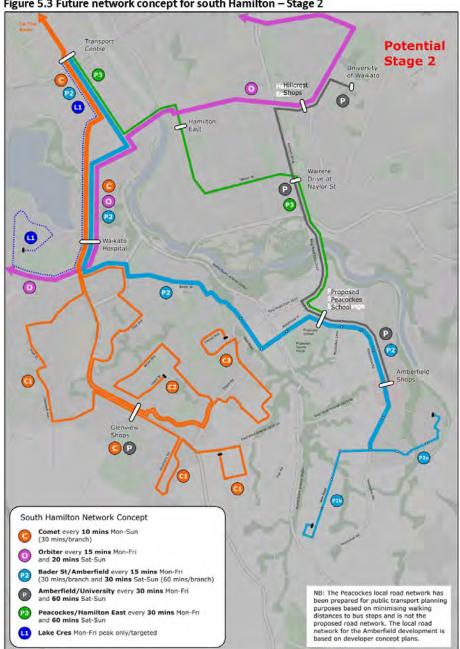
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#### 5.2. Stage 2 - Services extended to Amberfield south and improved access to **University and Hamilton East**

The potential Stage 2 includes services extended to Amberfield south and improve access to the University and Hamilton East as shown in Figure 5.3. Routes P and P3 are new routes.

Figure 5.3 Future network concept for south Hamilton – Stage 2



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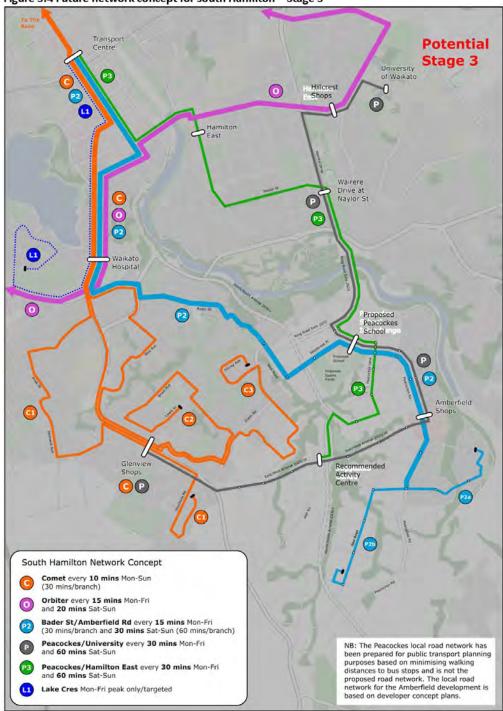
Page 24 of 35



#### 5.3. Stage 3 - Services extended along East/West Arterial

The potential Stage 3 includes services extended along the East/West Arterial as shown in Figure 5.4.

Figure 5.4 Future network concept for south Hamilton - Stage 3



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Page 25 of 35

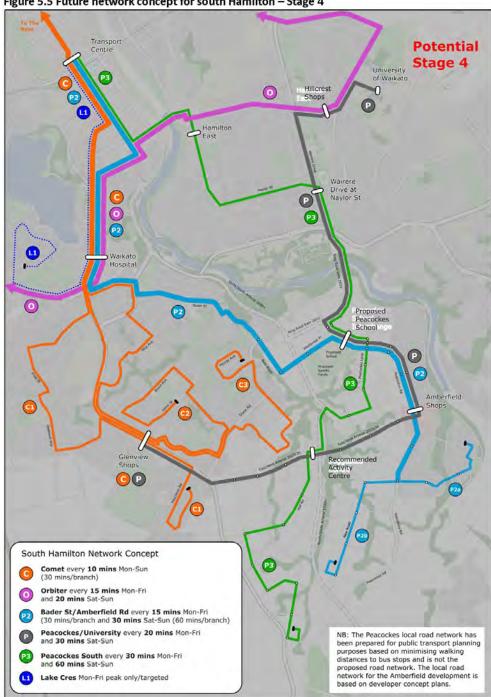
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#### 5.4. Stage 4 - Services extended to Peacockes south and East/West Arterial service enhancements

The potential Stage 4 includes services extended to Peacockes south and East/West Arterial service enhancements as shown in Figure 5.5.

Figure 5.5 Future network concept for south Hamilton – Stage 4



N283 South Hamilton PT review working paper Final 20200409.docx

Page 26 of 35

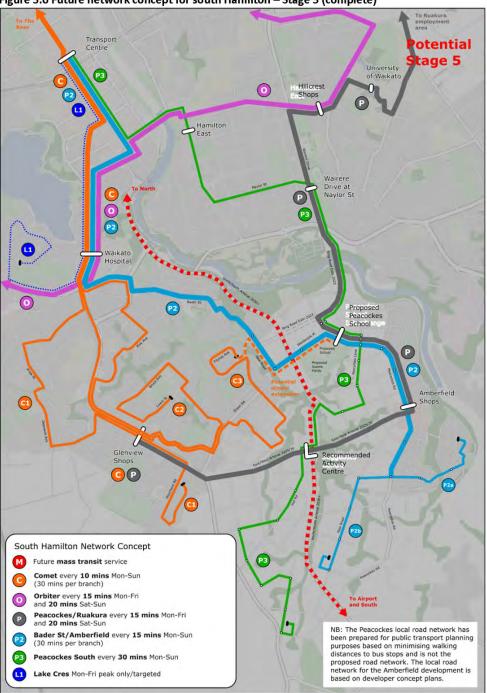
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# 5.5. Stage 5 – Services extended to Ruakura employment area and weekend service enhancements

The potential Stage 5 includes services extended from the University to the Ruakura employment area and weekend service enhancements as shown in Figure 5.6.

Figure 5.6 Future network concept for south Hamilton – Stage 5 (complete)



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Page 27 of 35

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#### 6. Costing and funding

This section looks at bus operating costs and funding implications. Infrastructure costs other than operating costs are not addressed in this report.

#### 6.1. Gross operating cost estimates

Gross operating cost estimates are provided in Table 6.1 based on the potential staging set out in section 5. The table shows service-kms increasing 23.3% and gross operating costs increasing by 19.0%.

Table 6.1 Operating cost estimates by potential stage

	Service-kms pa (#000)				Gross operating cost pa (\$000 excl. GST)		
	C1	Hamilton	Hamilton	C1	Hamilton	Hamilton	
Possible staging	Stage Change	Urban Total	Urban Change	Stage Change	Urban Total	Urban Change	
Current network	-	4,953	-	-	15,972	-	
Stage 1a – Basic service enhancements and Peacockes stages 1a/1b	209	5,162	4.2%	587	16,559	3.7%	
Stage 1b – Weekend service enhancements and extension to Amberfield Shops	127	5,289	6.8%	272	16,831	5.4%	
Stage 2 – Services extended to Amberfield south and improved access to University and Hamilton East	430	5,719	15.5%	1,206	18,037	12.9%	
Stage 3 – Services extended along East/West Arterial	51	5,770	16.5%	107	18,144	13.6%	
Stage 4 – Services extended to Peacockes south and East/West Arterial service enhancements	120	5,890	18.9%	322	18,466	15.6%	
Stage 5 – Services extended to Ruakura employment area and weekend service enhancements	217	6,107	23.3%	535	19,001	19.0%	
Grand total	1,154	6,107	23.3%	3,029	19,001	19.0%	

#### 6.2. Passenger demand and net cost estimates

Passenger demand estimates are based on existing passenger behaviour on the Hamilton Urban network as summarised by the performance criteria in section 2.1.2. The estimated impact on passenger demand and net operating costs based on the potential staging is provided in Table 6.2. This shows a potential increase in annual patronage of around 239,000 passenger journeys.

An alternative method of calculating demand based on potential dwelling density in Peacockes was also explored as set out in Appendix A. When assuming 10 dwellings per hectare the alternative method results in demand of around 200,000 passengers per year, which is not dissimilar to the estimates in Table 6.2. Increasing densities under the alternative method results in higher demand estimates, for example an average density of 20 dwellings per hectare result in demand estimates of around 400,000 passengers by the end of Stage 5. This indicates there is potential for higher demand than estimated above but at this stage caution should be applied as there are significant uncertainties.

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Table 6.2 Passenger demand and net cost estimates

	Estimated passenger journeys pa (#000)			Estimated net operating cost pa (\$000 excl. GST)		
Possible staging	Stage Change <sup>(a)</sup>	Hamilton Urban Total	Hamilton Urban Change	Stage Change	Hamilton Urban Total	Farebox recovery
Current network	-	2,734	-	-	11,012	31.1%
Stage 1a – Basic service enhancements and Peacockes stages 1a/1b	46	2,780	1.7%	503	11,515	30.5%
Stage 1b – Weekend service enhancements and extension to Amberfield Shops	27	2,807	2.7%	223	11,738	30.3%
Stage 2 – Services extended to Amberfield south and improved access to University and Hamilton East	89	2,896	5.9%	1,045	12,783	29.1%
Stage 3 – Services extended along East/West Arterial	10	2,906	6.3%	89	12,871	29.1%
Stage 4 – Services extended to Peacockes south and East/West Arterial service enhancements	24	2,930	7.2%	279	13,150	28.8%
Stage 5 – Services extended to Ruakura employment area and weekend service enhancements	43	2,973	8.7%	457	13,608	28.4%
Grand total	239	2,9 <b>7</b> 3	8.7%	2,596	13,608	28.4%

Notes: (a) Change in passenger journeys calculated using change in service-kms and elasticity of 0.4 which is a standard elasticity for demand impact of change in service levels.

#### 6.3. Funding implications

As outlined above the farebox recovery (commerciality ratio) will reduce from 31.1% to 28.4% and the net funding requirement will increase by around \$2.6 million (excl. GST) per year.

If we assume an additional 8,500 households and an average targeted public transport rate of \$128 per household (based on average house price of \$580,000 and targeted transport rate of \$0.00022069 per \$ capital value) this would raise around \$1 million per year. This means another \$1.6 million will be required from existing ratepayers noting that the benefit of the services outlined in this document will not only accrue to new Peacockes residents but also to many existing residents and businesses.

#### 7. Conclusion

This working paper outlines a future network concept for south Hamilton along with a potential staging plan and cost and demand estimates.

Stakeholder and community engagement will be required before progressing any of the network concepts outlined in this document.

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#### Appendix A Peacockes population catchment estimates

The Peacockes Housing Infrastructure Fund indicative business case in 2017 identified population estimates of 10,000 within 10-years and 24,000 within 30-years based on 160 hectares and 415 hectares of developable land respectively. This would give a development density of approximately 23 dwellings per hectare after 10-years and 19 dwellings per hectare after 30-years.

These densities will not be realised until the development is largely completed and will depend on staging of development. If we assume an initial density of 20 dwellings per hectare, passenger demand is estimated to be 400,000 passenger journeys per annum across the Peacockes bus routes. The calculation of passenger demand is shown in the following table with the catchment areas shown in Figure 7.1.

Passenger demand estimates assuming 10 dwellings per hectare

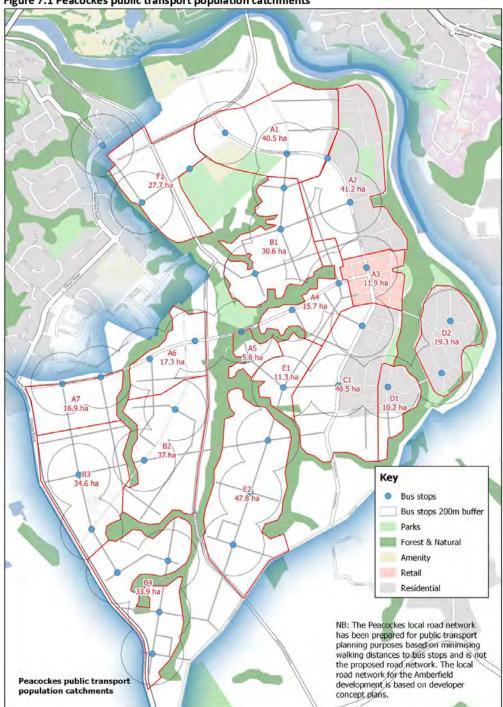
	Catchment	Estimated	Dwellings	Total	Residents	Total
Route code	area <sup>(a)</sup>	development	per	dwellings	per	residents
	area	area (ha)	hectare <sup>(a)</sup>	estimate	dwelling <sup>(b)</sup>	estimate
P1	A1	40.5	20	810	2.9	2,349
	A2	41.2	20	824	2.9	2,390
	A3	11.9	20	238	2.9	690
	A4	15.7	20	314	2.9	911
	A5	5.6	20	112	2.9	325
	A6	17.3	20	346	2.9	1,003
	A7	16.9	20	338	2.9	980
Total		149.1		2,982		8,648
P2	C1	46.5	20	930	2.9	2,697
	D1	10.2	20	204	2.9	592
	D2	19.3	20	386	2.9	1,119
	E1	11.3	20	226	2.9	655
	E2	47.8	20	956	2.9	2,772
Total		135.1		2702		<b>78</b> 35
P2 <sup>(f)</sup>	F1	27.7	20	554	2.9	1,607
Total		27.7		554		1,607
P3	B1	30.6	20	612	2.9	1,775
	B2	37	20	740	2.9	2,146
	В3	34.6	20	692	2.9	2,007
	В4	33.9	20	678	2.9	1,966
Total		136.1		2,722		7,894
Grand Total		448		8,406		24,377

#### Notes:

- (a) Dwellings per hectare based on average lot size of 800m2 with 20% of land used for roads and reserves.
- (b) Census 2018 identified average of 2.9 residents per household in Hamilton



Figure 7.1 Peacockes public transport population catchments



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Page 31 of 35



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#### Appendix B Other options considered

#### B.1. Existing Route 12 (Fitzroy) added to the Comet

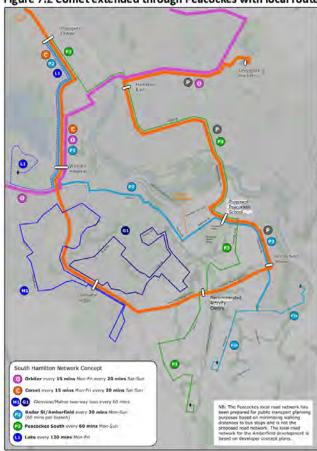
Adding existing Route 12 (Fitzroy) to the Comet was considered but would not have provided service to Peacockes Stage 1a unless extended to provide a Dixon Rd/Briannarose loop which in turn would have increased travel time for passengers travelling to the city centre. This option would also not provide connections to Glenview Shops.

#### **B.2.** Comet extended through Peacockes

The Comet currently provides north/south services, with local branches in the south. Consideration was given to extending Route C (Comet) via Peacockes instead of Route P. This would create a strong Frequent service corridor and reduce the potential need for transfers but creates other challenges.

Extended the Comet through Peacockes was ruled out due to consequential challenges servicing the existing Mahoe and Glenview catchments. Mahoe and Glenview services would have likely needed to be replaced with a new local route requiring transfers at Glenview Shops which in turn would increase travel time and require careful planning of connecting services. An alternative is to develop a new local route to the Transport Centre, but this would have a relatively low frequency due to duplicating Comet services. An example of this option is shown in Figure 7.2.

Figure 7.2 Comet extended through Peacockes with local routes for Mahoe and Glenview



N283 South Hamilton PT review working paper Final 20200409.docx

Page 32 of 35

Attachments



#### **B.3.** Orbiter extended through Peacockes

Consideration was given to operating the Route O (Orbiter) via Peacockes and the new river crossing instead of Route P (Peacockes). This option was ruled out for several reasons, including:

- The Orbiter would not be able to directly serve Waikato Hospital. The closest potential stops would be on Lorne St or Ohaupo Rd south of Lorne St which is at least 250m away from the main hospital building than the current stops.
- Longer journey times for existing passengers travelling between Hamilton East and destinations west of Pembroke St
- Loss of existing catchment along Pembroke St and the southern end of the CBD.

# B.4. Alternative future network concept with Bader St via new river crossing and Peacockes Stage 1b

An alternative future network concept for south Hamilton was also considered based on the concept of operating current Route 12 (Fitzroy) via the new river crossing. This alternative concept is shown in Figure 7.3 with the following key differences from the proposed network concept:

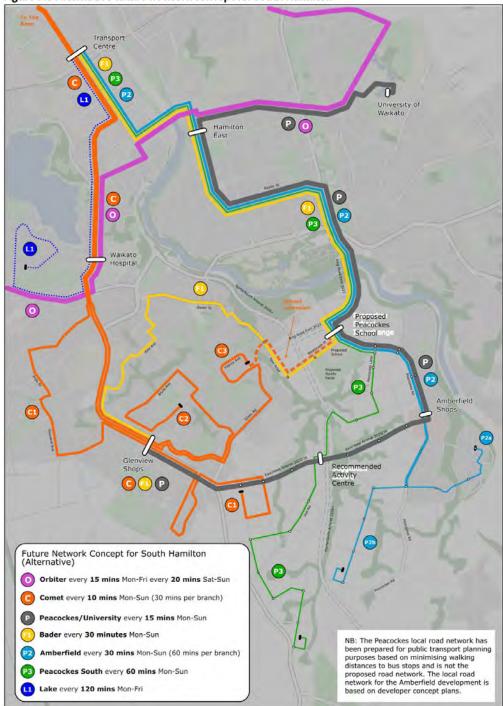
- Route F1 runs between Glenview Shops and Transport Centre via Bader St, new river
  crossing and Hamilton East, replacing current route 12 (Fitzroy). This route is designed to
  provide faster travel times using the new river crossing.
- Route P2 now operates via Hamilton East instead of Waikato Hospital
- Route C1 is extended to pick up catchment in Peacockes Stage 1b.
- Route C2 does not divert around Urlich/Pine/Willis St as this area is now covered by Route F1.

The main reason that this network concept is not recommended is the required duplication of service across the new river crossing resulting in higher costs (or lower frequencies) compared to the proposed network concept. This alternative also does not provide for a direct connection between Peacockes and Waikato Hospital.

While Route F1 could operate as an interim measure prior to the development of Peacockes this is not recommended as passengers will begin to rely on the route making changing it in the future more difficult. This will likely result in a lower frequency on other routes such as Route P which in turn will reduce the extent of the *Frequent* service network.

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Figure 7.3 Alternative future network concept for south Hamilton



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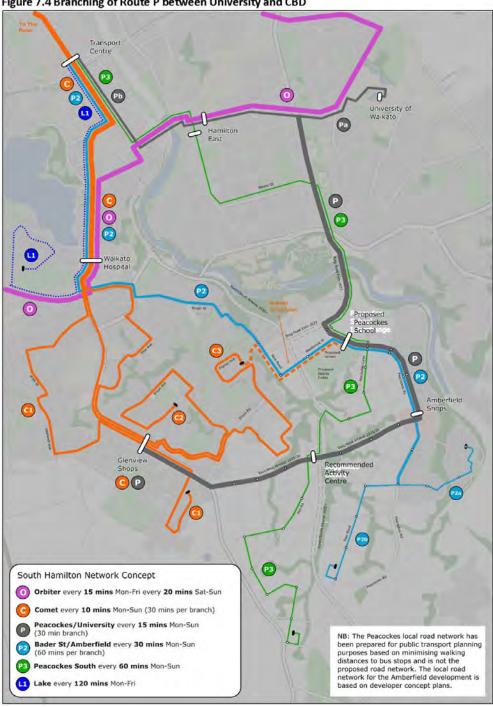
Page 34 of 35



#### B.5. Branching of Route P between University and CBD

Consideration was given to branching Route P, either via Hamilton East (Route P3) or as shown in Figure 7.4. This option has merit but duplicates Route P2 for access to the CBD.

Figure 7.4 Branching of Route P between University and CBD



N283 South Hamilton PT review working paper Final 20200409.docx

Page 35 of 35

Attachments



### **APPENDIX V**

**Hamilton City Council** 

# **Transit Plan for Peacocke**

Prepared for: Hamilton City Council

Prepared by: MRCagney Pty Ltd, Auckland, New Zealand



Transit Plan for Peacocke

### Document Information

Project Name	Transit Plan for Peacocke
Client	Hamilton City Council
Client Reference	PSP 17520
MRC Reference	NZ 2340
File Name	O:\NZ_Root\3. Councils Outside Auckland\Hamilton City Council\NZ2340 Hamilton Rapid Transit PBC\9. Early Works\1. Peacocke

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Transit Plan for Peacocke

## Quality Assurance Register

Issue	Description	Prepared by	Reviewed by	Authorised by	Date
1	Report	TC .	CI/ACF	NR	28 August 2019
					+

**MRC**agney

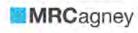
15



Transit Plan for Peacocke

### Contents

1	Introd	luction an	d strategic overview	9	
	1.1	Waikat	to Regional Public Transport Plan 2018 - 2028	9	
	1.2	Southe	ern Links	9	
	1.3	Access	Hamilton Strategy and Draft PBC	10	
	1.4	Peacoc	cke Housing Infrastructure Fund (HIF) Business Cases	11	
	1.5	Westor	n Lea Amberfield Development	12	
		1.5.1	Provision for cycling and public transport	14	
		1.5.2	Traffic generation	16	
	1.6	Summa	ary of strategic documents and ongoing developments	17	
2	High-	level netw	vork concepts and service types	18	
	2.1	Types	of public transport	18	
		2.1.1	Local public transport	19	
	2.2	Mass ti	ransit	19	
	2.3	Region	nal transit	20	
	2.4	Strateg	gic demands and key nodes of connectivity	20	
3	Short	and med	lium-term public transport considerations	22	
	3.1	Short-t	term	22	
		3.1.1	Route Options	23	
		3.1.2	Conclusions	27	
	3.1	Mediur	m-term network options	28	
		3.1.1	Route Options	28	
		3.1.2	Conclusions	36	
	3.2	37			
		3.2.1	Bus stops	37	
		3.2.2	Bus priority	38	
		3.2,3	Terminal infrastructure	38	
		3.2.4	Potential transit infrastructure in Peacocke	39	
4	Long-	term trans	sit considerations	40	
	4.1	Backgr	40		
	4.2	4.2 Context for mass transit			
		4.2.1	Mass transit principles	41	
		4.2.2	The role of mass transit in Peacocke	42	
	4.3	Mode	Considerations	43	
	4.4	Long-t	erm network integration	45	
	4.5	Corrido	or Design	46	



			Transit Plan for Peacocke
	4.5.1	Northern Section	47
	4.5.2	Southern section	49
	4.5.3	Cobham Drive link	50
	4.5.4	Intersections	50
4.6	Potenti	ial modeshare along mass transit corridor	50
4.7	Station	locations, access, and land use	52
	4.7.1	Land use considerations	52
	4.7.2	Stop spacing	52
	4.7.3	Walking and cycling integration	54
	4.7.4	Park and Ride and drop-off facilities	55
4.8	Access	to wider destinations	56
	4.8.1	Complementing regional transit	56
Appendix A	- Backgro	ound information	57
	Waikat	o Regional Public Transport Plan 2018 – 2028	57
	Access	Hamilton Strategy and Draft PBC	59
	Peacoc	ke Housing Infrastructure Fund (HIF) Business Cases	60
	Progre	ss on HIF projects	62
	Westor	n Lea Amberfield Development	64
		Street pattern	66
Appendix B	- Modelli	ng and potential patronage and modeshare	
	Traffic	generation from Amberfield	70
	Modell	ing	71
Poten	tial patrona	age and modeshare	71
		Public transport modelling – options and limitations	72
		Modelled traffic demands	
		Potential 2041 modeshare	73







Transit Plan for Peacocke

# **Figures**

igure 1: Hamilton Southern Links (Source: HCC)	10
igure 2: Arterial roads within Peacocke. Source: HIF DBC	11
igure 3: Street layout in Amberfield. Source: TDG	13
igure 4: Neighbourhood centre location and indicative centre layout. Source: Urbanismplus	14
igure 5: Indicative bus route into Amberfield, showing Stage 1 bus route (solid line) and bus route u ompletion of whole development (dashed)	
igure 6: Proposed cycle lanes, shared paths and low speed streets in Amberfield	16
igure 7: Key destinations in proximity to Peacocke	20
igure 8: Option 1A	23
igure 9: Option 2A	25
igure 10: Option 3A	26
igure 11: Option 1B	29
igure 12: Option 3B	30
igure 13: Option 4B	31
igure 14: Option 5B	32
igure 15: Option 6B	33
igure 16: Option 7B	34
igure 17: Option 8B	35
igure 18: Hamilton Southern Links (Source: HCC)	40
igure 19 Possible integration of mass transit and other services	45
igure 20: Cross Sections for north-south arterial from Southern Links Scheme Assessment Report Dr	awings.46
igure 21: Northern section Option 1 - bus lane	47
igure 22: Northern section Option 2 - bus lanes & improved active transport	47
igure 23: Northern section Option 3A - busway	48
igure 24: Northern section Option 3B – light-rail	48
igure 25: Northern section Option 4 - Mass Transit & 4 traffic lanes	
igure 26: Southern section Option 1 - bus lanes	49
igure 27: Southern section Option 2 - mass transit	50
igure 28 Three possible mass transit station locations	53
igure 29 800m flying catchment around possible station locations	54
igure 30 Comparison of 1km walking radius to Papakura and Waitakere stations	55
igure 31: RPTP Phased Implementation Approach (WRC)	57
igure 32: RPTP proposed public transport network layers	58
igure 33: RPTP service standards for Hamilton city	58



	Transit Plan for Peacocke
Figure 34: Arterial roads within Peacocke. Source: HIF DBC	61
Figure 35: Cobham Drive and Wairere Drive intersection plan (Source: HCC)	
Figure 36: Waikato River bridge and supporting road network (Source: HCC)	63
Figure 37: Proposed Ohaupo Road roundabout	63
Figure 38: Amberfield Site Location. Source: Weston Lea Ltd	64
Figure 39: Proposed layout of Amberfield. Source: Weston Lea Ltd	65
Figure 40: Street layout in Amberfield. Source: TDG	66
Figure 41: Local road cross-sections. Source: Boffa Miskell and Urbanismplus	67
Figure 42: Local road cross-sections. Source: Boffa Miskell and Urbanismplus	68
Figure 43: Minor arterial road (Peacockes Road) on the western edge of development centre. Source: TDG	
Figure 44: Collector Road (Peacockes Road) on the western edge of development, so	



6



Transit Plan for Peacocke

### **Executive Summary**

This report examines high-level considerations for transit planning in the Peacocke growth area in the short (next five years), medium- (from five to 15 years), and long-term (15 to 30 years). Peacocke is a planned growth area in the southern part of Hamilton City expected to accommodate more than 20,000 residents. Planning and design of some road elements is advancing rapidly. This document focuses on providing indicative public transport options to serve the Peacocke growth area over each time horizon within the existing planning context. This includes local bus route options in the short- and medium-term and consideration of how mass transit services could be provided in the long-term.

#### Strategic context

The 2010 Access Hamilton Strategy targets increasing the proportion of passenger transport journeys to work to seven percent (from two percent in 2010) and achieving seven percent annual growth in the number of passenger transport trips made each year. Meanwhile, the 2018 Regional Public Transport Plan (RPTP) targets implementing mass transit projects within the next ten years and transitioning to a mass transit network in the long-term. Services for Peacocke will need to be provided in accordance with these policies and goals.

Planning public transport services during this early development stage provides the opportunity for Peacocke to achieve significantly higher public and active transport modeshare than most Hamilton neighbourhoods. To achieve this, the following elements need to be provided:

- a well-designed local bus network with frequent routes and priority features to connect Peacocke residents with key destinations
- a corridor designed for frequent, reliable, and direct mass transit services
- integrated land use development with a permeable street network and higher densities around transit stops/stations dedicated infrastructure for active transport to access stations and connect to destinations outside Peacocke

#### Short-term considerations

Opportunities exist to provide high-quality bus services in the short-term with direct connections between Amberfield, the Waikato Hospital, and the city centre. Initially, bus patronage is expected to be low, with correspondingly low farebox recovery. However, new routes with good service levels can ensure residents do not become dependent on car travel, making public transport more viable in the medium- and long-term. Patronage will rise over time as Amberfield and other early stage developments progress.

Three short-term route network options are presented in Section 3.1. They explore extending the existing Comet route and Route 12, as well as creating a new route between the city centre and the planned Amberfield neighbourhood centre via Bader Road.

#### Medium-term considerations

In the medium-term, some short-term routes can be upgraded and additional routes provided to add direct access between Peacocke and the University of Waikato. Eight route options are explored with varying service levels and destination access. Several options explore developing new routes (with additional corresponding costs) or re-routing existing services. Some options presented may require more extensive reorganisation across bus services in southern Hamilton, including of the Orbiter service, which will require careful consideration.

In the medium-term, bus infrastructure will play an important role in ensuring the bus network offers a high level of service competitive with private vehicle travel. This includes well-placed and high-quality bus stops, and bus priority services such as bus lanes and transit signal priority.



7

Transit Plan for Peacocke

#### Long-term considerations

In the long-term, a mass transit corridor through Peacocke can provide excellent access to key destinations and a viable alternative to private vehicle travel in line with Access Hamilton and RPTP goals. The planned north-south arterial could serve as such a corridor. It could also use the future direct link between Cobham Drive and Peacockes Road, if it is built. A variety of bus- and rail-based mass transit systems could be considered. Service levels, priority features, and even mode can be upgraded over time as demand grows.

Though it would only be realised in the long-term, it is essential the corridor is designed for mass transit from the outset. Among other things, this will require preserving space for dedicated transit lanes and appropriately located stations. This can be accommodated within the existing corridor designation.

Section 4.3 presents high-level options for how the north-south arterial could be configured to accommodate mass transit. Indicative cross-sections suggest two lanes of general traffic could be provided alongside mass transit on some sections of the corridor. However, this would leave little space for cycle lanes and footpaths. Developing the mass transit corridor with one lane of general traffic each direction would allow for wide footpaths, cycle paths, and could be conducive to adjacent development.

High-level traffic modelling discussed in Section 4.6 suggests that further investigation is needed to determine if two general traffic lanes in each direction are required along the north-south arterial. If a 30% public transport modeshare is achieved along this corridor, one lane of general traffic in each direction may be sufficient. Such a modeshare should be achievable in the long-term based on comparable examples.

Considerations for mass transit station locations are presented in Section 4.7. They suggest three or more stations could be located within Peacocke, providing focal points for denser development than is planned for Amberfield. Even in medium-density environments such as Amberfield, though, public transport services can still be well used given high-quality service, priority, and connections to key destinations.

Section 4.7 also presents considerations for maximising mass transit station access. Cycling infrastructure is recommended along the mass transit corridor, and walking and cycling connections through Peacocke should be prioritised to accommodate short trips and maximise station connections. Park and Ride facilities are not recommended for mass transit stations in Peacocke.

A mass transit corridor through Peacocke could connect to destinations north of the city centre including Te Rapa and The Base, and to Hamilton Airport and the nearby business park to the south. This could form part of a mass transit network that provides access to key urban and suburban destinations through a single transfer in the city centre or other connection points. Extending mass transit to the airport could also catalyse significant development along the corridor that is relatively near the city centre and has excellent transport connections.

Although regional transit has distinct demand and operational characteristics to mass transit services, a busbased mass transit corridor through Peacocke could also be used by regional buses coming from Cambridge or Te Awamutu.



8

Transit Plan for Peacocke

### 1 Introduction and strategic overview

Several strategic documents and recent developments have a direct influence on the planning, design, and operation of public transport services in Peacocke as this suburb develops. This section describes the strategic goals set in these documents to ensure this Transit Plan is aligned with the overarching transport strategies for Hamilton. We also describe recent developments that have a material influence on the development patterns, road network, and public transport networks in Peacocke. These strategic documents and recent developments include:

- Waikato Regional Public Transport Plan 2018 2028
- Southern Links Notice of Requirement and associated designation approval documentation;
- Access Hamilton Strategy and associated Draft Programme Business Case (PBC);
- Peacocke Housing Infrastructure Fund (HIF) Detailed Business Case;
- Weston Lea Resource Consent Application Documentation for Amberfield development;

Each section briefly summarises the most important points related to each document or development, and a more thorough discussion of each is provided in Appendix A.

#### 1.1 Waikato Regional Public Transport Plan 2018 - 2028

The latest Regional Public Transport Plan (RPTP) produced by the Waikato Regional Council (WRC) was approved in 2018. Among other things, it prioritises the following over the next ten years:

- Improving public transport reliability and travel times
- Developing a mass transit plan, and
- Implementing mass transit start up projects within Hamilton, regionally, and between Hamilton and Auckland.

Over the long-term, the RPTP plans for transitioning to a mass transit network. It also sets out the key function, hours of operation, and minimum frequencies of routes types including mass transit, frequent, connector, coverage, and targeted routes.

New immediate and short-term services for Peacocke will need to be provided in accordance with these policies and standards. There is more flexibility in the longer term, as the RPTP is regularly reviewed.

#### 1.2 Southern Links

Southern Links is considered by the NZ Transport Agency (NZTA) and Hamilton City Council (HCC) as the optimum long-term solution to accommodate growth and manage existing traffic issues in the corridor. It is a joint NZTA and HCC initiative and involves the construction of 21 kilometres of state highway, three new bridges, and 11 kilometres of urban arterial roads within Peacocke.



9



Transit Plan for Peacocke

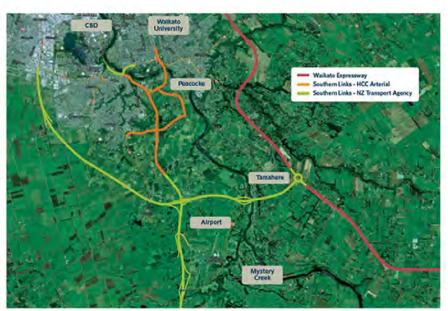


Figure 1: Hamilton Southern Links (Source: HCC)

The transport components of Peacocke are significant elements of the Southern Links Transportation Network. These include the bridge over the Waikato River and the associated arterial roads that come off the bridge and go through to the east-west arterial road.

### 1.3 Access Hamilton Strategy and Draft PBC

The 2010 Access Hamilton Strategy has a Passenger Transport Action Plan that sets a vision, objectives, and targets for public transport in Hamilton.

Its key targets include:

- increasing the proportion of passenger transport journeys to work to 7% (it was 2% in 2010)
   based on census data and household travel surveys; and
- achieving 7% growth annually in the number of passenger transport trips made each year based on WRC bus patronage data.

To achieve these targets HCC developed a Strategic Case in 2016, and a draft but unapproved Programme Business Case (PBC) written in 2018. The preferred programme involves several projects with direct influence on public transport in Peacocke, including:

- Access for Peacocke growth (Wairere Dr extension into Peacocke, River Bridge upgrade, arterial roads) (\$219m) to unlock residential growth in the Peacocke Structure Plan area;
- Increased public transport services (\$210m) to achieve the aforementioned modeshare targets, which would require a mixture of service level improvements, infrastructural improvements, and supporting land use and car parking policies;
- Biking Plan (\$55m); and
- Mass transit investigation and implementation (\$60m)

More information about Access Hamilton goals and policies is provided in Appendix A.



10



Transit Plan for Peacocke

#### 1.4 Peacocke Housing Infrastructure Fund (HIF) Business Cases

As part of the application process to central government for interest free loans from the Housing Infrastructure Fund (HIF), Hamilton City Council undertook an Indicative Business Case (IBC) and a Detailed Business Case (DBC) in 2017. HCC gained approval for \$290 million to enable growth at Peacocke to help fund arterial roads, water, and wastewater infrastructure.

An outcome of the HIF IBC process was a recommendation that the solution for transport infrastructure in Peacocke should be consistent with the staging plans for Southern Links. This solution should comprise:

- A bridge at Wairere Drive/Cobham Drive
- An extension of Wairere Drive to connect with the Hamilton Gardens bridge which will go over the Waikato River to Peacocke;
- An upgrade of the existing Peacockes Road from a rural to an urban road;
- An intersection at SH3/Dixon Road and arterial roading to connect Peacockes Road to east-west arterial roads;
- Land to build the future north-south arterial road within Peacocke;
- · A transfer pump station and pressure main.

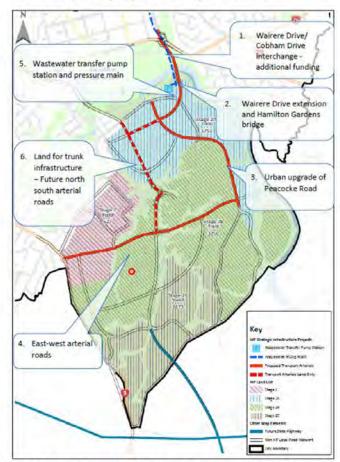


Figure 2: Arterial roads within Peacocke. Source: HIF DBC



11

Transit Plan for Peacocke

Since the approval of Housing infrastructure Fund loan in early 2018, there has been some progress on several of the key projects including:

- Construction of the new Cobham Drive and Wairere Drive interchange is underway). This new interchange provides for a future connection to the new Waikato River Bridge to Peacocke and will be a major interchange for people travelling north from Peacocke to the city centre or the eastern suburbs of Hamilton. This is due for completion in 2021.
- Planning has advanced for the new Waikato River bridge proposed as the key northern entry for Peacocke. Preliminary designs have been completed for the bridge. Construction is due to start in late 2020, and the bridge is due to open in 2023/20242. Plans of how the bridge fits into the supporting road network are shown in Appendix A.
- Construction started on proposed Ohaupo Road roundabout in July 2019. This roundabout connects the new East-West arterial with State Highway 3, immediately south of Dixon Road. This roundabout is due for completion in 2021.

More information about progress toward key projects is included in Appendix A.

#### 1.5 Weston Lea Amberfield Development

Weston Lea Ltd has applied to HCC for a subdivision resource consent for a major residential subdivision on a site in the eastern portion of Peacocke Structure Plan Area. This development is known as Amberfield.

It is anticipated that there will be approximately 1,000 dwellings in Amberfield, composed of 862 single dwellings with the balance made up of medium-density residential units. The subdivision will also provide for between 5,000m2 to 10,000m2 of retail or employment uses.

As shown in Appendix A, Amberfield makes up a major part of the overall Peacocke Structure Plan area. Therefore the development and road network patterns therein will have a major influence on public transport planning and operations in Amberfield and in Peacocke at-large. The subdivision's proposed street pattern is shown below.



12

<sup>1</sup> https://curhamilton.co.nz/on-file-move/final-stage-or-ring-read-project-underway/ 2 https://curhamilton.co.nz/orowing-hamilton/plans-progress-for-hamiltons-newest-t-

Transit Plan for Peacocke

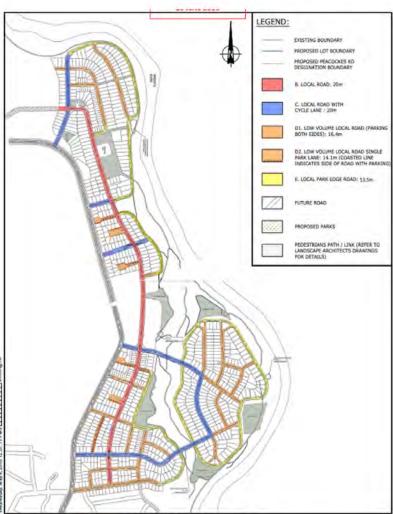


Figure 3: Street layout in Amberfield. Source: TDG

The location and potential indicative layouts of the proposed neighbourhood centre, which will be a destination for community activities and commerce, is shown below. The neighbourhood centre is referred to as a town centre in HCC Peacocke Structure Plan documents.





Transit Plan for Peacocke



ABOVE FIG. 4-2: Indicative neighbourhood centre structure.

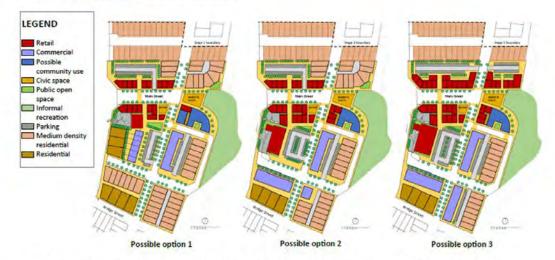


Figure 4: Neighbourhood centre location and indicative centre layout. Source: Urbanismplus

# 1.5.1 Provision for cycling and public transport

The resource consent application documents also show the development's provision for cycling and public transport. The indicative bus route into Amberfield is shown in Figure 5, while proposed streets with cycling infrastructure are outlined in Figure 6.



14

Attachments

Page 1630

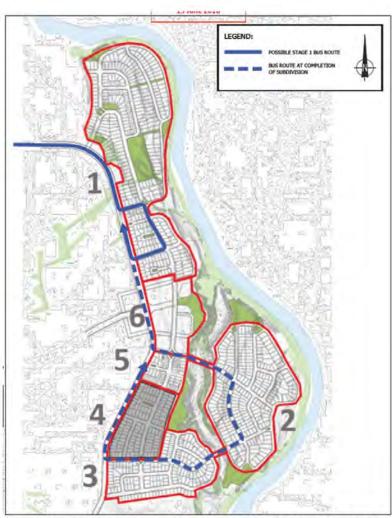


Figure 5: Indicative bus route into Amberfield, showing Stage 1 bus route (solid line) and bus route upon completion of whole development (dashed)

The consent documents do not discuss the origin of this route into Amberfield, nor do they provide operational details such as frequencies, span, etc. Further, vehicle tracking is premised on an 11.5m rigid bus, but most urban buses are 12.6m to 13.5m rigid.

The bus is proposed to travel along the southern edge of the neighbourhood centre, and not through it. There is berm space allocated along this edge that could theoretically accommodate a bus stop, though it is located near a roundabout.

Moreover, the one-way loop means that the first origin stop out of Amberfield toward the city centre may require this stop to be located on the collector/arterial Peacockes Road, which would require additional consideration around pedestrian crossing facilities.



15

Attachments



Transit Plan for Peacocke

When the scheme plan for the neighbourhood centre is developed, it will be critical to ensure that sufficient road width is provided to allow for safe bus operations as well as kerbside spaces for bus stops.

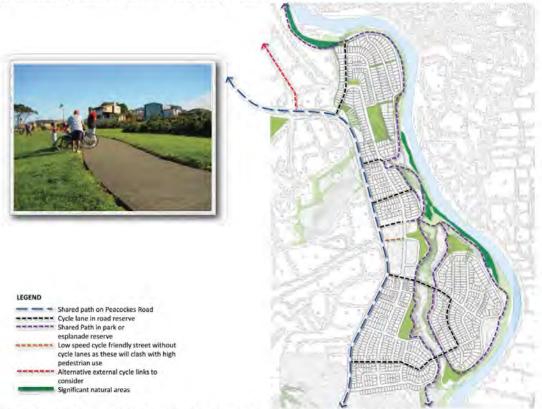


Figure 6: Proposed cycle lanes, shared paths and low speed streets in Amberfield

More information about the Amberfield development, including street cross sections, are provided in Appendix A.

# 1.5.2 Traffic generation

According to the Integrated Transport Assessment (ITA) submitted with the Amberfield resource consent application, the anticipated 1,000 residential lots in Amberfield are expected to generate an additional 8,000 vehicles per day (vpd), of which 6,500 vpd involves travel beyond the Amberfield subdivision area. Other key points from the ITA regarding traffic generation include those listed below. Additional points are identified in Appendix B:

- The existing rural form of Peacockes Road is predicted to be able to accommodate the 8,000 vpd traffic forecast to be generated by the subdivision, but there are no existing facilities for walking and cycling and the carriageway is not wide enough to safely accommodate cyclists with the expected increase in traffic and cyclists (and pedestrians). Therefore, there is a need to provide an off-road shared path along the eastern side of the northern section of Peacockes Road.
- Even with the full Southern Links and HIF roading built, the modelling suggests that the vpd along Peacockes Road in 2041 generated by Amberfield and the new roading would not exceed 8,000 vpd.



16



- The ITA recommends a collector road upgrade for Peacockes Road in the vicinity of Amberfield
  would be adequate, at least for the short-term. However, the 2041 modelling suggests that the
  northermost section of Peacockes Road that intersects with the proposed road from the new
  Wairere Drive river bridge (HIF-funded) may attract up to 15,000 vpd, so in this part of Peacockes
  Road north of the neighbourhood centre, an upgrade to minor arterial road standard is
  appropriate.
- Internal roads within Amberfield will carry less traffic than the 2,000-8,000 vpd expected for
  collector roads and this is not expected to change due to the constraint on future growth
  imposed by the adjoining river. Accordingly, all of these roads are designed as 'local roads'. The
  north south internal road within Amberfield that is parallel to Peacockes Road is also a 'local
  road' and has not been designed for bus circulation because it assumes that a route along
  Peacockes Road would be within reasonable walking distance to dwellings in Amberfield.

More information about traffic generation in Amberfield is provided in Appendix B.

# 1.6 Summary of strategic documents and ongoing developments

Based on the review of the relevant strategic documents and ongoing developments above, it is concluded:

- The Regional Public Transport Plan outlines that Hamilton is planning to shift toward a mass transit network over the next decade and sets out service standards that should be considered for any new bus services proposed for Peacocke.
- The Access Hamilton Strategy and associated Passenger Transport Action Plan's targets for
  modeshare and modal shift remain relevant for the development of public transport in Peacocke,
  and given the strategic location in proximity to the city centre, hospital, university, airport and
  Hamilton Gardens, ensuring a high public transport modeshare here will contribute significantly
  in assisting Hamilton to meet these targets.
- The Access Hamilton PBC, while in draft, provides a sense of the key transport and land use challenges present in Peacocke and broader Hamilton. The targeted programme of investment identifies the key interventions necessary to achieve Access Hamilton's mode shift goals.
- The HIF funding for Peacocke has enabled several key parts of the Southern Links project to
  progress immediately in order to realise the benefits of unlocking residential growth in Peacocke;
  these include the Wairere Drive ring road extension into Peacocke and associated bridge, and the
  Peacocke North-South and East-West arterial roads.
- Other parts of the Southern Links project, although designated and with consents granted, remain unfunded. However, if built, these projects will have a considerable influence on traffic and transport conditions within and surrounding Peacocke.
- Amberfield represents one of the first major developments in the Peacocke Structure Plan area
  that will benefit from the HIF-funded transport infrastructure, which covers a significant eastern
  portion of Peacocke. Amberfield will deliver around 1,000 dwellings, a new neighbourhood centre
  and associated new commercial land uses, which will need to be connected appropriately to road,
  public transport, and active transport infrastructure and services.
- Amberfield will generate up to a maximum of 8,000 vpd by 2041 according to modelling
  documented in the consent application's ITA, even accounting for Southern Links and HIF-funded
  roads. This would require upgrades for Peacockes Road to minor arterial and collector road
  standard with shared path facilities. Intersection upgrades further down the network at the
  intersection of Normandy Avenue and Lorne Street in Melville may also be required for traffic
  egressing Amberfield. Aside from this, it is expected that there will be a low volume of internal
  traffic from Amberfield and only smaller scale 'local roads' will be built.



17



Transit Plan for Peacocke

# 2 High-level network concepts and service types

The consent documents for Amberfield and the Southern Links NOR documentation reference a range of potential public transport options for Peacocke and the surrounding area. These include a mix of:

- · Express bus services from the city centre through Peacocke and to the airport; and
- Local bus services that circulate through Amberfield and the wider Peacocke Structure Plan area, which connect with an existing Hamilton bus route (e.g. Orbiter) for journeys to other parts of Hamilton.

It is our view that there are a broader range of public transport service and routing options available to Peacocke, providing a wider range of functions than the options presented in existing planning documents. This section provides a high-level description of several public transport network concepts that could be used to serve Peacocke. The subsequent sections comment on how these different network concepts could be implemented across the short-term, medium-term, and long-term. The concepts are shown in Table 1 below.

Table 1: High level network concepts

Name	Extent	Jurisdiction	Trip markets	Purpose	Service qualities
Local public transport	Suburban Hamilton	Hamilton City and Waikato Regional Council	Neighbourhood coverage, local trips, shopping, services, workers	Provide public transport to every neighbourhood.	High accessibility, closely spaced stops, local circuitous routes, medium to high frequency
Mass transit / rapid transit	Suburban Hamilton	Hamilton City and Waikato Regional Council	People using congested corridors, city commuters, major destinations, hospital, university.	Improve busy public transport corridors with improved infrastructure and vehicles to achieve fast and reliable transit.	Higher speed and reliability, high frequency, widely spaced but regular stops, more direct routes
Regional transit	Hamilton and nearby towns	Hamilton City, Waipa, Matamata- Pioko, Waikato Regional Council.	People commuting long distance for jobs, study or medical care; people without access to private vehicles.	Deliver quick and reliable trips to Hamilton from nearby commuter towns (e.g. Huntly, Ngaruawahia, Te Awamutu, Morrinsville, Cambridge)	Fast and direct, medium length trips, lower frequency / peak-only, limited stops (one stop per town)

As the table above shows, there are three distinct types of service that could be operated to serve Peacocke and surrounding areas. The following sub-sections highlight some of the strategic considerations for selecting public transport options and elaborate on each of the concepts outlined in Table 1.

# 2.1 Types of public transport

This section discusses in more detail the three different types of public transport service identified in Table 1 – local public transport, mass transit, and regional transit - and how they can meet the needs of a variety of trip types for Peacocke residents. The potential networks for these are then discussed over different time horizons in the following sections.



18



# 2.1.1 Local public transport

In the context of Peacocke and Hamilton, local public transport comprises bus routes that would connect Peacocke with the rest of Hamilton as well as serve residents and businesses within Peacocke. With reference to the service levels adopted by the Waikato Regional Public Transport Plan (RPTP) 2018-2028, there would be three types of local bus routes:

- Frequent Minimum headway of 15 minutes, 6am to 11pm weekdays and 7am to 9pm weekends;
- Connector Minimum headway of 30 minutes, 6am to 9pm weekdays and 7am to 9pm weekends:
- Coverage Minimum headway of 60 minutes, 6am to 9pm weekdays and 7am to 9pm weekends

Frequent routes are targeted at connecting major population and activity centres and moving many people as efficiently as possible, whilst offering an all-day, reliable, 'turn up and go' service so that people do not have to look at a timetable to take the bus, These services are useful for trips being taken for many reasons (shopping, education, entertainment, etc) at different times of the day or evening, in addition to peak commuter trips. In the context of Peacocke, one could expect frequent buses connecting the suburb with major activity centres in other parts of Hamilton, such as the city centre.

Connector and coverage routes provide broader area coverage so that most people are within a short walk of a bus service. These routes provide connections to the more widely spaced frequent routes and single-seat rides (no transfer required) to local destinations within suburbs and between neighbouring suburbs. In Peacocke, connector or coverage services could provide circulation around Peacocke, connections to the frequent network for people who live too far from a frequent stop, and connections to adjacent suburbs such as Glenview.

Section 3 discusses local public transport options in the short- and medium-term. Section 4 explores how local public transport services could integrate with potential mass transit services in the long-term.

### 2.2 Mass transit

Mass transit<sup>3</sup> is effective at improving busy public transport corridors by providing infrastructure for public transport vehicles that is largely or wholly separated from other traffic to deliver higher speed, high reliability, and high frequency services. While the RPTP envisages a minimum headway of 15 minutes for such services, our experience suggests that 10-minute headways are better suited for this level of transit to make the most of the extensive infrastructural investments required for mass transit.

While mass transit does not exist in Hamilton, other examples in New Zealand include Auckland's Northern Busway and passenger rail network, as well as Wellington's passenger rail network. In the context of Peacocke, corridors for mass transit could be reserved on proposed arterial roads or elsewhere to deliver this high-quality service in the future when patronage and congestion conditions necessitate them.

Mass transit considerations for Peacocke are explored in Section 4.

<sup>:</sup> This aucument will refer to this mode as mass datest in time with the definition in the Hamilton KETF in should be noted that NATA refers to this midde as right unusual





Transit Plan for Peacocke

#### Regional transit 2.3

Regional transit's purpose is to connect Hamilton with nearby satellite towns such as Cambridge, Huntly or Te Awamutu, with a focus on direct and fast trips to get passengers from these towns to Hamilton as quickly as possible, as there is unlikely to be passenger demand in places in between. As such, regional transit services typically have few stops. Hamilton already has examples, such as bus routes to Huntly, Raglan, and Cambridge.

Regional transit considerations are not a focus of this document. In the long-term, though, regional transit has the potential to route through Peacocke using the proposed north-south arterial. Regional transit considerations are thus explored briefly in Section 4.8.1

# Strategic demands and key nodes of connectivity

For public transport to function effectively in Peacocke it will need to serve a range of destinations. Figure 7 shows key destinations in proximity to Peacocke that may generate demand and dominate travel patterns.

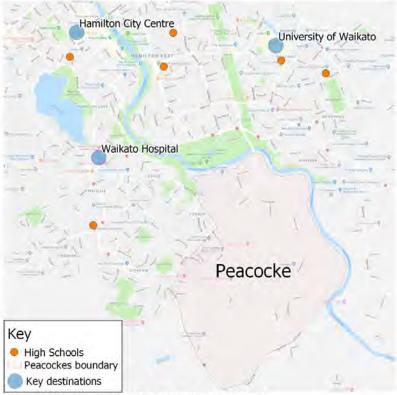


Figure 7: Key destinations in proximity to Peacocke

Peacocke is located four kilometres south-west of the Hamilton city centre, which is the most important demand generator within the Hamilton urban area and the location of the Hamilton Transport Centre, which provides a key connection to intercity modes.



20



The city centre has4:

- 15,200 employees or 28% of Hamilton's total
- Retail sales of \$775 million, which is 50% of Hamilton's overall retail spend
- 20,000 students (Primarily at Wintec) which is about 50% of the Hamilton tertiary student population,

The Waikato Hospital is located three kilometres west of Peacocke. This is a major regional hospital, with over 600 beds, 2000 staff, and over 1000 carparks. The hospital generates high levels of transport demand from across the Hamilton urban area, as well as the Waikato region.

The University of Waikato is located 2.5 kilometres north of Peacocke. The University has over 10,000 students and 1400 staff<sup>5</sup>.

Schools will be an important destination for children that live in Peacocke. A primary school will likely be developed within the site as the population increases, although children will likely use existing high schools for the foreseeable future. There are six high schools within four kilometres of Peacocke, These are:

- Melville High School (Melville)
- Hamilton Boys' High School (Hamilton East)
- Hamilton Girls' High School (city centre)
- Hillcrest High School (Hillcrest)
- Sacred Heart Girls' College (Hamilton East)
- St John's College (Hillcrest)

Other destinations that are likely to be important for people living in Peacocke are:

- The Base shopping centre and Te Rapa employment area
- Hamilton East employment area and schools
- Hamilton Airport
- Chartwell Shopping Centre
- Frankton employment area



21

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Transit Plan for Peacocke

# Short- and medium-term public transport considerations

Following our review of the high-level network concepts available to Peacocke and greater Hamilton in the preceding section, this section applies these concepts to the Peacocke Structure Plan area by proposing and describing potential public transport route alignments, associated service levels, and interactions with existing bus routes. Our proposals are sorted into three horizons:

- 'short-term' which relates to interventions that can be completed within the next five years.
- 'medium-term' which identifies interventions in the five to 15-year horizon, and
- 'long-term' which relates to a 15- to 30-year horizon.

The short-term horizon discusses local public transport options. These are expanded upon in the mediumterm as development continues, the street network is connected, and patronage increases. The long-term horizon primarily discusses mass transit options for Peacocke and how this could connect to and be supported by the existing local network. The long-term section will also discusses how regional transit could be considered.

Each of the horizons contain a set of assumptions about the presence or absence of varying pieces of transport infrastructure, based on the strategic review conducted in Section 1. For each horizon, we also propose both 'do minimum' and more comprehensive options to allow for an objective comparison of the public transport network concepts available to Peacocke. Each option contains a description of its rationale and potential benefits and drawbacks. An examination of the three horizons and their associated options follows.

It should be noted that this section focusses on the key entry corridors to Peacocke and the destinations of routes. Operations within Peacocke including terminus points, circulation and coverage are best dealt with at a later stage once planning for the street network and road cross-sections is more advanced. Once public transport options have been selected, it will be easier to understand the requirements for infrastructure to support bus services.

## Short-term

The short-term scenario focuses on providing a base level of transport service to the early stages of the Peacocke development in the next five years before major infrastructure projects are completed. This would be focussed around serving Stage 1a (500 lots) and 1b (350 lots)<sup>c</sup>, as well as the first tranche of the Amberfield development.

#### Key Assumptions7

- Bridge from Wairere Drive over to Peacocke is not completed
- North-South Arterial is not completed
- New roundabout along Ohaupo Road is completed
- East-West arterial is completed from the new Ohaupo Road roundabout to at least Shaw Wetlands.

Sumbers taken from the HIF IBC.

Numbers taken from the HIF IBC.

Number taken from the HIF IBC.

Number taken from the HIF IBC.





 Peacockes Road urban road upgrade is completed adjacent to the Weston Lea Amberfield development to a collector road standard south of the proposed neighbourhood centre and a minor arterial road standard north of the neighbourhood centre.

During this period, we expect infrastructure to be under a continual process of change, which will complicate bus route planning. Implementation of the first set of service improvements will involve consideration of several important factors:

- · Ensuring bus service is provided early in the development to shape new travel patterns
- New bus routes may have very low patronage and cost recovery in the early stages
- Construction will impact bus routes
- Infrastructure may not be ready for bus services, and buses may initially need to use roads that are not
  intended for bus service.

# 3.1.1 Route Options

This section presents three high-level options for bus network routes in the short-term. Construction and development staging may mean that some options will be able to proceed earlier that others, and options may need to be staged.

# Option 1A (Do Minimum):

This option is designed to provide a basic level of service to the early stages of the Peacocke development at minimal cost. It consists of two minor extensions to existing routes.



Figure 8: Option 1A



23

Transit Plan for Peacocke

Route 12 east extension - Extend Route 12 from Fitzroy into Peacocke as the Amberfield development progresses.

#### The advantages are:

- Provides a reasonable level of service, with buses every 30 minutes all day on weekdays.
- Provides a direct connection between the Amberfield stage of Peacocke with Waikato Hospital
  and the city centre using existing roads that will be built in the short-term.
- Minimal extra cost as this is short extension of an existing route.

#### The disadvantages are:

- Route 12 is already indirect as it services Bader before serving Fitzroy.
- Route would be circuitous as would have to serve existing Route 12 stops in Fitzroy, before backtracking to continue along Peacockes Road.

Comet branch extension - Extend one branch of the Comet along the early stages of the East-West arterial Road (shown by the yellow line on map)

#### The advantages are:

- Provides a reasonable level of service, with buses every 30 minutes all day on weekdays.
- Provides direct connections between the first two stages of Peacocke and Waikato Hospital, city
  centre, and Te Rapa/The Base using existing roads that will be built in the short-term
- Minimal extra cost as it is short extension of an existing route.

### The disadvantages are:

- Route is circuitous as would be an extension of one of the branches that serves either Bruce Avenue or Deanwell Avenue.
- This is likely to make the Comet route branches more uneven in terms of trip length, which could make the route inefficient,

## Option 2A:

This option is designed to provide fast and direct routes from the northern part of Peacocke to the city centre and Waikato Hospital that are competitive with car journeys. It consists of one extension to an existing route and one new route.



24



Figure 9: Option 2A

CBD via Bader St - New route from city centre to Peacocke north via Waikato Hospital, Bader Street and Peacockes Road

The advantages are:

- Fast and direct route giving competitive journeys with the car for local trips.
- Scalable to meet demand could start at low frequency and increase as demand increases.
- Provides direct connections between Peacocke north with Waikato Hospital and the city centre, using existing roads that will be built in the short-term

## The disadvantages are:

High cost, as an entirely new bus route is required.

Route 12 south extension - Extend Route 12 south along Dixon Road to serve the first two stages of development in Peacocke.

#### The advantages are:

- Provides a reasonable level of service, with buses every 30 minutes all day on weekdays.
- Provides a direct connection between the first two stages of Peacocke and Waikato Hospital and the city centre using existing roads that will be built in the short-term.
- Minimal extra cost as it is a short extension of an existing route.
- No disruption or changes needed to new Comet route.



25



Transit Plan for Peacocke

The disadvantages are:

- Dixon Road is rather narrow and windy, and not ideal for regular bus services.
- Route 12 is indirect as it serves Bader before serving Fitzroy.
- Takes passengers close to, but not into the hospital, requiring a steep walk up to the hospital from Ohaupo Road.

# Option 3A:

This option is designed to provide a high level of service to both the north and south ends of Peacocke as soon as infrastructure allows.

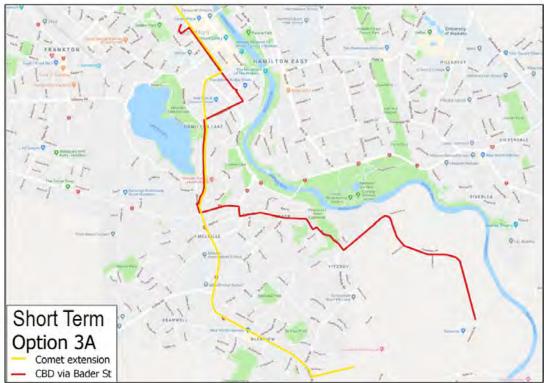


Figure 10: Option 3A

Comet extension - Extend full service on the Comet along the early stages of the East-West arterial Road.

The advantages are:

- Provides a high level of service, with buses every 15 minutes all day on weekdays.
- Fast and direct route giving competitive journeys with the car for local trips.
- Provides direct connections between Peacocke Stages 1A and 1B with Waikato Hospital, city centre, and Te Rapa/The Base using existing roads that will be built in the short-term.
- Short extension of an existing route.



26



The disadvantages are:

- High cost as it would require a new route to serve Glenview and Mahoe.
- Disruptive for passengers catching the Comet from Glenview or Mahoe as bus services have already changed recently to give these passengers access to the Comet.

**CBD via Bader St** - New route from city centre to Peacocke north via Waikato Hospital, Bader Street and Peacocke Road (as per Option 2 above).

The advantages are:

- Fast and direct route giving competitive journeys with the car for local trips.
- Scalable to meet demand could start at low frequency and increase as demand increases.
- Provides direct connections between Peacocke north with Waikato Hospital and the city centre, using existing roads that will be built in the short-term.
- Route 12 remains unchanged.

The disadvantages are:

High cost as entirely new bus route required.

### 3.1.2 Conclusions

A brief assessment of each of the route options is shown in Table 2 below.

Table 2: Short-term route options assessment

Criteria	Utilises available road network?	Direct route to city centre?	Direct route to hospital?	Direct route to university?	Indicative Cost
Option 1A	¥	×	×	×	\$
Option 2A	×	×	×	×	\$
Option 3A	1	*	1	×	\$\$

This highlights Option 3A is the preferred option as it offers a direct service to both Waikato Hospital and the city centre. The downside is that this is a high cost option as it involves a new route. Option 1A may be acceptable in the very short-term to offer a coverage service to initial stages of the development at a very low cost, however the extended route (Route 12) is already circuitous so would offer a very poor journey time to the city centre.



27

Transit Plan for Peacocke

# 3.1 Medium-term network options

The medium-term builds on the short-term options provided and focuses on establishing a good level of transport service to the Peacocke development once the local road network is fully connected, in approximately a 5-15 year timeframe.

#### Key Assumptions8

- Bridge from Wairere Drive to Peacocke is completed
- East-West arterial is fully completed from the new Ohaupo Road roundabout to the Peacocke neighbourhood centre
- Peacockes Road urban road upgrade is completed adjacent to the Amberfield development to a collector road south of the proposed neighbourhood centre, and to a minor arterial road north of the neighbourhood centre
- North South Arterial is not completed

## 3.1.1 Route Options

This section presents eight high-level options for the medium-term. It is anticipated that by this point in time the street network at the northern and central parts of Peacocke should be completed, so all routes will be able to be implemented in a similar timeframe. While development is likely to continue to the south and west of Peacocke, these routes can be extended as infrastructure and development allows.

# Option 1B/3B (Do Minimum):

The medium-term "do minimum" option provides two scenarios for building on options 1A and 3A provided in the short-term scenario in the preceding section. This is intended to provide a basic level of service to the Peacocke development at minimal cost. Under these options, existing routes selected in the short-term would be retained and extended to serve the full extent of Peacocke. By extending either options 1A or 3A, the two proposed routes would connect at the new Amberfield neighbourhood centre. An extended version of short-term option 2A is not provided in this section. Planning documents show that there are no roads that would allow the two proposed routes to connect and therefore this short-term option would not scale well to the medium-term.

<sup>\*</sup> Note these assumptions are based on the talkst information supplied to regard to progress or FIH funded intrastructure



28





Figure 11: Option 1B

Option 1B further extends the Comet branch extension from 1A to meet the Route 12 extension (already completed in the short-term if 1A is selected). This provides greater coverage of Peacocke and connects to the neighbourhood centre.





Transit Plan for Peacocke

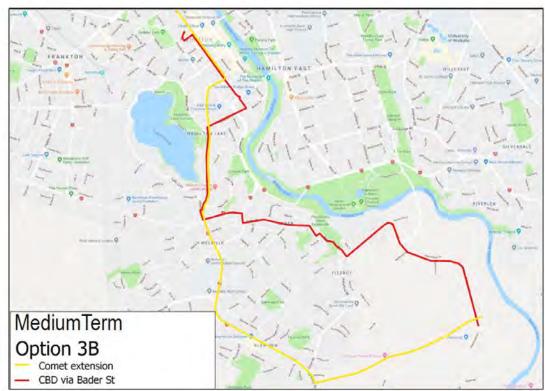


Figure 12: Option 3B

Option 3B completes the Comet extension initiated in Option 3A to connect with the CBD via Bader St. route. This provides a more direct route than the Comet extension in 1A and 1B.

Each of these two "Do Minimum" options are assessed as follows:

### The advantages are:

- Provides a basic level of service to key destinations, with buses every 30 minutes all day on weekdays.
- Minimal extra cost as is short extension of an existing route.

#### The disadvantages are:

- This level of service would be increasingly inadequate to serve the growing population of Peacocke.
- Passengers heading to the University of Waikato or Hamilton East would need to connect in the city centre, despite a direct road connection now being available.

# Option 4B:

This option is a modified version of option 3B above. As in 3B, the Comet extension and CBD via Bader Street routes connect in the Peacocke neighbourhood centre. In addition to this, the Orbiter route would be diverted into Peacocke to provide improved connections with the wider Hamilton area.



30

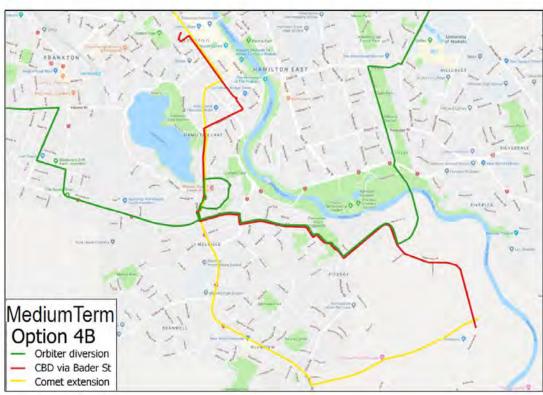


Figure 13: Option 4B

#### Option 4B would include the following:

- Extend full service on the Comet along the early stages of the East-West arterial Road.
- New route from city centre to Peacocke via Waikato Hospital, Bader Street and Peacocke Road.
- Deliver the Orbiter route into Peacocke North utilising the new Wairere Drive bridge. The route
  would deviate from the existing route on Clyde Street and turn into Wairere Drive where it would
  cross the Waikato River on the new bridge. It would then enter Peacocke to stop in a central
  location, before turning around to continue to Waikato Hospital via Peacockes Road, Bader
  Street, and Ohaupo Road. Note the route would need to circulate around the Waikato Hospital
  using Hague Road.

### The advantages are:

Provides a frequent, direct service to a wide range of key destinations, including the city centre,
 The Base, Waikato Hospital, University of Waikato and Chartwell. Buses would run every 15 minutes all day on weekdays on all three routes.

### The disadvantages are:

- High cost option with one new route, and one extended existing route.
- Some existing Orbiter customers would be disadvantaged. This would largely be caused by the
  removal of the Orbiter from Anzac Parade in the southern city centre, and from Clyde Street in
  Hamilton East. Other customers may have increased journey times, such as those travelling from
  Chartwell to Waikato Hospital or Dinsdale to the University of Waikato, but this would depend



31

Page 1647



Transit Plan for Peacocke

how far into Peacocke those trips would travel. An extra route may be required from the city centre to Waikato Hospital

# Option 5B:

This option is a modified version of Option 4B above, but with a more direct route to the city centre.



Figure 14: Option 5B

### Option 5B would:

- Extend full service on the Comet along the early stages of the East-West arterial Road.
- Include a new route from city centre to Peacocke use the new Wairere Drive bridge, and then
  direct to the city centre via Cobham Drive.
- Divert the Orbiter route into Peacocke north utilising the new the Wairere Drive bridge (as above).

### The advantages are:

- Provides a fast, direct route to the city centre that will be highly competitive with car travel.
- Provides a frequent, direct service to a wide range of other key destinations, including The Base,
   Waikato Hospital, University of Waikato and Chartwell. Buses would run every 15 minutes all day on weekdays on all three routes.





#### The disadvantages are:

- High cost option with two new routes, and one altered route.
- Some existing Orbiter customers would be disadvantaged by the removal of the route from the southern edge of the city centre.

### Option 6B:

This option provides two routes to the city centre, one to the east, and one to the west. It does not provide a direct service to the University of Waikato.

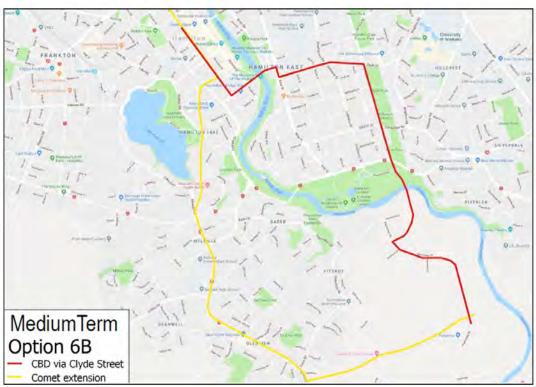


Figure 15: Option 6B

### Option 6B would:

- Extend full service on the Comet along the early stages of the East-West arterial Road.
- New route from city centre to Peacocke via Hamilton East, Clyde Street, and the Wairere Drive bridge.

#### The advantages are:

- Provides a frequent, direct service to a range of key destinations, including the city centre, The Base, Hamilton East and Waikato Hospital. Buses would run every 15 minutes all day on weekdays on all three routes.
- · Reasonably fast and direct route to the city centre.



33

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Transit Plan for Peacocke

#### The disadvantages are:

- Passengers bound for the University would be required to alight on Clyde Street, and walk 10 to 15 minutes, or transfer to the Orbiter to finish their journey.
- High cost option with one new route, and one extended existing route.
- No direct route to the Hospital from the north of Peacocke.

# Option 7B:

This option is a modified version of Option 6B above, but with the city-centre-bound route running via the University of Waikato.



Figure 16: Option 7B

### Option 7B would:

- Extend full service on the Comet along the early stages of the East-West arterial Road.
- Include a new route from city centre to Peacocke via Hamilton East, Clyde Street, (alternatively Te Aroha Road and Ruakura Road), University of Waikato, Hillcrest Road, Cambridge Road and the Wairere Drive bridge.

#### The advantages are:

Provides a frequent, direct service to a range of key destinations, including the city centre, The Base, Hamilton East and Waikato Hospital. Buses would run every 15 minutes all day on weekdays on both routes.



34



- Unlike most options, it also provides a direct connection to the University of Waikato from Peacocke.
- Unlike most options, it also provides a new frequent and direct connection between the Transport Centre and University of Waikato.

### The disadvantages are:

- High cost option with one new route, and one extended existing route.
- No direct route to the Hospital from the north of Peacocke.
- Routes less competitive with private vehicle travel for journeys from parts of Peacocke to the city

# Option 8B:

This option is a modified version of Option 8B above, but with the addition of a direct city centre route.

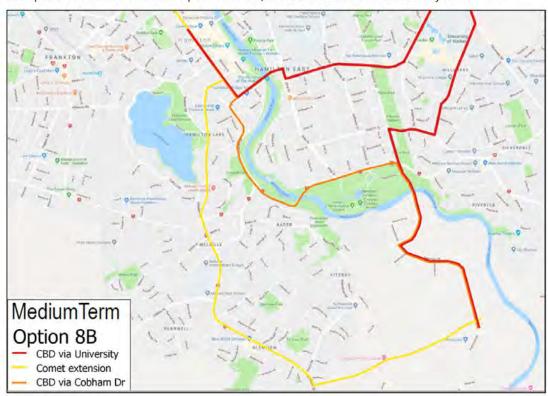


Figure 17: Option 8B

#### Option 8B would:

- Extend full service on the Comet along the early stages of the East-West arterial Road.
- Include a new route from city centre to Peacocke via Hamilton East, Clyde Street, (alternatively Te Aroha Road and Ruakura Road), University of Waikato, Hillcrest Road, Cambridge Road and the Wairere Drive bridge.
- Include a new route from city centre to Peacocke via Cobham Drive.



35



Transit Plan for Peacocke

#### The advantages are:

- Provides a frequent, direct service to a range of key destinations, including the city centre, The Base, Hamilton East and Waikato Hospital. Buses would run every 15 minutes all day on weekdays on all three routes.
- Unlike most options, it also provides a direct connection to the University of Waikato from Peacocke.
- Unlike most options, it also provides a new frequent and direct connection between the Transport Centre and University of Waikato.

#### The disadvantages are:

- Very high cost option with two new routes, and one extended existing route.
- No direct route to the Hospital from the north of Peacocke.
- May not be enough patronage to run all three routes frequently, so may need to downgrade the two new routes from frequent to connector.

## 3 1.2 Conclusions

A brief assessment of each of the route options is shown in Table 3 below. Options 58 or 88 offer direct service to the three major destinations (city centre, University of Waikato and Waikato Hospital). However, each of these options poses several operational complexities. For example, option 58 requires re-routing the Orbiter, which would improve service to Peacocke but would impact existing Orbiter customers as this route would no longer enter the southern side of the City Centre. This option would require a much more complex reorganisation of the Hamilton bus network across southern Hamilton, while other options would only have minimal impacts.

Option 8B also provides a very high level of service to key destinations but requires two new routes and one extended route. It is therefore the highest cost option. This may be viable in the longer term when Peacocke is developed but may not be viable in the medium-term when there is insufficient patronage to justify three separate routes.

Options 6B and 7B are worth investigating if resources are constrained. The relative merits of these options vary depending on whether the University is a key destination for Peacocke residents. Option 6B does not have direct service to the University of Waikato, with patrons needing to walk 1 kilometre, or transfer to another bus service to complete their journey. Option 7B provides direct service to the University of Waikato, but both options for journeys to the city centre are indirect, with one travelling via Ohaupo Road, and one via the University of Waikato.

MRCagney

36

Attachments



Table 3: Medium-term route options assessment

Criteria	Utilises available road network?	Direct route to city?	Direct route to hospital?	Direct route to university?	Indicative Cost
Option 1B	×	×	×	×	\$
Option 3B	×	×	*	×	\$
Option 4B	1	×	1	V	\$\$
Option 5B	1	1	1	<b>*</b>	\$\$
Option 6B	~	1	1	*	\$\$
Option 7B	<b>V</b>	×	1	1	\$\$
Option 8B	<b>√</b>	1	1	1	\$\$\$

# 3.2 Bus network infrastructure

The bus networks described above will require supporting infrastructure to serve several purposes, including:

- · Offer a high level of service for customers for the entirety of their journey.
- Ensure bus services are reliable and offer competitive journey times with private vehicles.
- Meet operational requirements.

Infrastructure requirements can be analysed through three lenses: bus stops, bus priority, and terminal infrastructure. These various infrastructure requirements are discussed in general principle in the following sections. Specific options for how these could be applied within Peacocke are discussed in Section 3.2.4.

## 3.2.1 Bus stops

Bus stops need to be provided at regular intervals along a route. Stop locations need to balance passenger access (ensuring bus stops are within an easy walk of customers or destinations) and bus speeds (too many stops slow services making them uncompetitive with other modes). Generally, spacings of 300 to 400 metres are seen as ideal in residential areas. However, this will vary based on a range of factors such as:

- Walking catchments of each bus stop, including street networks, safe street crossings and presence of
  off-road paths that provide extra links.
- Bus stops should be placed immediately outside key destinations such as shops and schools.



37

Transit Plan for Peacocke

- Topography: Where streets are steep or undulating, people are less willing to walk, so stops should be more closely spaced.
- Population characteristics: Stops need to be more closely spaced where there are higher proportions
  of elderly people or people with disabilities. Stops should be placed directly outside retirement
  villages or other care facilities.

Bus stops should also be provided with appropriate infrastructure for passenger comfort and accessibility. This includes shelter, benches, rubbish bins, passenger information, and real times signs. In general, stops with a high volume of people boarding need higher quality facilities, while stops used primarily for alighting can have more basic facilities. Busier stops that generate demand across the day, especially those outside shopping centres, need to have the highest stop quality.

# 3.2.2 Bus priority

Bus services need to offer competitive and reliable journeys to ensure they are attractive to customers. This will help bus services meet the modeshare targets discussed in section 1. Bus priority is an important tool to create an attractive service.

Bus priority should be considered for all frequent routes where travel times are impacted by private vehicles. The type of bus priority chosen will depend on bus frequency, passenger volumes, bus delay, corridor widths, and intersection configurations. Key methods of providing bus priority are as follows:

- Continuous bus lanes these provide high levels of reliability and improved journey times, however, they require two travel lanes beyond those used by private vehicles.
  - In suburban settings, these lanes usually function at peak times and peak direction only (minimum times 7am – 9am, 4pm – 6pm).
  - In busy corridors such as city centres these may be operate 12 hours (7am to 7pm) or even 24 hours, 7 days per week.
  - A low-cost solution can be converting a continuous parking lane or extra traffic lane to a bus lane when required. By contrast, extensive road widening to provide for a bus lane is a high cost option that requires high patronage and passenger delay to justify the expenditure.
- Isolated bus lanes isolated bus lanes are only provided at select locations where buses experience
  delay, usually in an extended stretch leading up to an intersection where long traffic queues develop.
- Intersection bus priority pocket these are a very short (15 to 50 metres) stretch of bus lane
  immediately before a signalised intersection. These allow buses to skip short traffic queues so that
  they can depart first.
- Transit signal priority transit signal priority generally uses bus priority pockets with an extra 'B' signal added to traffic lights. Sensors in the bus lane detect when a bus is present. The 'B' signal lights up several seconds before general traffic is given a green light, so buses can get in front of the traffic. More advanced versions of transit signal priority are available that ensure buses are given a green light as they arrive at an intersection.

Bus priority interventions work best when a full suite of interventions is implemented across a whole corridor. Extensive rollout of bus priority, combined with high frequency bus services, can create a service that approaches mass trait performance.

### 3.2.3 Terminal infrastructure

Every bus route needs an identified terminus point, where trips terminate and commence. For short, low frequency routes, this may entail a normal bus stop in the street. However, frequent routes, or routes that are



38



further from the city centre, need dedicated terminal infrastructure. This terminal infrastructure needs to allow the following activities to occur;

- Allow buses to turnaround and start the next trip at the correct location. This may be difficult in
  developing residential areas. For this to occur, buses generally need either a roundabout, an
  appropriate street network loop, or a dedicated turnaround facility. Many streets are not designed for
  buses, so even though the street network may appear to allow a turnaround, this may not be suitable
  for buses.
- Ensure space available for buses to layover between trips. Layover time is essential between trips to allow for variability in travel times and to allow for bus trips to commence on time. Generally, this layover is at least five minutes, although can be up to 30 minutes depending upon the route. On low frequency routes, only one layover space/stop may be necessary. As routes increase in frequency, there is the need to provide multiple stops to allow for multiple buses to park at the same time.
- The Employment Relations Amendment Act 2019 created new requirements for rest breaks. Drivers
  must have a ten-minute break at least every two hours. This will generally occur during the layover
  period.
- Bus terminals should have access to toilet facilities for drivers. This either means the stop should be
  adjacent to a location where a public toilet is available (i.e. a public park or shopping centre), or a
  dedicated toilet is provided for bus drivers adjacent to the stop.

## 3.2.4 Potential transit infrastructure in Peacocke

The strategic background information reviewed in Section 1 allows for early considerations of appropriate infrastructure for Peacocke, especially in relation to the new Waikato River Bridge, East-West arterial, and the Amberfield development.

#### **Bus Lanes**

The new Waikato River bridge is being built to four lanes, along with the supporting roads to the north and south. Bus lanes should be considered for this bridge to ensure that future services can be adequately accommodated. Bus lanes should also be considered at key signalised intersections south of the bridge, as these may experience high levels of vehicle traffic, which could impact on bus journey times and reliability.

The cross section currently proposed for Peacockes Road will not allow for full length bus lanes, as parking is embedded in bays, rather than adjacent to the standard kerb. This eliminates the opportunity for timed parking removal to allow for bus lanes. Bus lanes and transit bus priority should be considered for signalised intersections along Peacockes Road.

### Terminal Locations

The bus route planning conducted as part of the Amberfield Resource Consent application (see Section 1.5.1) has not considered terminal locations. The bus route is shown as a continuous loop, however this will not be possible in practice and a terminal location with need to be identified.

#### **Bus Stops**

Bus stops have not yet been identified on streets. Appropriate bus stop locations in Peacocke need to be determined following a detailed analysis of the walking network, and use and street designs proposed. This should include a well-located high-quality bus stop within the neighbourhood centre.



39



Transit Plan for Peacocke

# Long-term transit considerations

In the long-term, a mass transit corridor through Peacocke can provide excellent access to key destinations and a viable alternative to private vehicle travel in line with Access Hamilton and RPTP goals. The planned north-south arterial through Peacocke could serve as such a corridor. It could also use the future link between Cobham Drive and Peacockes Road, if it is built. A variety of bus- and rail-based mass transit systems could be considered. Service levels, priority features, and even mode can be upgraded over time as demand grows. Though it would only be realised in the long-term, it is essential the corridor is designed for mass transit from the outset. Among other things, this will require preserving space for dedicated transit lanes and appropriately located stations. This can be accommodated within the existing corridor designation.

This section presents high-level options for how the north-south arterial could be configured to accommodate mass transit, which requires more detailed study. This section also explores key considerations related to mode options, integration with local public transport, active transport, station spacing, land use development, and station access.

#### 4.1 Background

This section focusses on the potential for Peacocke to connect to Hamilton city centre and other key destinations as part of a mass transit network. This involves reviewing the Southern Links north-south arterial designation and preliminary designs to understand options for fitting mass transit into the designation. This would be a long-term project, built in the ten- to 30-year timeframe. The review has focussed on the Hamilton City Council section of the north-south arterial, shown as the north-south arterial in orange on the west of the Peacocke growth area in Figure 18.

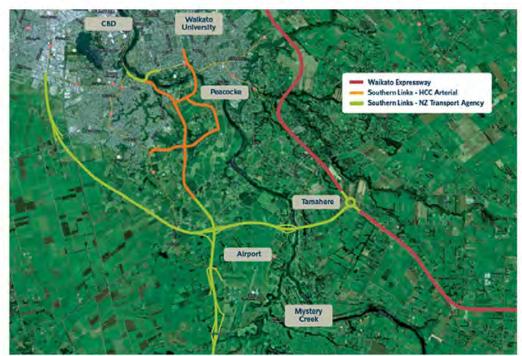


Figure 18: Hamilton Southern Links (Source: HCC)



40



South of Peacocke, the designation is under the control of the NZTA, and will be part of the future State Highway network. This will replace the existing State Highway 3 route in this area. Of note, however, is that the north-south arterial will provide a future link to both Hamilton Airport, and onwards to Te Awamutu.

## 4.2 Context for mass transit

Investigating a mass transit route through Peacocke comes in the context of broader goals set forth in *Access Hamilton* and the *Regional Public Transport Plan*. We understand that existing work is underway to develop a ten-year and 30-year transit plans for Hamilton and the immediate surrounding region. A mass transit route through Peacocke should complement city-wide mass transit planning.

# 4.2.1 Mass transit principles

Mass transit services are frequent, convenient, and rapid. They provide users a realistic alternative to driving. As shown in the Appendix in Figure 32, the RPTP differentiates mass transit from frequent, connector, coverage, and targeted services. Mass transit provides the backbone of a suburban/urban transit network and is complemented by local services. It does not replace local, intercity, or commuter services.

Public transport requires high service levels (eg frequency) and priority level (eg dedicated right of way) to qualify as mass transit. It can be provided through a range of bus- and rail-based options. These include the following (with photos of illustrative examples from other cities):

#### Standard buses using bus lanes:



A bus rapid transit system with higher capacity buses using a centreline busway:





41

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Transit Plan for Peacocke

#### Light rail vehicles using central median tracks:



Capital and operational expenditures vary widely between mode options. Modes with higher capacities tend to have both higher capital and operational costs. It is thus important to balance costs and capacity requirements when designing a mass transit corridor. Investing in a mode with significant operational costs, for example, could make running frequent, all-day service prohibitively expensive.

In most cases, mode can be expanded and upgraded on the same corridor as demand grows. Most modes can operate at street-level, rather than off-street options such as tunnelled or elevated corridors. Street-level corridors tend to be cheaper to build and able to link people more directly to their destinations.

Mass transit corridors should link key demand generators, including dense residential and employment areas and key destinations. The spatial efficiency of mass transit allows for urban areas to grow in ways that are impossible with cars alone. For example, mass transit can deliver two to ten times the capacity of a general traffic lane on core corridors and reduce the need for extensive parking.

## 4.2.2 The role of mass transit in Peacocke

The Peacocke growth area provides a promising opportunity to establish a mass transit corridor for several reasons:

- The Peacocke growth area ranges from approximately three to six kilometres from the city centre. With high quality services, this close proximity means transit can provide quick access between city centre destinations and large sections of Peacocke.
- A mass transit corridor through Peacocke could connect well to several destinations across the region. For example, a mass transit corridor through Peacocke could extend to the hospital, city centre, and destinations north of the city centre including The Base and south to the Airport. A mass transit corridor could also be used by regional transit services, for example, buses connecting to satellite towns south of the city including Te Awamutu or Cambridge.
- As a greenfield development, a new street-level road corridor can be built to accommodate mass transit rather than retrofitting mass transit to an existing corridor.
- Similarly, land use development can be integrated with mass transit planning to create transit-oriented development nodes.

A well-used mass transit line through Peacocke would support city-wide goals including modeshift from private vehicles. It could also reduce congestion and the amount of land needed for parking in the city centre.





# 4.3 Mode Considerations

As described in Section 4.2.1, a mass transit mode should have a high enough capacity to meet demand, but have low enough operating costs to justify frequent, all-day service. Mode can be upgraded along a mass transit corridor as demand grows. As described in Section 414.2.1, several types of configurations and mode can be investigated to serve Peacocke, including:

- Standard buses using bus lanes
- Bus rapid transit vehicles using with centreline busway
- Light Rail using central median tracks

Table 4 shows approximate vehicle and operating costs for the three different modes. Standard buses using bus-only lanes represent the cheapest public transport option both in terms of capital expenditure and operating costs, but may not provide sufficient capacity as demand grows.

Table 4: Approximate costs by mode

Mode	Approximate cost per vehicle	Approximate operating cost per vehicle mile
Lower-capacity bus	\$500,000	\$100
Higher-capacity bus	\$1m - \$1.5m	\$150
Light rail vehicle	\$5m	\$300

Capital costs to configure a mass transit corridor also differ widely, with bus lanes representing the lowest level of investment. Street-level busway investments are more expensive, and street-level LRT corridor infrastructure is much more expensive.

One advantage of a bus-based mass transit corridor is the versatility it offers compared to a rail-based corridor. Bus infrastructure and priority features may vary along a mass transit corridor according to context and need. For example, such a corridor could include shoulder bus lanes for some sections and a centreline busway for others. Sections of the corridor can also be upgraded over time as demand increases – for example as population grows and traffic congestion increases in Peacocke.

Further, standard buses and bus rapid transit vehicles can operate on the same dedicated corridor, meaning some local buses could also use the corridor where routes overlaps. Investment in bus infrastructure through Peacocke could also be used by other bus routes travelling to Te Awamutu or Cambridge, for example. In comparison, a light rail system would likely need tracks extended to the north of the city centre to maximise its value and would not offer the same ability for local transport vehicles to share the corridor.

#### Provide for a range of potential modes and vehicles to be staged over time

Any reservation for a mass transit corridor through Peacocke should ensure that there is sufficient space to allow for consideration for bus, bus rapid transit, and light rail options. This includes the ability to stage implementation from one mode to another at various points in time across a long programme of corridor development and land release. For example, the corridor may begin in the first stage with supporting lanes for conventional buses over the first few kilometres and transition to a higher capacity mode as patronage, density, and demand increase along with development.



43



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#### Heavy Rail

Heavy rail built to Kiwirail mainline standards has particularly constrained geometry of curves and grades. It also has a general requirement to provide a very high level of separation for general traffic, cyclists and pedestrians, usually through grade separation. Given the north-south Peacocke arterial does not connect well to the existing rail network at either the north or south end, further planning for heavy rail appears to be unnecessary.

#### Twin lane/track rail option

Under the Hamilton Southern Links works, AECOM developed a 2012 report titled "Hamilton CBD to Peacocke and Airport: Rail Opportunities." This report analysed six possible LRT routes servicing Hamilton city centre, Peacocke, and the Hamilton Airport. It estimated lines would cost between \$15m and \$25m per kilometre.

This report suggests that such a rail system could be developed using a single track with passing loops. This would mean that trains would need to stop at periodic passing loops rather than being able to pass each other throughout the corridor, which would be possible if it was double tracked.

Corridor designs from the Southern Links Scheme Assessment Report Drawings for a north-south arterial through Peacocke show a four-metre median. The reasoning for this median may be to allow for centre running LRT in the long term. However, the four-metre width would only allow for a single track, which we do not believe would provide enough flexibility in the longer term.

Provision of single track would impose several constraints on the future operation of the network. These include:

- Single track with passing loops would require direct network management with signalised operation
  or other systems of safeworking, speed limits entering and exiting single lane/track sections, and/or a
  limited timetable.
- Single lane/track with passing loops would result in a maximum of approximately 15-minute peak
  headways depending on the exact design and configuration of the system. Reliability of the system
  would be limited, and greater timing points and timekeeping delays would be required. As vehicles
  operating in one direction will be dependent on the reliability of vehicles operating in the other
  direction to clear a single-track section, delays in one part of the route in any direction would cascade
  into delays across the whole route in both directions.

In contrast, a two lane/track would allow for five minute headways under a basic configuration and operating plan, headways of as little as one to two minutes under a carefully planned and directly managed operation. With all other factors constant, a twin lane/track corridor will allow capacity for three to four times that of a single lane/track with passing loops. The provision of two lanes/tracks is also essential to allow for a range of vehicle configurations and lengths, otherwise the limited space available for passing loops could limit vehicle sizes and limit the ability to operate at higher capacities to meet future demand.

In general, rail-based systems tend to be cost efficient only when demand is quite high and the city-wide mass transit network is advanced. However, a bus-based mass transit corridor would have similar width requirements as a rail-based system. Thus, the corridor could be upgraded from a bus-based system to a rail-based system as demand grows.



44

Attachments



# 4.4 Long-term network integration

The new north-south arterial mass transit corridor would provide a high-level service between Peacocke and Hamilton city centre. However, there are several reasons why additional complementary public transport services may be desired to serve Peacocke.

First, additional services may be desired to provide more direct access from Peacocke to other key destinations not served by the mass transit route, for example Waikato Hospital and Hamilton University. The Orbiter diversion presented previously in Medium-Term Option 4B and 5B could serve this purpose.

Additional reasons that complementary public transport services may be desired to support the mass transit route include:

- Providing direct access between Peacocke neighbourhood centre and key destinations such as Waikato Hospital and the city centre.
- Extending public transport coverage closer to a higher proportion of Peacocke residents.
- Providing feeder bus services that provide access to mass transit stations for further afar residents in Peacocke and elsewhere.

The CBD via Cobham Drive route and Comet extension presented previously in Option 3B and 4B could serve several of these purposes. Each would provide direct access to the Peacocke neighbourhood centre and Hamilton city centre. They could interchange with the mass transit service at potential station locations in the north and centre of Peacocke. The following figure shows how such services could integrate with a mass transit corridor.



Figure 19 Possible integration of mass transit and other services



45

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If a more extensive mass transit network is developed, it may diminish the need for these direct connections, as they destinations may be serviced by other mass transit routes and accessed through a transfer in the city centre.

In any event, long-term local, coverage, and feeder routes will need to reflect development within the Peacocke growth area. Demand characteristics may change over time and as the area is further developed. Figure 19 is shown only to demonstrate one way in which such service can be integrated in the long-term.

# 4.5 Corridor Design

This section will discuss corridor designs taken from the review of the Southern Links Scheme Assessment Report Drawings and provide several indicative options for allocating space within the existing designation to show how mass-transit could operate on the north-south arterial, while still maintaining the arterial road function.

In order to assess the mass transit options for Peacocke, a review of the plans created as part of the Southern Links designation work was undertaken. The north-south arterial has two key cross-sections: North of the east-west arterial road there is a 35.8 metre cross-section, designed for four lanes of general traffic; South of the east-west arterial road there is a 28.8 metre cross-section, designed for two lanes of general traffic. This corridor width does not include the full designation width, which is often much wider to allow for construction activities such as supporting earthworks.

We understand that these cross sections are not considered final, and various corridor configurations have been and are being considered to include transit. This section aims to support these investigations by providing illustrative cross-section configurations by which the north-south arterial could deliver mass transit.

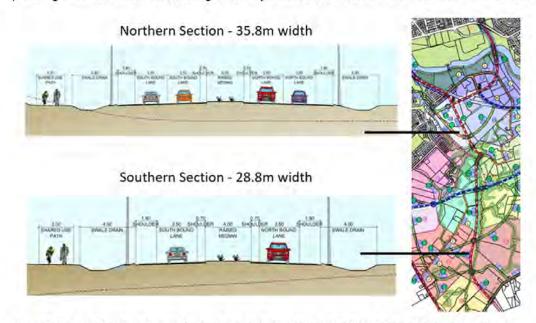


Figure 20: Cross Sections for north-south arterial from Southern Links Scheme Assessment Report Drawings



46



There appears to be opportunity for these cross-sections to be arranged to allow for mass transit to be provided, without further changes to the designation. Options for allocating space within the existing designation include narrowing the four-metre raised median, as well as replacing the wide swale drains with alternative forms of drainage with a lower footprint.

The following sections provide several indicative cross-sections for allocating corridor space in both the northern and southern sections of the arterial corridor. These are preliminary cross sections based on proposals for similar corridors in other New Zealand cities. Further detailed design work would be required to confirm exact dimensions, compliance with standards, and to determine alternative methods of handling stormwater that do not involve the use of swales.

# 4.5.1 Northern Section

There are a range of options for configuring the northern end of the corridor within the existing 35.8 metre width. The lowest level of intervention to support public transport would be to add a bus lane in place of a general traffic lane, as seen in Figure 21 below. This preserves the swales, the shoulder, and does not change the proposed walking and cycling infrastructure.



Figure 21: Northern section Option 1 - bus lane

More extensive changes allow improved walking and cycling facilities, as in Figure 22 below.



Figure 22: Northern section Option 2 - bus lanes & improved active transport



47

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Rather than just bus lanes, it is possible to provide a bus rapid transit system using centre lanes within the available cross-section width. The cross-section is similar for both bus rapid transit (Figure 23) and light rail (Figure 24). Due to safety considerations, a 2.0 metre shoulder is required for the general traffic lanes if the road speed is above 50km/h, which is what is shown below.



Figure 23: Northern section Option 3A - busway



Figure 24: Northern section Option 3B - light-rail

It is also possible to provide two traffic lanes, as well as two mass transit lanes. However, as a trade-off, the walking and cycling infrastructure would be of a slightly lower quality. Again, this cross-section could be used for bus rapid transit or light-rail.



48



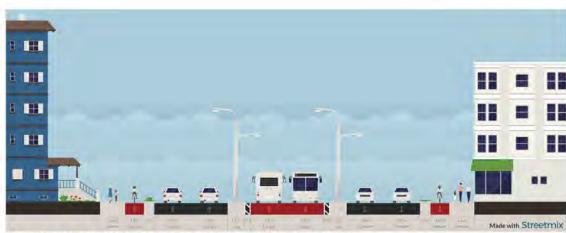


Figure 25: Northern section Option 4 - Mass Transit & 4 traffic lanes

## 4.5.2 Southern section

The southern section consists of a 28.8 metre corridor. This is a much more restrictive cross-section, which limits the options for configuring the corridor for mass transit. The options provided below may involve significant changes to previous corridor designs.

Bus lanes can be added to the corridor as in Figure 26 below. This still allows space for berms, and good quality walking and cycling facilities.



Figure 26: Southern section Option 1 - bus lanes

The cross section can also be configured to support centre bus rapid transit or light rail, as seen in Figure 27 below. However, the space available for berms, walking and cycling is significantly constrained.



49

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Figure 27: Southern section Option 2 - mass transit

In summary, both sections of the north-south arterial can be configured to allow bus lanes, bus rapid transit, or light rail. In each case trade-offs need to be made between the space allocated to different uses. The southern section is more complicated than the northern section as the corridor is seven metres narrower. Further detailed investigation is required to understand the impact of different options, including on other services that are planned for the corridor, as well as how stormwater should be handled.

#### 4.5.3 Cobham Drive link

A link between Peacockes Road and Cobham Drive would provide the most direct route between Peacocke and the city centre. Current planning efforts indicate that while the creation of this link is being explored, nothing has been finalised. Initial indications are that this link is being considered as a four-lane road, but that this option faces a range of complexities. These include geotechnical difficulties, high costs of bridge construction, and the disruptive impact it would have on the surrounding environment. We recommend considering such a link exclusively for mass transit vehicles. This narrower corridor could present a cheaper and less disruptive infrastructure opportunity. However, delivering such a busway could still be relatively complex and difficult.

The mass transit routes proposed in this document suggest using such a link. If the link is not created, mass transit services could be routed using the Waikato River bridge to connect to Cobham Drive if priority is provided.

#### 4.5.4 Intersections

Preliminary drawings show roundabouts at each of the key intersections along the Hamilton City Council section of the north-south arterial road. These intersections will need to be rethought if the north-south arterial becomes a mass transit corridor: roundabouts are generally not compatible with the bus priority required for mass transit services as they require traffic to mix in the intersection. Roundabouts may be acceptable with bus lanes, but only if traffic volumes are very low, so bus services do not experience any delay. Traffic signals are essential for centreline running mass transit, be this either bus rapid transit or light rail.

## 4.6 Potential modeshare along mass transit corridor

Public transport patronage modelling has not been undertaken for Peacocke transit options to date. We do not attempt to predict specific ridership outcomes of any of the scenarios presented. However, we have examined high level modelling to understand a range of feasible patronage and modeshare targets that could be readily achieved in future years on the proposed mass transit corridor in Peacocke.



50



The following table is an excerpt from the 2018 Auckland Regional Public Transport Plan. It shows the peak-hour bus and car modeshare achieved on a range of streets and roads in the Auckland area.

Table 5: People moved, by vehicle, for selected arterials, in peak Source: Auckland RPTP

Arterial	Number of (2-hour an		Number of vehicles (2-hour am period)	
	buses	cars	buses	cars
Dominion Road(View Road)	1,556	2,717	59	2,133
	36%	64%	3%	97%
Great North Road(Ponsonby Road)	1,646	2,673	58	2,114
	38%	62%	3%	97%
Fanshawe Street	10,134	2,922	257	2,351
	78%	22%	10%	90%
Symonds Street	7,856	1,893	228	1,419
	81%	19%	14%	86%
Sandringham Road	1,159	1,869	28	1824
	38%	62%	2%	98%
Mount Eden Road	1,779	1,419	43	1,165
	56%	44%	4%	96%
New North Road	1,721	3,231	53	2,580
	35%	65%	2%	98%
Quay Street	946	4,268	31	3,522
	18%	82%	1%	99%
Broadway Avenue	2,738	1,942	78	1,582
	59%	41%	5%	95%

Symonds Street and Fanshawe Street are the two main bus corridors approaching the Auckland city centre from the south and north respectively. Each is a major arterial with dedicated bus lanes in addition to one or more traffic lanes in each direction. Fanshawe Street is the main exit from the harbour bridge with up to three traffic lanes in each direction. As they both receive a confluence of several busy bus routes, they achieve very high bus modeshare of 81 percent and 79 percent respectively.

In effect, the bus lanes on each of these corridors carry three times as many people than all the adjacent traffic lanes at peak times. This indicates the potential modeshare that could be achieved on one or two major bus corridors entering the Hamilton city centre.

The other corridors listed in the table are more typical of narrower suburban streets, with one traffic lane in each direction, served by one or two bus routes each. While streets like Sandringham Road, Dominion Road



51



Transit Plan for Peacocke

and Mt Eden Road do have partial bus lanes, these are generally intermittent, have time restrictions, and are not located through intersections and pinch points. Nonetheless, due to variable traffic congestion, a lack of alternative routes, and the relative speed and convenience of the bus, these corridors still achieve high bus modeshare in the range of 35% to 56% of peak users. These corridors are indicative of the potential modeshare that could be achieved on the roads between the Peacocke area and the rest of Hamilton, particularly on pinch points such as the proposed bridge or Cobham Drive extension.

These figures indicate that a 30% modeshare or higher on a mass transit corridor through Peacocke is achievable in the long-term provided that the corridor faces congestion constraints, and mass transit has high service levels, priority, and connects key destinations, among other factors.

To provide additional context, we used previously modelled traffic demands to understand the approximate number of people that would need to use public transport along the north-south arterial for the corridor to have a 30% transit modeshare. As presented in Appendix B, we used traffic modelling done by AECOM for the Southern Links NOR application as a benchmark for potential non-traffic modeshare in 2041.

This modelling suggests achieving a 30% modeshare on key corridors would require accommodating less than 400 people during the one-hour peak on the north-south arterial. For scale, a service of one bus every five minutes at relatively high loading volumes can accommodate approximately 600 people during a one-hour period.

This high-level analysis suggests that a 30% modeshare on a mass transit corridor in Peacocke is achievable in the long-term. A 30% modeshare could significantly reduce the need for general traffic throughout on this north south arterial. We thus recommend the configuration consider limiting general traffic to one lane in each direction to support denser adjacent development that leverages mass transit along the corridor.

## Station locations, access, and land use

## 4.7.1 Land use considerations

Mass transit is a tool to enable denser development with vibrant street life and less space required for car parking. Stations can be focal points to catalyse dense development, including demand for terraced housing and apartments over time.

Many factors influence mass transit patronage, and mass transit can support high ridership volumes when surrounded by a range of densities. As a high-level indication, though, well used mass transit stations tend to have residential densities of about 50-100 people per gross hectare or more in the surrounding area. For comparison, the Amberfield site is expected to house more than 2,000 people on its site of 105 hectares, making the density somewhat higher than 20 people per hectare. As such, transit-oriented developments supported by mass transit could target significantly higher densities in station areas.

#### 4.7.2 Stop spacing

As well as bus priority infrastructure, services running along the north-south arterial will need well located stops. Because mass transit serves as the backbone of a public transport network, it prioritises fast service and has further spaced stops than local services. Mass transit stops are typically spaced between 800 metres and 1.5km from one another. Stops spaced further apart can increase journey speeds, however, this does sacrifice convenient access for some users.



52



Determining stop spacing in Peacocke should be based partially on the volumes of mass transit passengers passing through Peacocke compared to volumes of passengers boarding and alighting in Peacocke. If the mass transit corridor is connected between northern destinations such as The Base and southern destinations such as the Airport (see Section 4.8 for more information), a greater number of passengers would be inconvenienced by frequently spaced stops in Peacocke.

Several other factors that influence stop include: maximising access to key destinations such as shops and schools; topography limitations such as gullies and protected areas; and geometric considerations such as the space available within the corridor footprint to add stops.

The following figure shows three possible station locations approximately 1km – 1.5km apart from one another, located near expected east-west road connections. This is only one possible alignment, and more frequent stop spacing can be explored.



Figure 28 Three possible mass transit station locations

Locating mass transit stops also requires incorporating strategies to maximise station accessibility including through walking and cycling infrastructure, street network permeability, feeder bus provision, and Park and Ride and drop-off facilities.



53

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Te kaunihera o Kirikiriroa

Transit Plan for Peacocke

## 4.7.3 Walking and cycling integration

Walking is the most important mode by which mass transit is accessed at most mass transit stations. Planning for direct, pleasant, and safe access by foot is a critical way to improve station assess, leveraging mass transit investment and maximising patronage. Riders will often walk 800m or further to access mass transit stops – significantly further than for local bus services. A 2013 NZTA analysis found the median walk length of 1.04km for walk-to-rail trips. The median distance may be lower in Peacocke given that the relatively short distance to the city centre may mean the walking time accounts for a significant portion of the overall trip length.

Figure 29 shows 800m catchments around three possible station locations in Peacocke.

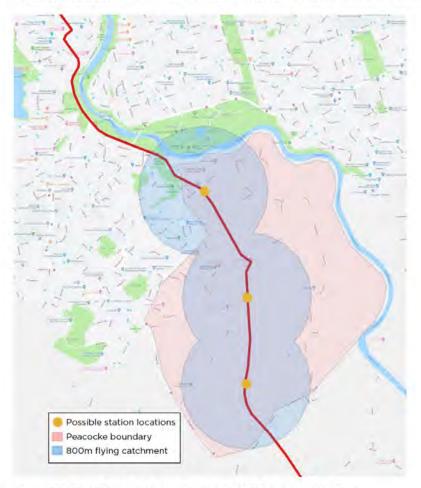


Figure 29 800m flying catchment around possible station locations

Street network design greatly effects the time required to walk to a station. Figure 30 shows the impact a disconnected street network has on a walking catchment, from two mass transit stations in Auckland. The grey circle represents the 1km "flying catchment," while the blue/green area shows the 1km walking catchment.

<sup>9</sup> https://www.nzta.govt.nz/assets/resources/research/reports/537/docs/537.pdf



54



Figure 30 Comparison of 1km walking radius to Papakura and Waitakere stations 10

The pedestrian environment also has a significant impact on pedestrians' willingness to walk a given distance to access a transit station. Features such as footpath availability and width, intersection design, and vehicle volumes around stations impact rates of walking to transit. Steep street grade, the presence of major intersections that delay pedestrians, and lack of perceived safety (both from crime and from wide and busy streets) can all discourage walking to transit stations.

Biking extends the catchment area of a mass transit station as compared to walking. A person can typically bike five times as quickly as they can walk, extending the estimated coverage area to approximately 3km for a mass transit station – about the distance the average person can easily bike in 10 minutes. If safe cycling routes are provided throughout Peacocke, the entire area would be within quick cycling range of a mass transit station.

Cycling infrastructure should also be strongly considered on the mass transit corridor. Because the mass transit corridor should be a focal point for denser development, cycle paths along the corridor are an effective way to provide safe cycling access to key destinations. Cycle paths along the mass transit corridor can also serve the greatest density of residents and provide a route to the city centre. Finally, cycling paths on the corridor can provide a safe last leg of a multimodal journey to access stations by bike.

#### 4.7.4 Park and Ride and drop-off facilities

Park and Ride services can encourage public transport patronage by widening a station catchment. However, it entails significant monetary and opportunity cost, and is thus not appropriate for all mass transit stations. The land purchase and construction costs of providing surface and structured carparks in New Zealand can vary between \$10,000 and \$40,000 per car-park respectively. 11 Further, car-parking can detract from the pedestrian and business environment near stations and preclude valuable land from being developed for other uses. By reducing uptake of walking and cycling to stations, park and ride facilities can also reduce patronage relative to other land uses, which can detract from stated goals to shift travel away from private vehicles.

Provision of park and ride facilities is thus typically only appropriate in lower density stations or topographically challenging areas where walking, cycling, and connector bus services are limited. Given Peacocke's close proximity to the city centre and potential for relatively dense transit-oriented development, significant park and ride facilities are not recommended for transit stops in Peacocke.

<sup>9</sup> https://catchies.micagneyworks/ 9 https://catchies.micagneyworks/ 9 https://catchies.micagneyworks/ 10 https://catch



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Alternatively, areas for drop-off services including "kiss and ride" and taxis and ride-share should be considered to improve station accessibility without requiring space for car storage.

## 4.8 Access to wider destinations

A mass transit corridor through Peacocke could provide direct access to several key destinations to the north and south. Such a corridor could have several stops in the city centre before continuing north to destinations including Te Rapa and The Base. To the south, the corridor could extend to Hamilton Airport and the business park under development. Such a corridor would have several major implications:

- It would provide direct access between Peacocke and several key destinations across Hamilton.
- By connecting key destinations throughout the urban area, such a mass transit corridor through Peacocke would become part of a larger mass transit route that connects high demand areas.
- This mass transit corridor could be coupled with development of a larger mass transit network with interchanges in the city centre (among other possible locations). Such a mass transit corridor could improve access to key destinations along this line to the wider region through a single transfer point in the city centre.

Extending the mass transit corridor south of Peacocke to the airport requires significant investigation as it involves many considerations. Some of these considerations include:

- South of Peacocke, buses could use the new state highway expressway links proposed as part of Southern Links, potentially with bus shoulder lanes added to improve service performance.
- Extending mass transit to the airport could catalyse significant development along the line. This could
  open opportunities for additional greenfield development relatively close to the city centre with
  excellent transport connections.
- It would also serve employment areas being built around Hamilton Airport such as Titanium Park.
   However, it could be difficult to provide an efficient service pattern that provides both a direct service to Hamilton Airport and serves the employment areas being developed around the airport.
- Terminus would be required at Hamilton Airport.
- It requires the north-south arterial to be linked to State Highway 3 before the service can commence.
- Stop frequency in Peacocke requires balancing good access catchments and maintaining good
  journey times and reliability. This would be impacted by the volume of patrons using the line who pass
  through Peacocke compared to those who board and alight in Peacocke.
- It is often difficult for transit to achieve high modeshare by servicing Airport employment precincts
  due to shift-work, low employment density, poor street network, and poor walkability.
- LRT to the airport could only potentially be justified if a large dense employment cluster developed around Hamilton Airport, and the airport experienced large increases in passenger movement.

#### 4.8.1 Complementing regional transit

Mass transit across the urban/suburban area and regional transit to satellite towns have distinct costs, benefits, and demand characteristics. It may not be feasible to extend a mass transit corridor through Peacocke to Cambridge or Te Awamutu, and these satellite towns may have lower off-peak demand for transit to Hamilton city. However, regional services from these satellite towns to the city centre could benefit from a bus-based mass transit corridor through Peacocke. Regional buses could join the corridor from its southernmost point (such as the Airport), and travel on the corridor to benefit from bus priority and avoid key congestion points approaching the city centre. Such a regional service could be rapid but is likely to be significantly less expensive to operate than a rail connection between the city centre. We recommend further investigating the potential of bus-based mass transit through Peacocke as part of future work surrounding mass transit for regional services.



56



# Appendix A - Background information

The following sections provide background information related to strategic documents and ongoing developments that influence transit plans in Peacocke.

#### Waikato Regional Public Transport Plan 2018 - 2028

The Regional Public Transport Plan (RPTP) is produced by the Waikato Regional Council (WRC). The latest version was approved in 2018. The RPTP has a 10-year horizon and sets out the objectives and policies for public transport in the Waikato Region. The plan outlines how the public transport network is expected to evolve over the next decade, and also sets expectations around service standards. Figure 31 below outlines the 10-year RPTP plan at a high level.

hasing	Hamilton and neighbouring towns	Regional network
0-10 years	Improve public transport reliability and travel times via infrastructure priority measures.	Expand the public transport network to include more areas within our region, including links between:
	Develop and trial public ride-share services.	Tokoroa and Hamilton via south Waikato towns
	Develop a Mass Transit Plan  Implement mass transit start up projects:  passenger rail Hamilton to Auckland (subject to the approval of the Single Stage Business Case for Passenger Rail).  high capacity, rapid and frequent bus corridors within Hamilton	Matamata and Hamilton     north Waikato towns and Auckland     north Waikato towns and Hamilton     Taupō and surrounding towns.  Any other areas where there is demand and sufficient funding.  Develop and trial demand responsive services.
	<ul> <li>rapid and frequent public transport service between Hamilton and Cambridge, Huntly to Hamilton, and Te Awamutu to Hamilton</li> </ul>	Support community transport initiatives.
10+ years	Transitioning to mass transit network (significant infrastructure and service improvements), guided by the Mass Transit Plan.	incremental service improvements to deliver the regional network concept as outlined in figure 1.

Figure 31: RPTP Phased Implementation Approach (WRC)

The RPTP also outlines the proposed layers for the public transport network, which is shown in Figure 32 below; and the service standards for each layer, which is shown in Figure 33 below. Only service standards for Hamilton city are shown, standards are lower for services to neighbouring towns and regional services.



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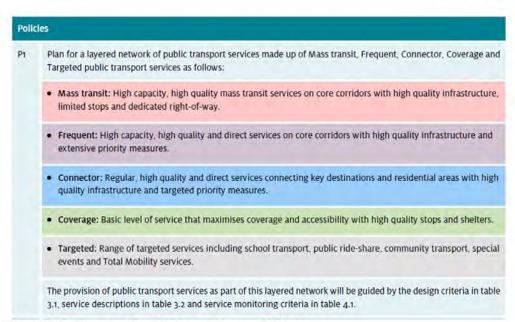


Figure 32: RPTP proposed public transport network layers



Figure 33: RPTP service standards for Hamilton city

The RPTP also outlines objectives and supporting policies for public transport in the Waikato Region.

- Objective 1: Deliver a layered network of public transport services that meets a diverse range of travel needs
- · Objective 2: Transition to a mass transit oriented network over time



58



- Objective 3: Provide the infrastructure necessary for an accessible, effective and efficient public transport network
- Objective 4: Provide high-quality and intuitive public information
- Objective 5: Provide a fares and ticketing system that is easy to use and affordable for passengers
- Objective 6: Provide public transport services that are affordable for passengers and funders
- Objective 7: Develop and maintain partnerships that obtain best value for money in the delivery of transport solutions

New immediate and short-term services for Peacocke will need to be provided in accordance with these policies and standards. There is more flexibility in the longer term, as the RPTP is regularly reviewed.

## Access Hamilton Strategy and Draft PBC

The 2010 Access Hamilton Strategy has a Passenger Transport Action Plan that sets a vision, objectives, and targets for public transport in Hamilton. Its vision is to deliver "an affordable, integrated, safe, responsive and sustainable transport system". Delivering this vision involves realising the following objectives:

- Optimise levels of service, working with Waikato Regional Council (WRC);
- Increase passenger transport patronage and modal share;
- Provide infrastructure across the city for consistent, high quality passenger transport services;
- Integrate and coordinate the timing of passenger transport service and infrastructure improvements with road improvements and developments to ensure a balanced network;
- Provide fully accessible passenger transport infrastructure; and
- Ensure services are easy to understand and well promoted

Targets to realise these objectives and vision involve:

- increasing the proportion of passenger transport journeys to work to 7% (it was 2% in 2010)
   based on census data and household travel surveys; and
- achieving 7% growth annually in the number of passenger transport trips made each year based on WRC bus patronage data.

To deliver on the vision, HCC embarked on developing a business case for a preferred programme of transport improvements over the next 30 years. This has culminated in an approved Strategic Case in 2016, and a draft but unapproved Programme Business Case (PBC) written in 2018. The PBC's preferred programme sought to resolve the following three problems:

- Growth and economic development are happening faster than anticipated leading to congestion, and a demand for transport investment earlier than planned
- Systems failures such as network characteristics, user behaviour and increasing demand, are resulting in death and serious injuries
- Our transport system has focused on cars, resulting in the low use of other modes, and higher future costs for transport;

Resolving the three problems would realise the following three benefits:

- Efficient and reliable access between key activities for all transport system users
- 2. A transport system that is safe to use regardless of mode



59

Transit Plan for Peacocke

 Infrastructure and service delivery that contributes to the strategic priorities of Hamilton City and its investment partners.

The preferred programme involves a number of elements, but those that have a direct influence on public transport in Peacocke include:

- Access for Peacocke growth (Wairere Dr extension into Peacocke, River Bridge upgrade, arterial roads) (\$219m) to unlock residential growth in the Peacocke Structure Plan area;
- Increased public transport services (\$210m) to achieve the aforementioned modeshare targets, which would require a mixture of service level improvements, infrastructural improvements, and supporting land use and car parking policies;
- Biking Plan (\$55m); and
- Mass transit investigation and implementation (\$60m)

Thus far, the draft PBC has not yet been approved by the NZ Transport Agency (NZTA), however elements of the 'Access for Peacocke growth' programme have been brought forward as part of the Peacocke Housing Infrastructure Fund Detailed Business Case, which is described below.

## Peacocke Housing Infrastructure Fund (HIF) Business Cases

The Housing Infrastructure Fund (HIF) was established by central government in 2016 as a way to help high growth councils fund infrastructure that would enable housing development. The HIF was a one off \$1 billion fund that would be loaned to local authorities with a 10-year interest-free period. Hamilton City Council was successful in gaining approval for \$290 million to enable growth at Peacocke<sup>12</sup>, which would help fund arterial roads, water and wastewater infrastructure. As part of the application process to central government, Hamilton City Council undertook an Indicative Business Case (IBC) and a Detailed Business Case (DBC) in 2017.

An outcome of the HIF IBC process was a recommendation that the solution for transport infrastructure in Peacocke should be consistent with the staging plans for Southern Links. This solution should comprise:

- A bridge at Wairere Drive/Cobham Drive
- An extension of Wairere Drive to connect with the Hamilton Gardens bridge which will go over the Waikato River to Peacocke;
- An upgrade of the existing Peacockes Road from a rural to an urban road;
- An intersection at SH3/Dixon Road and arterial roading to connect Peacockes Road to east-west arterial roads;
- Land to build the future north-south arterial road within Peacocke;
- A transfer pump station and pressure main.

Peacocke is a staged development. There are already 111 dwellings in the area known as Stage 2 of Peacocke. However, with the approved HIF funding, there is the potential for 3,750 dwellings to be built in this area between 2018 and 2028, and an additional 4,650 dwellings to be built over the period to 2048. This means approximately 8,400 dwellings could be built in Peacocke over the next 30 years.

<sup>10</sup> https://www.nua.govi.nz/urban-development/inusingenrasinurure-rund/



60



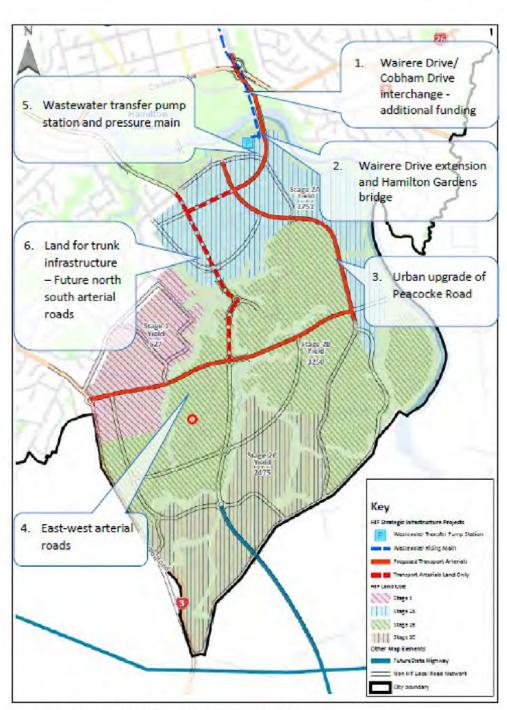


Figure 34: Arterial roads within Peacocke. Source: HIF DBC



61



## Progress on HIF projects

Since the approval of Housing infrastructure Fund loan in early 2018, there has been some progress on several of the key projects.

Construction of the new Cobham Drive and Wairere Drive interchange is underway<sup>13</sup>. This new interchange provides for a future connection to the new Waikato River Bridge to Peacocke and will be a major interchange for people travelling north from Peacocke to the City Centre or the eastern suburbs of Hamilton. This is due for completion in 2021.



Figure 35: Cobham Drive and Wairere Drive intersection plan (Source: HCC)

Planning has advanced for the new Waikato River bridge proposed as the key northern entry for Peacocke. Preliminary designs have been completed for the bridge. Construction is due to start in late 2020, and the bridge is due to open in 2023/2024<sup>14</sup>. Plans of how the bridge fits into the supporting road network are shown in the Figure below.

<sup>&</sup>lt;sup>13</sup> https://ourhamilton.co.nz/on-the-move/final-stage-of-ring-road-project-underway/ 14 https://ourhamilton.co.nz/growing-hamilton/plans-progress-for-hamiltons-newest-bridge/





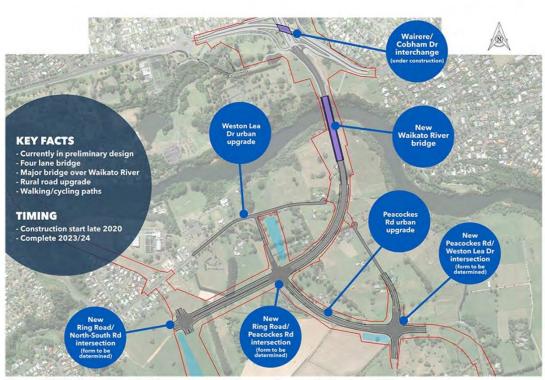


Figure 36: Waikato River bridge and supporting road network (Source: HCC)

Construction started on proposed Ohaupo Road roundabout in July 2019. This roundabout connects the new East-West arterial with State Highway 3, immediately south of Dixon Road. The proposed design is shown in Figure 37 below. This roundabout is due for completion in 2021.



Figure 37: Proposed Ohaupo Road roundabout



63



## Weston Lea Amberfield Development

As a sign of the residential development to be anticipated in Peacocke, Weston Lea Ltd has applied to HCC for a subdivision resource consent for a major residential subdivision on a site in the eastern portion of Peacocke Structure Plan Area, as shown in the red polygon below. This development is known as Amberfield.

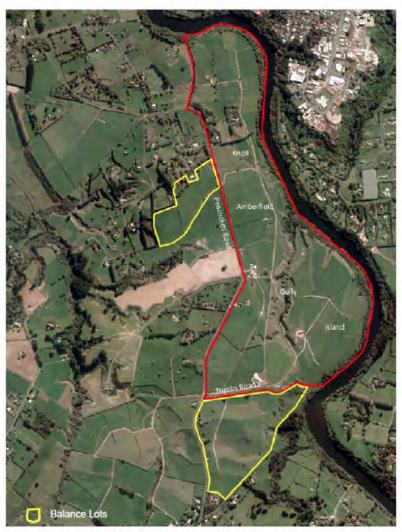


Figure 38: Amberfield Site Location. Source: Weston Lea Ltd

The total site area subject to urban development and subdivision comprises approximately 105ha, and the subdivision would involve a total of 867 fee-simple lots from the site. This includes two 'large lots' for future residential and commercial development (identified as neighbourhood centre in peach colour in Figure 10), one commercial lot (shown as future showroom/café in Figure 10) and two rural balance lots (shown in Figure 9 above).



64



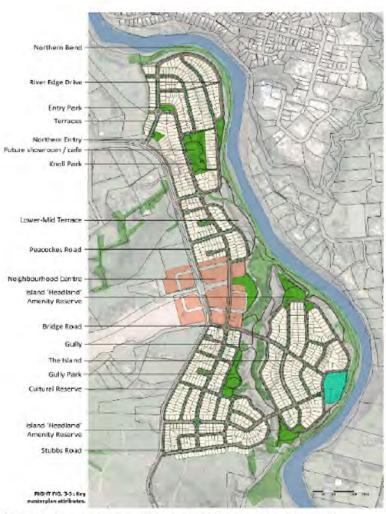


Figure 39: Proposed layout of Amberfield. Source: Weston Lea Ltd

It is anticipated that there will be approximately 1,000 dwellings in Amberfield, composed of 862 single dwellings with the balance made up of medium-density residential units. The subdivision will also provide for between  $5,000 \text{ m}^2$  to  $10,000 \text{ m}^2$  of retail or employment uses.

As shown by Figure 40 and Figure 41, Amberfield makes up a major part of the overall Peacocke Structure Plan area. Therefore the development and road network patterns therein will have a major influence on public transport planning and operations in Amberfield and in Peacocke at-large.

The resource consent application for Amberfield was lodged in June 2018, with submissions received and closed by late 2018. A public hearing for the application is set down for May 2019.



**Hamilton** City Council

Transit Plan for Peacocke

## Street pattern

The subdivision's proposed street pattern is revealed in the application documentation, as shown below.

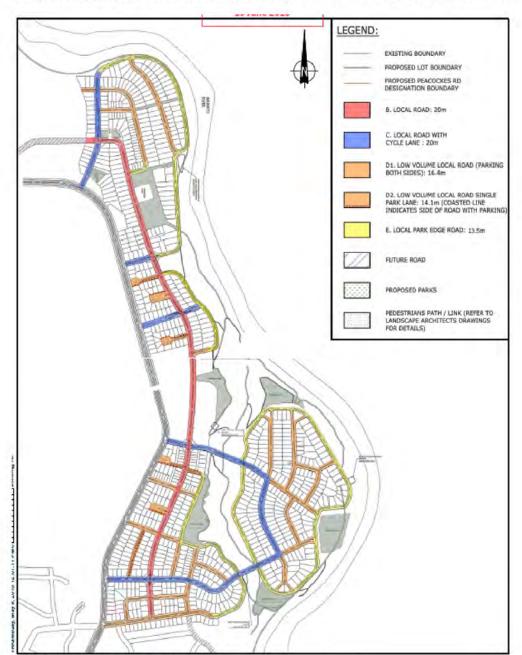


Figure 40: Street layout in Amberfield. Source: TDG



66

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Cross-sections of the different types of roads and streets shown in Figure 3 are shown in the figures below.

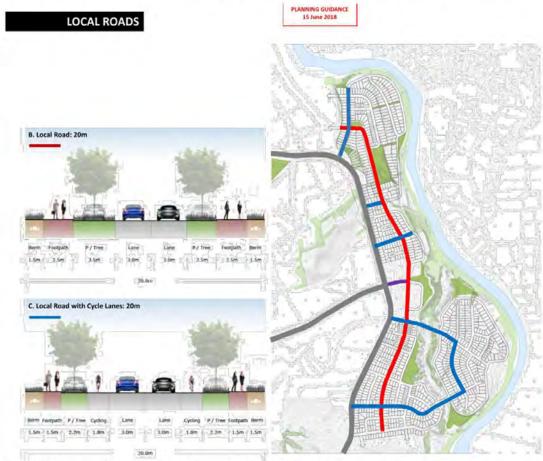


Figure 41: Local road cross-sections. Source: Boffa Miskell and Urbanismplus



MINOR LOCAL ROADS

D1. Minor Local Road (parking both sides): 16.4m

D2. Minor Local Road (single parking lane): 14.1m

D3. Minor Local Road (single parking lane): 14.1m

E. Minor Local Park Edge Road: 13.5m

E. Minor Local Park Edge Road: 13.5m

Figure 42: Local road cross-sections. Source: Boffa Miskell and Urbanismplus

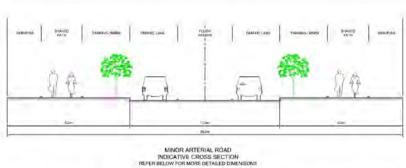
It is important to note that Peacockes Road runs along the western edge of the subdivision, which is currently a rural road. The upgrade of this road is not part of the Amberfield development and will be funded out of the HIF loan. Nonetheless, Weston Lea Ltd has provided indicative cross-sections of Peacockes Road both north and south of the proposed neighbourhood centre, that the developers believe would best serve Amberfield. These cross sections are provided below.

MRCagney

68

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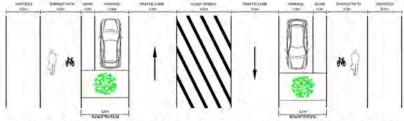
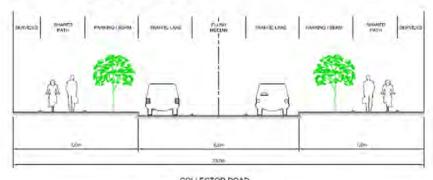


Figure 43: Minor arterial road (Peacockes Road) on the western edge of development, north of neighbourhood centre. Source: TDG



COLLECTOR ROAD INDICATIVE CROSS SECTION REFER BELOW FOR MORE DETAILED DIMENSIONS

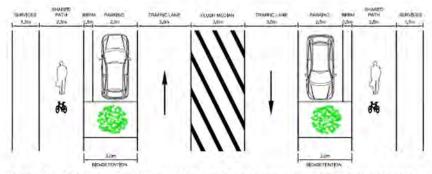


Figure 44: Collector Road (Peacockes Road) on the western edge of development, south of neighbourhood centre. Source: TDG



Page 1684 Attachments



## Appendix B – Modelling and potential patronage and modeshare

## Traffic generation from Amberfield

According to the Integrated Transport Assessment submitted with the Amberfield resource consent application, the anticipated 1,000 residential lots in Amberfield are expected to generate an additional 8,000 vehicles per day (vpd), of which 6,500 vpd involves travel beyond the Amberfield subdivision area. The ITA states that "if a neighbourhood centre were developed before the subdivision is completed then the generation rate for trips beyond the subdivision could be expected to be even lower". This statement implies that having developed shops and employment opportunities in an established neighbourhood centre at Amberfield in advance of residential development being completed would attenuate the number of trips travelling out of Amberfield, as the centre could cater for local shopping and activity centre needs.

Other key points from the ITA regarding traffic generation include:

- The existing rural form of Peacockes Road is predicted to be able to accommodate the 8,000 vpd
  traffic forecast to be generated by the subdivision, but there are no existing facilities for walking
  and cycling and the carriageway is not wide enough to safely accommodate cyclists with the
  expected increase in traffic and cyclists (and pedestrians). Therefore, there is a need to provide an
  off-road shared path along the eastern side of the northern section of Peacockes Road.
- The traffic generated by the subdivision will result in an increase in traffic volumes primarily on the Peacockes Road - Bader Street route to Normandy Avenue;
- These volume increases will only result in minor delays at major intersections in Melville and Bader, except for the increase in delay at the intersection of Normandy Avenue and Lorne Street.
- There will also be minor increases in traffic volumes and delays at two Ohaupo Road intersections, namely the right turn movements from Raynes Road and Dixon Road but specific additional mitigation measures are not considered necessary.
- The proposed subdivision may trigger a need for intersection improvements at Normandy
  Avenue / Lorne Street, but the timing of the effects resulting from the subdivision will determine
  the need and timing for the potential mitigation measure identified for the Normandy Avenue /
  Lorne Street intersection
- Even with the full Southern Links and HIF roading built, the modelling suggests that the vpd along Peacockes Road in 2041 generated by Amberfield and the new roading would not exceed 8,000 vpd.
- In light of this, the ITA states that given minor arterial roads cater for 8,000 20,000 vpd,
  Peacockes Road in the vicinity of the Amberfield subdivision will struggle to attract traffic
  volumes that justify a minor arterial standard upgrade for all the potential situations with the
  Amberfield subdivision (i.e. with or without Southern Links and / or HIF roads).
- The ITA recommends therefore a collector road upgrade for Peacockes Road in the vicinity of Amberfield would be adequate, at least for the short-term. However, the 2041 modelling suggests that the northernmost section of Peacockes Road that intersects with the proposed road from the new Wairere Drive river bridge (HIF-funded) may attract up to 15,000 vpd, so in this part of Peacockes Road north of the neighbourhood centre, an upgrade to minor arterial road standard is appropriate.
- Internal roads within Amberfield will carry less traffic than the 2,000-8,000 vpd expected for
  collector roads and this is not expected to change due to the constraint on future growth
  imposed by the adjoining river. Accordingly, all of these roads are designed as 'local roads'. The





north-south internal road within Amberfield that is parallel to Peacockes Road is also a 'local road' and has not been designed for bus circulation because it assumes that a route along Peacockes Road would be within reasonable walking distance to dwellings in Amberfield.

## Modelling

Traffic modelling done by AECOM for the Southern Links NOR application shows the vehicles per day (VPD) anticipated on the different parts of the key Peacocke roading infrastructure as a result of the new Southern Links and Peacocke roads, and the lane provisions recommended by the modelling. The key components are summarised below:

- Wairere Drive Ring Road Bridge (Peacockes Road to Cobham Dr) 22,000 vpd, 2 lanes in each direction recommended to accommodate PT services at LOS C;
- Peacocke North-South Arterial at Cobham Bridge 21,000 vpd, 2 lanes in each direction recommended to accommodate PT services at LOS A or B;
- Peacocke North-South Arterial between East-West Arterial to Ring Road 16,000 vpd, 2 lanes in each direction recommended to accommodate PT services with peak hour PT lanes;
- East-West Arterial between North-South Road and Ohaupo Road 9,000 to 14,000 vpd, 1 lane in each direction:
- East West Arterial between North South Road Peacockes Road 6,000 vpd, 1 lane in each direction would be able to accommodate PT services
- Peacockes Road, north of East-West Arterial to Ring Road 13,000 to 21,000 vpd, 2 lanes in each direction with PT accommodated via peak PT lanes
- Peacockes Road, south of East-West Arterial to Gainsford Road 2,000 vpd, increasing to 12,000 vpd closer to the neighbourhood centre – no specific lane recommendations

## Potential patronage and modeshare

The ability to attract significant public transport patronage and achieve high non-car modeshare in a given corridor is informed by several factors. These include push factors such as levels of traffic congestion and unreliable travel times that prevent or dissuade people from driving; and pull factors such as the speed, reliability, and capacity of alternative modes.

A significant public transport modeshare can readily be achieved at peak times in any urban or suburban corridor with high travel demands and traffic congestion, provided that the transit network serves the right corridors of demand and provides a reasonable user experience. The following elements are necessary to provide a competitive alternative to driving:

- service levels for frequency and span should be high to attract and retain customers;
- passenger capacity should be sufficient to avoid overcrowded conditions; and
- transit vehicles should have enough priority to maintain competitive speeds and avoid delays and unreliability generated by traffic congestion.

This section outlines what service levels and capacities would be required to achieve high public transport modeshare on the main corridors proposed for the Peacocke area, with reference to modelled traffic demands.





Transit Plan for Peacocke

#### Public transport modelling - options and limitations

Public transport patronage estimates can be modelled using a four-stage strategic transport model that includes parameters to assign travel demand to different modes. Nonetheless it is often hard to predict long range transit trends from transport models. These are calibrated to existing conditions, and therefore tend to be most effective at predicting short-term outcomes of business-as-usual travel patterns and mode choices.

These strategic transport models will therefore tend to be less effective at predicting changes in travel preferences and behaviour in response to vastly different public transport service levels and capacity. In the context of options for the Peacocke area featuring mass transit in 2040, a traditional modelling approach may greatly underestimate demand.

#### Modelled traffic demands

Previously modelled traffic demands have been used as a benchmark for potential non-traffic modeshare.

Traffic modelling done by AECOM for the Southern Links NOR application shows the vehicles per day (VPD) anticipated on the different parts of the key Peacocke roading infrastructure as a result of the new Southern Links and Peacocke roads, and the lane provisions recommended by the modelling. The key components are summarised below:

- Wairere Drive Ring Road Bridge (Peacockes Rd to Cobham Dr) 22,000 vpd, 2 lanes in each direction recommended to accommodate PT services at LOS C;
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- Peacocke North-South Arterial between East-West Arterial to Ring Road 16,000 vpd, 2 lanes in each direction recommended to accommodate PT services with peak hour PT lanes;
- East-West Arterial between North-South Road and Ohaupo Road 9,000 to 14,000 vpd, 1 lane in each direction;
- East-West Arterial between North-South Road Peacockes Road 6,000 vpd, 1 lane in each direction would be able to accommodate PT services
- Peacockes Road, north of East-West Arterial to Ring Road 13,000 to 21,000 vpd, 2 lanes in each direction with PT accommodated via peak PT lanes
- Peacockes Road, south of East West Arterial to Gainsford Road 2,000 vpd, increasing to 12,000 vpd closer to the neighbourhood centre – no specific lane recommendations

The following table shows vehicle data from traffic modelling at screenlines between Peacocke and the rest of Hamilton or to the south.



72

Attachments



Screenline	Sector	Direction	AM Peak (two hour)	PM Peak (two hour)	All day (24 hours)
Dixon Road connection	East	Outbound (toward Peacocke)	200	100	1,600
Dixon Road connection	East	Inbound (toward Hamilton)	200	200	1,600
East-west arterial	East	Outbound (toward Peacocke)	600	1,600	7,100
East-west arterial	East	Inbound (toward Hamilton)	1,500	800	6,300
CBD - Cobham Drive arterial	North	Outbound (toward Peacocke)	500	2,500	12,500
CBD - Cobham Drive arterial	North	Inbound (toward Hamilton)	1,800	1,000	8,400
Peacockes Road to Bader Street	North	Outbound (toward Peacocke)	600	800	3,600
Peacockes Road to Bader Street	North	Inbound (toward Hamilton)	600	500	3,300
Wairere Bridge Link	North	Outbound (toward Peacocke)	1,100	2,100	10,800
Wairere Bridge Link	North	Inbound (toward Hamilton)	2,700	1,500	11,300
Peacockes Road to Ohaupo Road	South	Outbound (toward Rukuhia/Airport)	100	200	1,100
Peacockes Road to Ohaupo Road	South	Inbound (toward Peacocke and Hamilton)	200	100	800
Southern Links arterial	South	Outbound (toward Rukuhia/Airport)	800	1,000	5,100
Southern Links arterial	South	Inbound (toward Peacocke and Hamilton)	1,000	900	5,900

## Potential 2041 modeshare

This table covers input assumptions to translate vehicles into vehicle passengers, and modeshare into transit passengers.



73

Transit Plan for Peacocke

Factor	Value
Traffic occupancy (people per vehicle)	1,2
Capacity per bus (seating + standing)	70
Desireable occupancy per bus	80%
Two-hour peak to one-hour factor	60%
All day to interpeak one-hour factor	3.4%
Bus modeshare target	30%

This table converts modeled vehicle demand and modeshare target into the required public transport passengers per hour to achieve the modeshare target of 30% by public transport per corridor.

Screenline	Sector	Direction	Passengers - AM Peak (one hour)	Passengers - PM Peak (one hour)	Passengers Interpeak (one hour)
Dixon Road connection	East	Outbound (toward Peacocke)	43	22	20
Dixon Road connection	East	Inbound (toward Hamilton)	43	43	20
East-west arterial	East	Outbound (toward Peacocke)	130	346	87
East-west arterial	East	Inbound (toward Hamilton)	324	173	77
CBD - Cobham Drive arterial	North	Outbound (toward Peacocke)	108	540	154
CBD - Cobham Drive arterial	North	Inbound (toward Hamilton)	389	216	103
Peacockes Road to Bader Street	North	Outbound (toward Peacocke)	130	173	44
Peacockes Road to Bader Street	North	Inbound (toward Hamilton)	130	108	41
Wairere Bridge Link	North	Outbound (toward Peacocke)	238	454	133
Wairere Bridge Link	North	Inbound (toward Hamilton)	583	324	139
Peacockes Road to Ohaupo Road	South	Outbound (toward Rukuhia/Airport)	22	43	14



74

Attachments



Transit Plan for	Peacocke
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Peacockes Road to Ohaupo Road	South	Inbound (toward Peacocke and Hamilton)	43	22	10
Southern Links arterial	South	Outbound (toward Rukuhia/Airport)	173	216	63
Southern Links arterial	South	Inbound (toward Peacocke and Hamilton)	216	194	72

This table indicates that the busiest corridor would need to carry less than 600 passengers on public transport during the morning peak to achieve a 30% modeshare. For scale, one bus every five minutes for an hour at relatively high loading volumes can accommodate about 600 people.



75



# REPORT APPENDIX Y

# Tonkin+Taylor







#### **Document Control**

Title: Estimation of Potential Esplanade Reserve Extent						
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:	
14/11/2019	1	Working draft	M Lake	B Quilter	B Quilter	
28/11/2019	2	Final	M Lake	B Quilter	B Quilter	

## Distribution:

Hamilton City Council 1 PDF copy
Tonkin & Taylor Ltd (FILE) 1 PDF copy



## **Table of contents**

1	Introduction	1			
2	Criteria	2			
	2.1 Summary interpretation	2			
	2.2 Uncertainties and how we dealt with them	2			
3	Methodology				
	3.1 Field assessments	5			
4	Data interpretation and mapping	7			
5	Applicability				

Appendix A: Esplanade reserve extent map

Appendix B: Watercourse Classification Definitions

12 August 2021



#### **Executive summary**

Hamilton City Council (HCC) are seeking to understand the potential extent of any esplanade reserves they may obtain through future development of the Mangakootukutuku Stream catchment upstream of Waterford Road.

To meet this need, a method for identifying the lineal extent of esplanade reserves was developed that used a combination of broad-scale field assessments and mapped flood extents derived from a hydrologic model.

Criteria for determining stream characteristics which would trigger an esplanade reserve were derived from legislation, plan rules and case law. A methodology previously developed elsewhere in New Zealand was also relied on but adapted for use in the incised gullies that are typical features of stream catchments in the Hamilton area.

Outputs from the field survey and hydrological model were combined using GIS to create a map showing the likely lineal extent of esplanade reserves if the Mangakootukutuku catchment upstream of Waterford Road was fully developed. As individual lots are developed and detailed assessments are undertaken, the extent and connectivity of the esplanade reserves presented could change.

The methodology used in this study could be applied in other Hamilton stream catchments where subdivision is likely to occur.



1

#### 1 Introduction

Hamilton City Council (HCC) are seeking to understand the potential extent of any esplanade reserves they may obtain through future development of the Mangakootukutuku Stream catchment upstream of Waterford Road.

Methods for delineating esplanade reserves have been developed elsewhere in New Zealand and there is existing case law on the subject. However, it was not clear how readily these could be applied to the incised Hamilton gullies like those in the Mangakootukutuku Stream catchment.

The objective of this project was to identify the expected lineal extent of esplanade reserves, in the Mangakootukutuku catchment upstream of Waterford Road that may be obtained by HCC through future land subdivision. The Esplanade Extent maps provide an expected extent of Esplanade Reserves but are not intended to be a substitute for site-specific assessment when lots are being subdivided. Nor does this study remove the need to assess esplanade extents outside the mapped extent. A methodology for identifying when relevant legislation, plan rules and stream characteristics would trigger the vesting of Esplanade Reserves was developed as part of this project. This methodology could be used as a guide for identifying where future Esplanade Reserves may be obtained in other Hamilton streams.

This report has not been prepared specifically to support a change to the Hamilton City District Plan. In that regard, no rules or other statutory provisions associated with the esplanade extents have been developed or recommended in this report. The esplanade extents layer is however likely to be suitable to inform a plan change, subject to any modifications deemed appropriate through the Schedule 1 process of the Resource Management Act (RMA) or the application of the tests in section 32 of the RMA.

2

#### 2 Criteria

The following data sources were used to define and map the potential extent of esplanade reserves;

- A procedure determining stream width for the purpose of setting aside esplanade reserves developed by Stumbles et al (2008)<sup>1</sup>.
- Case law, specifically:
  - Whitby Coastal Estates vs Porirua City Council<sup>2</sup>, and
  - Canterbury Regional Council vs Dewhirst Land Company Ltd<sup>3</sup>
- GIS flood extent layer based on the 2-year flood model<sup>4</sup>.
- Auckland Unitary Plan stream definitions and criteria.

#### 2.1 Summary interpretation

Section 230 of the RMA states that an Esplanade Reserve of not less than 20 m shall be set aside along the bank of any river whose bed has an average width of 3 m or more. The definition of what constitutes the bed of river is central to determining when an Esplanade Reserve is vested with a council as part of the subdivision process.

Section 2 of the RMA defines "river" as "a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse".

For the purposes of esplanade reserves, esplanade strips and subdivision, Section 2 of the RMA defines the "bed" as "the space of land which the waters of the river cover at its annual fullest flow without overtopping its banks". The "banks" of a river are not defined in the RMA, however, case law<sup>5</sup> has provided two means of interpreting stream width and this was used in a methodology to determine esplanade width by Stumbles et al. (2008).

- 1 Width where the level is at the annual fullest flow without overtopping any bank.
- 2 Otherwise, the bank is the level where flow spills over on to a more extensive floodplain or secondary flow path.

Stumbles et al. (2008) also interpreted the RMA definition of the bed of a river as including wetland areas that are wet during normal stream flows and levels. This is important within the context of Hamilton gullies where wetlands typically form along the gully floor.

#### 2.2 Uncertainties and how we dealt with them

Mean Annual Flow (MAF) has been identified as the most appropriate measure of annual fullest flow. However, information on the spatial extent of MAF was not available for this study. Instead, the two-year flood flow  $(Q_2)$  was used as a proxy for MAF. MAF is statistically equivalent to a 2.33-year flood flow so using the  $Q_2$  could be expected to provide more narrow flows widths than using MAF.

Literature reviewed does not explicitly state that the flow assessment should be made using existing or future development scenarios nor does it address the matter of climate change. We have elected to use the existing development scenario without allowance for climate change as it provides the

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Estimation of Potential Esplanade Reserve Extent - Mangakoo tuku tuku Stream
Hamilton City Council

November 2019 Job No: 1011923.v2

Attachments

<sup>&</sup>lt;sup>1</sup> Stumbles, C., Levy, G., Brown, N. and Carter, B., 2008. How wide is the stream? https://www.waternz.org.nz/Attachment?Action=Download&Attachment\_id=1236

<sup>&</sup>lt;sup>2</sup> Decision No. W61/2008

<sup>&</sup>lt;sup>3</sup> Court of Appeal of New Zealand CA4/2019

<sup>&</sup>lt;sup>4</sup> Supplied by HCC. It is understood that the model is currently being developed by AECOM and is subject to change.

<sup>&</sup>lt;sup>5</sup> Decision No. W61/2008 as described in Stumbles et al (2008)

Hamilton City Council
Te kaunihera o Kirikiriroa

3

best estimate of flow width at the present time i.e. an 'as-is/where-is' assessment relevant to the time of an application for subdivision is made.

The broad-scale approach used for this scale of assessment has meant that the resolution is much courser than that in the procedure developed by Stumbles et al. (2008) and did not include any weighted averaging of cross-section widths. The broad-scale approach was considered adequate for the purposes of the current study but could be insufficient for determining esplanade extent at the lot level when subdivision of individual lots takes place. Site-specific assessment using cross-sections at 20 m centres and weighted averages may potentially change the result, particularly in the upper headwaters where stream width is typically narrower.

Delineating the transition between perennial/intermittent and ephemeral watercourses is difficult to define accurately and generally relies on expert judgement. Criteria developed for the Auckland Unitary Plan<sup>6</sup> (refer Appendix B) were used in the field assessments as they were considered the most practical field guidance available. No such guidance is available from Waikato Regional Council.

The presence of wetlands was determined using the definition in the RMA which "includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions".

It is important to note that the outputs of this study are a here and now estimate based on flow and geomorphic conditions at the time field surveys were completed. Changes in flow resulting from development and/or restoration of the catchment could influence the future lineal extent of where esplanade reserves may be taken.

Tonkin & Taylor Ltd
Estimation of Potential Esplanade Reserve Extent - Mangakootukutuku Stream
Hamilton City Council

November 2019 Job No: 1011923.v2

Attachments

<sup>&</sup>lt;sup>6</sup> Chapter J Definitions in the Auckland Unitary Plan Operative in part (updated 24 October 2019)



4

#### Methodology 3

The process developed to identify the potential longitudinal extent of esplanade reserves is summarised in the flow chart presented in Figure 3.1. The process was developed so that it could be applied to streams in the local Hamilton area and not just the study area of interest in this report.

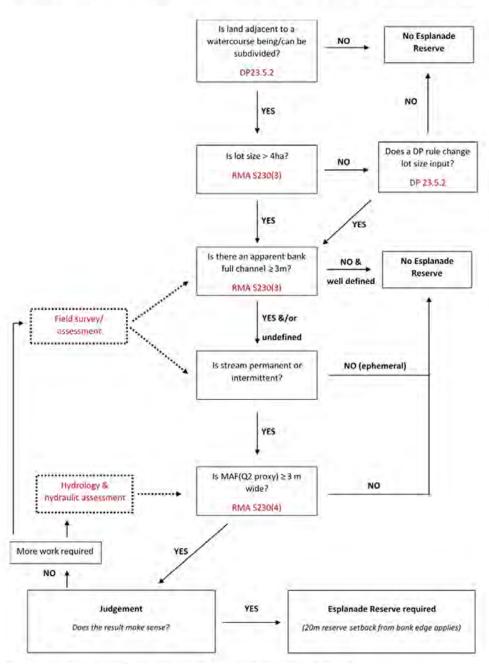


Figure 3.1: Process for identifying where an esplanade reserve would be required.

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November 2019 Job No: 1011923.v2



5

3 1 Field assessments

Initially, we reviewed available stream walk over data undertaken by various consultants and held by HCC. The stream walkover data available was not suitable as a specific measurement of bank full width was not recorded.

Field assessments were conducted (where access permissions were granted) to inform the esplanade identification process in the Mangakootukutuku Stream upstream of Waterford Road. It was necessary to take a broad-scale approach to completing field assessments due to the size of the catchment and the resources (time/budget) available. Cross-sections were assessed at approximately 100 m intervals along the main stem of the stream and as many tributaries as possible. The location of transects was recorded using an iPad integrated GPS with a likely accuracy of +/- 5 m depending on satellite reception in the gullies. Additional transects were added where marked transitions in channel form were noted, particularly at the interface between intermittent and ephemeral streams. There were a number of properties where access to the stream could not be obtained, most notably a large tributary running along the Western side of Hall Road which includes the 'Shaw Ponds'. Assessments have been made in these areas based on available information including aerial imagery and previous site visits undertaken by T+T<sup>7</sup>.

Field assessments were undertaken on October 22, 24-25 and November 1 2019. Rainfall occurred on all of the days apart from November 1.

Table 3.1: Rainfall conditions (as measured at the Hamilton Rainfall Gauge) prior to undertaking field assessments in the Mangakootukutuku Stream upstream of Waterford Road

Field Assessment Date	Rainfall (mm) – preceding day	Rainfall (mm) – on day	Total
22/10/2019	2.6	2.8	5.4
24/10/2019	7.8	3.8	11.6
25/10/2019	3.8	0	3.8
1/11/2019	1.6	0	1.6

At each transect the following parameters were recorded where they were apparent:

- Watercourse classification: was the stream perennial, intermittent or ephemeral?
  - Waikato Regional Plan definitions were found to be unhelpful for supporting field assessments so definitions and supporting guidance was taken from the Auckland Unitary Plan (see Appendix B).
- Wetted channel width.
  - Many online man-made ponds were observed. We treated these as a 'modified watercourse' and therefore considered them to be part of the wetted stream.
- Bankfull channel width.
  - This was the most difficult variable to define due to the shape of the gully. If there was no marginal wetland then bankfull channel width was measured between points where there was a significant decrease in bank slope above the wetted channel. If there were one or more channel benches making delineating the channel difficult then the width of each one was measured. If there were marginal wetlands and they were contiguous with the stream, then they were considered to be part of the bankfull channel width.

Estimation of Potential Esplanade Reserve Extent - Mangakootukutuku Stream Hamilton City Council

November 2019

Job No: 1011923.v2

<sup>&</sup>lt;sup>7</sup> T+T letter 'Shaw Ponds - Initial Review' (Ref: 1009146), dated 22/1/19 issued to HCC as part of the Southern Links project



6

- Floodplain width.
  - In practice, this feature was rarely apparent as the bed of the gully tended to gradually slope up from the wetted channel.
- Photos were taken and a sketch made of the channel shape to support any post-field work assessments of the data.



7

# 4 Data interpretation and mapping

Field data was exported to an excel spreadsheet where it was checked before being imported to ArcGIS. Cross-section points were overlaid with the two-year flood flow extent layer to determine whether the flow would exceed 3 m within the vicinity of the survey point. The flood layer consists of 2 x 2 m cells so it was necessary to apply category based on the following levels of certainty:

- ≤1 cell = No, flood flow levels not exceeding 3 m
- 2 cells = Possible that flow levels exceed 3 m
- >2 cells = Yes, flood flow levels exceeding 3 m

The flood level information and field assessment data were then used to identify whether, at each assessment point, an esplanade reserve would be triggered (Yes), not triggered (No), possibly triggered (Possible). The dataset was then re-mapped in ArcGIS to allow further checks of whether the results were logical in a spatial sense. This included checking all 'No' results as well as any 'Yes' results located upstream of 'No' results. An indicative esplanade reserve layer was then added to the digital map by plotting a 20 m buffer along the centre of the streamline. The results of the mapping are presented in Appendix A and provided in shapefile form.



8

## 5 Applicability

This report has been prepared for the exclusive use of our client Hamilton City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

This report has not been prepared specifically to support a change to the Hamilton City District Plan. In that regard, no rules or other statutory provisions associated with the esplanade extents have been developed or recommended in this report. The esplanade extents layer is however likely to be suitable to inform a plan change, subject to any modifications deemed appropriate through the 1<sup>st</sup> Schedule process of the Resource Management Act (RMA) or the application of the tests in section 32 of the RMA.

Report prepared by:

Authorised for Tonkin & Taylor Ltd by:

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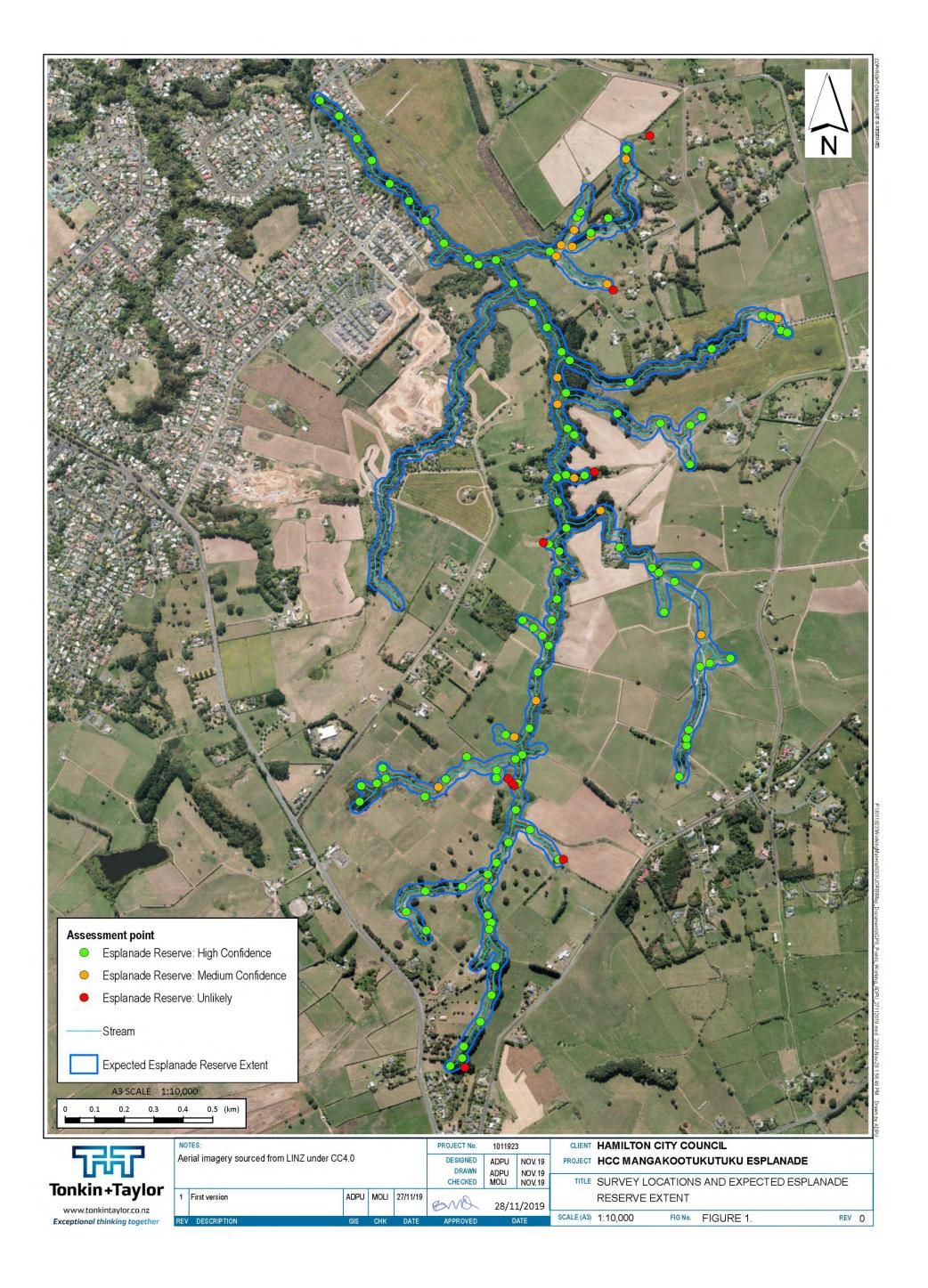
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# Appendix A: Esplanade reserve extent map





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# **Appendix B: Watercourse Classification Definitions**

<u>Definitions taken from Chapter J of the Auckland Unitary Plan Operative in Part (Updated 24 October 2019)</u><sup>8</sup>.

## Permanent river or stream

The continually flowing reaches of any river or stream.

#### Intermittent stream

Stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least *three* of the following criteria:

- (a) it has natural pools;
- (b) it has a well-defined channel, such that the bed and banks can be distinguished;
- (c) it contains surface water more than 48 hours after a rain event which results in streamflow;
- (d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel;
- (e) organic debris resulting from flood can be seen on the floodplain; or
- (f) there is evidence of substrate sorting process, including scour and deposition.

#### **Ephemeral stream**

Stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream.

<sup>8</sup> https://unitaryplan.aucklandcouncil.govt.nz/pages/plan/Book.aspx?exhibit=AucklandUnitaryPlan\_Print



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# Mangakotukutuku ICMP

Hydrogeological & Geotechnical Investigations - Stage 1

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Attachments



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

# **Table of Contents**

Execu	tive Sumr	mary	
1.0	Introdu	uction	1
	1.1	Background	1
	1.2	Mangakotukutuku Catchment	1
	1.3	Objective	2
	1.4	Scope	2
	1.5	Methodology	1 2 2 3 3
2.0	Conce	eptual hydrogeology	3
	2.1	Climate and rainfall	3
	2.2	Geology	4
		2.2.1 Regional geology	4
		2.2.2 Catchment geology	4
	2.3	Soils	5
	2.4	Geomorphology	6
	2.5	Groundwater Levels	4 5 6 7 8 8 9
	2.6	Recharge and Discharge	8
	2.7	Groundwater consents	8
3.0		sment	9
	3.1	Groundwater & baseflow	9
	3.2	Stream flow gauging	9
	3.3	Imperviousness & groundwater	12
		3.3.1 Introduction	12
		3.3.2 Relevance to Mangakotukutuku	12
	3.4	Geotechnical analysis scenarios	13
		3.4.1 Introduction	13
		3.4.2 Methodology	13
		3.4.3 Assessment results and discussion	15
	3.5	Piped discharges, culverts and overland flow to gullies	20
	3.6	Maintaining water balance with development	20
4.0		nary and recommendations	21
	4.1	Summary	21
	4.2	Geotechnical recommendations	21
	4.3	Groundwater and stream flow recommendations	21
	4.4	Provisional development controls and BMPs	22
5.0		nary of issues and options	23
6.0	Refere		24
7.0	Limitat	tions	24
Apper	ndix A		
1-1		ment geology	А

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

Hamilton City Council
Te kaunihera o Kirikiriroa



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

## List of Tables

AECOM

Table 1	Mangakotukutuku streamflow gauging results	10
Table 2	Sub-catchment specific discharges	11
Table 3	Modelled scenarios	14

## **List of Figures**

Figure 1	Mangakotukutuku Stream catchment	1
Figure 2	Mean monthly rainfall and evapotranspiration (2007 – 2017)	4
Figure 3	Catchment geology	5
Figure 4	Catchment Soils (S-Map ONLINE)	6
Figure 5	Mean monthly recharge and discharge (2007 – 2017)	8
Figure 6	Mangakotukutuku Stream Gauging Locations and sub-catchment boundaries	10
Figure 7	Uniform permeability with no soakage on Day 2	16
Figure 8	Uniform permeability with soakage on Day 2	16
Figure 9	High over low permeability with soakage on Day 2	17
Figure 10	Low over high permeability with soakage on Day 1	17
Figure 11	Low over high permeability without soakage on Day 1	18
Figure 12	Ash mantle with flow path and soakage trench on Day 1	19
Figure 13	Ash mantle with soakage and no flow path on Day 1	19

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

# **Executive Summary**

The Mangakotukutuku gully system, in particular the undeveloped Peacocke Arm, appears to rely on groundwater infiltration to support baseflows. The Mangakotukutuku arm is also fed from the peat swamp in Waipa District so is less reliant on local groundwater infiltration. Wider groundwater flow contours cannot yet be defined but there is sufficient information to conclude that local infiltration is important.

The geology in the catchment allows rainfall to infiltrate and migrate to gully slopes and streams as seeps and springs which contribute to stream baseflows. The same regime could result in instability particularly if development mitigation involves concentrated infiltration.

The baseflows are higher than one would expect, and the seepages appear to be relatively uniformly spread along the channels and not concentrated. Given the strength of the base flow it suggests that infiltration rates and volumes across the catchment need to be maintained so that the strong base flow can be supported through development rather than reduced or diverted.

The catchment will benefit from dispersed infiltration to mitigate the potential effects of development, if the existing stream environment is to be maintained as far as practical. Care will need to be taken to ensure that the method of groundwater replenishment does not increase risk to the built environment through targeted assessment and recommendation of appropriate setbacks.

Geotechnical and hydrogeological conclusions are outlined below. Refer to Section 5.0 for a tabulated summary of issues, options and further investigation recommended by this report.

An overarching Stage 2 recommendation is to develop an integrated GIS map with multiple detail layers informed by further investigations. The GIS map will allow sites to be ranked and constraints to be highlighted as well as linking into other ICMP mapping later in the project.

#### Geotechnical

As part of the resource consent for development it is recommended the effects of the development on groundwater flows, stability and erosion as a result of landform changes, impervious surfaces and soakage infiltration systems is assessed. This will require groundwater modelling in the predevelopment and post-development state.

Therefore, it is important to have an understanding of the baseline groundwater conditions, deep permeability characteristics and rainfall response over an extended period of time that can form the basis of specific assessments.

#### Groundwater and stream flow

Integrated catchment management pre and post development monitoring is recommended to fully implement objectives associated with best practice. Groundwater needs to be monitored so that groundwater flow can be determined, response to rainfall assessed, and potential development effects identified

The spatial spread of monitoring points needs to cover all of the undeveloped catchment. More monitoring points may be required for groundwater and streamflow than are required only for geotechnical considerations. In the first instance a review is recommended of whether any of the bores in the WRC database are unused and would make suitable monitoring locations.

Stream flow monitoring is recommended to assess baseflow, and to support ecological and water quality monitoring. At least one permeant continuous flow recording station is recommended to be established in the lower catchment. Additional continuous recorder stations may be of benefit in the upper catchment for ecological and water quality monitoring.

## Provisional development controls and BMPs

Additional investigation and assessment are recommended to set exacting requirements for development and infiltration setbacks. To do so the geotechnical risk should be determined in more detail for scenarios with increased infiltration around slopes and retaining walls. A higher level of assessment will enable the catchment to be mapped in high resolution and variable requirements set, as opposed to a single catchment wide requirement.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



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To achieve the desired outcome, it is considered that the following Best Management Practices (BMPs) are appropriate:

- Provide appropriate setbacks from slopes and walls for development to reduce risk of instability.
- Provide appropriate setbacks from slopes and walls for enhanced infiltration zones to reduce the risk of instability.
- Utilise swales and subsoil drainage to enhance infiltration at lot and minor road level (dispersed and distant from at risk gully slopes).
- Provide at source infiltration via District Plan mandated on-lot water efficiency measures.
- Apply similar approach to major roads where possible.
- Locate wetlands where outlet drainage can be connected directly to groundwater using vertical drainage when centralised collection and treatment is adopted.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

## 1.0 Introduction

## 1.1 Background

An Integrated Catchment Management Plan (ICMP) is being prepared for the Mangakotukutuku Catchment in the south of Hamilton City. Hydrogeological and geotechnical investigations are required to inform the ICMP.

Geotechnical assessment will focus on the portion of the ICMP extent within the green field area which is known as the Peacocke Development Area. Hydrogeological assessment will focus primarily on the Peacocke area but also considers the developed portion of the catchment and the wider catchment within Waipa District.

### 1.2 Mangakotukutuku Catchment

The Mangakotukutuku hydrological catchment (Figure 1) is approximately 2,677 hectares and is located south of the Hamilton City Centre. The hydrological boundary extends beyond the Hamilton City Boundary into Waipa District. The catchment is bound to the north and east by the Peacocke Riverside catchment and to the west by the Waitawhiriwhiri catchment.

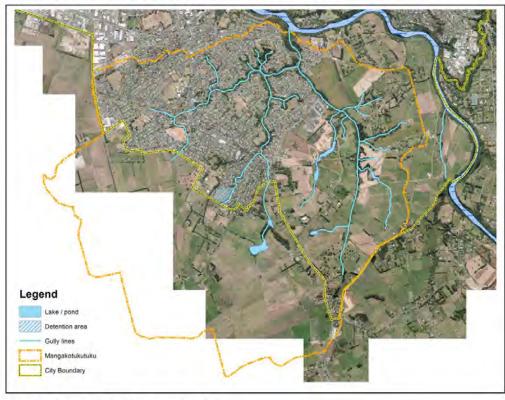


Figure 1 Mangakotukutuku Stream catchment

The hydrological catchment of the Mangakotukutuku Stream is shown in Figure 1.

The ICMP will also address the Peacocke Riverside area which is located between the main catchment and the Waikato River. The Peacocke Riverside area has separate discharge points direct to the Waikato River.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

Hamilton City Council
Te kaunihera o Kirikiriroa

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Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

The brownfields area within the Hamilton City boundary is predominately residential with several commercial pockets and one area of industrial land use to the west. The land use beyond the Hamilton City boundary, in the Waipa district, is rural with predominantly pastoral farming, and includes a significant farm drainage network.

The green field area within the Hamilton City boundary is within the Peacocke Structure Plan area. Peacocke was incorporated into Hamilton City in 1989 from Waipa District Council with the main purpose being to provide an area for growth and eventually a community hub.

The dominant future zoning will be residential with an indicative future reserve zoning approximately 20 m from centre of the Mangakotukutuku stream. Furthermore, the designation of the Southern links roading project in the eastern sub catchment identifies this area to be one that will experience substantial change over the next few decades. Walkways and cycle ways will allow for increased access to gully systems and river corridors.

Residential development has started to occur in the western edge of the structure plan around Dixon Road which is referred to as Peacocke Stage 1.

## 1.3 Objective

The objectives of this initial investigation are broadly as follows:

- Identify potential effects of imperviousness on catchment springs, baseflow of the stream and / or ground settlement within the catchment.
- Advise on soakage, stability and top of bank issues in relation to stormwater management and development setback requirements.
- Identify areas requiring specific geotechnical investigation in relation to the above.
- Identify the requirement for targeted investigations, such as stream gauging and the quantitative measurement of groundwater contribution to base flows. Targeted geotechnical and stream flow investigations will be undertaken during Stage 2 of the investigations if required.

This report covers the initial assessment which is Stage 1 of the project.

The initial hydrogeology assessment has informed the initial geotechnical assessment. The first objective and matter to address is to understand if groundwater recharge is important in maintaining base flows in the Peacocke sub-catchment. The initial assessment will seek to understand this using readily available information.

The geotechnical assessment presented in this report is based on a number of representative scenarios. The geotechnical assessment provides comment on the erosion susceptibility within the catchment and effects of development on catchment stability based on the initial hydrogeological assessment.

Further investigation has been recommended on the basis that groundwater recharge appears to be important. More detailed hydrogeological investigation and assessment and targeted geotechnical investigation and specific assessment is also recommended.

## 1.4 Scope

The Stage 1 scope of works has been carried out as a desktop assessment using information provided by Hamilton City Council and existing knowledge of the catchment from previous AECOM projects associated with Southern Links and the Peacocke Stage 1 CMP. The following tasks have been undertaken:

- Identify relevant geology, geological hazards, spring locations and water take consents.
- Interpret the results of previous hydrogeological studies and geotechnical investigations undertaken in the area.
- Estimate the influence of groundwater recharge on water balance and therefore the potential
  effect of increased impervious surfaces.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

- Carry out representative geotechnical assessment to identify potential development controls to be confirmed through more detailed investigation and assessment.
- Identify future investigation requirements for Stage 2 of the project.

### 1.5 Methodology

The following methodology has been applied when undertaking the Stage 1 scope of works.

#### Hydrogeology

- Collate previous reports already held by AECOM with HCC supplying additional reports prepared as part of previous projects within the catchment.
- Collate GIS database information that is available in relation to geology, consents, spring locations (i.e. layers of all relevant factors will be sought from HCC and WRC as applicable).
- Review and interpret the existing reports and information obtained in (a) and (b) above.
- Map the geology, streams, springs etc. to enable GIS analysis for the identification of patterns and connections.
- Assess the likely role of groundwater in base flows.
- Consider and comment on the location of springs in relation to stormwater management device location (especially the role of soakage) and erosion and geotechnical investigation sites.

#### Geotechnical

- Review existing geological information of the project area including investigation logs and maps.
- Create typical sections and scenarios based on the identified geology and slope angles observed within the catchment.
- Compare the reaction of the gully slopes within each typical section during an empirical storm event and the subsequent infiltration through soakage trenches.

## 2.0 Conceptual hydrogeology

This section outlines the conceptual hydrogeology used in Stage 1 based on information from the previous reports and other readily available sources.

## 2.1 Climate and rainfall

Rainfall and potential evapotranspiration data were obtained from the NIWA Cliflo site for the period 2007 to 2017. The data were obtained for Site 26117 which is located at Ruakura. Mean monthly rainfall and evapotranspiration are shown in Figure 2.

Mean annual totals for the period were 1,107 mm for rainfall and 903 mm for evapotranspiration. Annual rainfall totals varied between 951 mm and 1,395 mm. Rainfall exceeds evapotranspiration from April to October while evapotranspiration is greater than rainfall for the remaining five months from November through to March.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



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Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

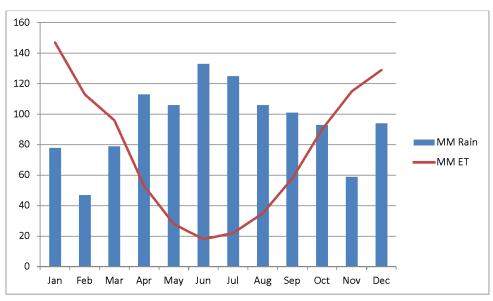


Figure 2 Mean monthly rainfall and evapotranspiration (2007 – 2017)

## 2.2 Geology

# 2.2.1 Regional geology

The Mangakotukutuku Stream catchment is situated in the south east of Hamilton City. Hamilton City is situated approximately centrally in the Middle Waikato Basin (Hamilton Lowlands). The Hamilton Lowlands is a broad, low angle alluvial fan built by the Waikato River in the late Quaternary.

The Hamilton Lowlands fan extends from Karapiro in the south to Taupiri in the north. The fan comprises mainly sandy volcaniclastic sediments, derived from rhyolitic eruptions in the mid North Island. The rhyolitic eruptions were deposited on an older highly eroded surface underlain by mixed alluvial sediments, peat and pyroclastic flows referred to as the Walton Subgroup.

The eroded surface of the Walton Subgroup was covered by beds of weathered airfall tephra (Hamilton Ash formation) prior to deposition of the fan materials (known as the Hinuera Formation). The fan materials only partly covered the older ash-covered surface, leaving linear, sinuous and discontinuous ridges rising above the level of the alluvial fan surface. These are commonly referred to as the Hamilton Hills.

Gullies within the Hamilton Basin are the result of head ward erosion as the Waikato River degraded and cut down through alluvial sediment. The gully erosion process exposed groundwater confined by impervious silt layers and forming springs. Over time these springs eroded and collapsed the heads of small gullies forming the system of tributaries common in Hamilton City.

#### 2.2.2 Catchment geology

A recent geological map of the Waikato region (GNS QMAP4 Waikato 1:250,000) maps the Mangakotukutuku Stream catchment as Hinuera Formation alluvium and older Pleistocene age Walton Subgroup alluvium and distal weathered ignimbrite. Areas of elevated land within the catchment are likely to consist of Puketoka Formation and Karapiro Formation (both belonging to Walton Subgroup) weathered ignimbrite and weathered alluvium.

The Rukuhia peat bog forms broad flat plains surrounded by the elevated Hamilton Hills to the south and west of Ohaupo Road. Figure 3 shows the extent of the Hamilton Hills in the catchment and the Hinuera Formation alluvium.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

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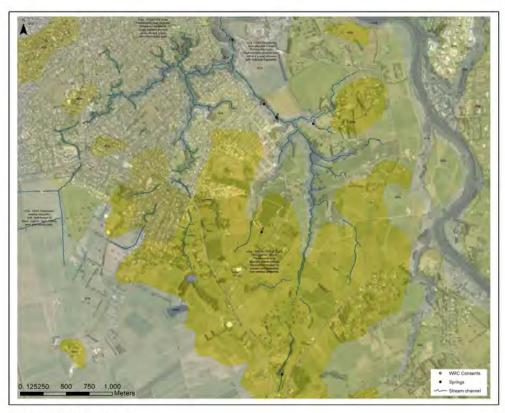


Figure 3 Catchment geology

Darker areas labelled eQa are Hamilton Ash soils likely to be of low soakage. Lighter areas of Q2a and Q1a are Hinuera formation with better soakage. Refer to Section 2.3 and 3.3.2 for further information in regard to likely soakage.

## 2.3 Soils

Soils information has been derived from the Landcare Research S-Map ONLINE. The S-Map database provides information on soil type, soil water holding capacity and soil drainage.

Soils over the Hinuera formation generally have a deep profile, high water holding capacity and are free draining. Hamilton Ash soils over the hills have more clay content, are shallower with reduce water holding and drainage capacity. Within the gullies soils tend to have a lower drainage capacity.

Soils within the catchment are diverse and their spatial extents indicate a potentially complex hydrogeology with respect to groundwater and spring discharge to support stream baseflow. Figure 4 shows the variability in soil drainage across the catchment. This variability in the soils across the catchment will result in variable groundwater recharge and surface runoff.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

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Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

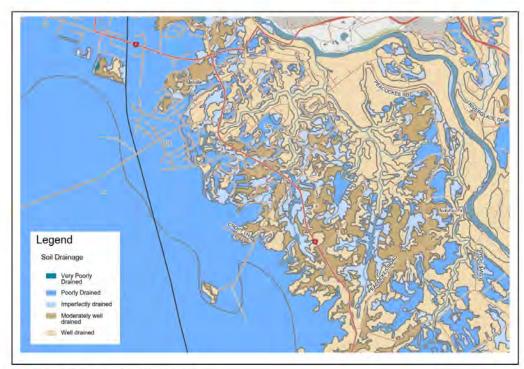


Figure 4 Catchment Soils (S-Map ONLINE)

## 2.4 Geomorphology

The Mangakotukutuku Stream catchment encompasses the system of tributaries south east of Hamilton City and west of the Waikato River. The stream is generally orientated north south beginning as a series of drainage channels in the eastern extent of the Rukuhia peat swamp. The stream eventually discharges into the Waikato River near Bader Street, Melville.

The catchment topography is characterised by generally flat to low rolling terrain bounded by low Hamilton Hills to the east and south that protrude above the Hinuera Formation alluvial surface. The Mangakotukutuku Stream gully is generally well defined and meanders across flat Hinuera formation topography, dissecting low hills of the Walton subgroup.

The gully geomorphology is typical of a low gradient, incised dendritic gully system with the base level at the Waikato River. Geometry varies downstream from the head of the catchment, with a generally shallow but narrow base in the upper reaches of the catchment and a well-defined and broad base near the confluence with the Waikato River at Melville.

The gully can be broadly described based on proximity to the Waikato River and the gradient of the stream.

#### Upper Waipa (peat swamp)

South of Houchens and Ohaupo Road, and Saxbys Road, the eastern and western branches of the stream head north, crossing pastoral farmland entrenched 2 m to 3 m below the surrounding land. The stream banks are typically moderately steep and sparsely vegetated where land use is pastoral farmland.

As the stream enters the city limits, the channel remains narrow and shallow with residential development less than 5m from the stream banks. Structures such as retaining measures and culverts are common where residential properties are bounded by the stream and gully.

Revision D = 01-May-2020 Prepared for = Hamilton City Council = Co No.: N/A

**Hamilton City Council** 

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#### West branch

From Saxbys Road, gully slopes steepen as the stream intersects the base of low Walton Subgroup hills. Slopes are generally greater than 25° and up to 8m high. Vegetation cover within the city is variable and often affected by residential development. Sections of this portion of the stream gully have been cleared of vegetation.

The central sub-catchment crosses the low Hamilton Ash hill that Ohaupo Road follows. East from Ohaupo Road the stream is entrenched some 20 m below the level of the surrounding residential land with gully slopes exceeding 35° in places. The channel is generally centralised and 3 m to 4 m wide. As the stream is deeply entrenched, the stream banks consist of dense and partially cemented Walton Subgroup materials. The portion of the catchment east of Ohaupo Road is generally well vegetated.

#### Central branch

The gully is shallow and poorly defined South of Pelorus Street near where it begins as a series of drainage channels in pastoral farmland. The upper gully is generally shallow at 3 m to 5 m deep with a 5 m to 6 m wide base and an approximately 3 m wide channel. The stream meanders around low Walton subgroup hills and is commonly channelised by engineered erosion protection and in the vicinity of culverts and pedestrian bridges. The stream banks are generally very steep to near vertical and the gully slopes sparsely vegetated.

The central branch of the gully crosses flat to undulating residential land and council reserve (Te Anau Park) from Pelorus Street to the confluence of the central and western branches of the stream near Sanford Park. From Te Anau Park to Sanford Park the gully is approximately 6 m to 8 m deep with well vegetated slopes up to 30°. A significant portion of the gully between Te Anau Park and Sanford Park is inaccessible so no direct observation of geomorphology has been recorded.

#### Peacocke branch

The Peacocke Branch is a shallow infilled channel that from the headwaters flows north through farmland. Some ponding has been created within the upper reaches. As the stream progresses downstream it has developed in a manner similar to that described above for the progressive channelization of the central branch. The upper sections are shallow in farmland and become progressively incised with distance downstream.

## Waikato River confluence

Near the confluence of the Mangakotukutuku Stream and the Waikato River, the gully is broad and deeply incised with a generally narrow channel. The gully floor is typically up to 20 m to 25 m wide and approximately 25 m below the level of the surrounding residential land.

Walton Subgroup materials are exposed and form the lower gully slopes in the base of the gully. More recent alluvium forms the channel banks where the gully is broad. Slopes are steep, locally up to 40° and variably vegetated. The gully narrows and the slopes steepen where the low hills of the Walton Subgroup group are dissected by the stream. Shallow gullies have formed in the true left catchment slope where groundwater seeps from the contact of the Hinuera Formation and Walton Subgroup materials.

## 2.5 Groundwater Levels

Groundwater has been measured as part of specific investigations within the catchment. This has been in the Dixon Road area and associated with the Southern links route investigations. These are ad hoc measurements so there is no data that is really suitable for temporal or spatial application. However, the range in water level from the spot measurements indicates that water levels range between 0.6 m and 1.5m below ground level from summer to winter. This is a broad generalised interpretation and all that can be inferred is that water levels do fluctuate as expected with the seasons and all bore records seem to exhibit a similar response.

A number of other bores in the catchment appear on the Waikato Regional Council website maps but there is no indication of water levels.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

AECOM

Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1 8

## 2.6 Recharge and Discharge

Groundwater seepage from side slopes and the gully slopes has been reported along or close to the channels. Seepage appears to occur between soils of varying permeability and occurs from the contact between Hinuera Formation materials and the less permeable underlying Walton Subgroup materials.

Figure 5 shows mean monthly rainfall, evapotranspiration and the combined recharge and discharge for the period 2007 to 2017. Overall, from November to March there is a rainfall deficit and so any soil moisture or groundwater storage will generally be depleted during those months even though rainfall occurs. From April to October there is a surplus which either discharges or recharges groundwater.



Figure 5 Mean monthly recharge and discharge (2007 - 2017)

This annual pattern is generalised for the whole catchment. The amount of surface runoff and groundwater recharge depends on the extent of routing the excess through the soil. With the variable soil drainage as shown in Figure 4 the amount of infiltration into the soil will vary. The poorer the soil drainage is the greater the surface runoff. The better drained soils will have higher infiltration and groundwater recharge.

Consequently, development of impervious surfaces on poorly drained soils is likely to have less of an impact on groundwater recharge than if the same area was developed on free draining soils. Therefore, it is not a simple matter of estimating the increase in impervious land cover with development and assuming that percentage can be directly applied to the recharge reduction. The proportions have to be weighed against the soil types.

Land development practices including cut, fill and compact along with the conveyance of runoff to specific locations will alter the natural recharge with lower infiltration rates and the concentration of runoff to point sources rather than the dispersed natural recharge pattern.

## 2.7 Groundwater consents

Waikato Regional Council mapping shows a number of bores across the catchment. The bores are located in urban and rural areas. The bores range in depth from less than 25 m to over 100 m deep.

There is no specific bore information that indicates whether groundwater is abstracted, or if it is, how much water is taken. Given that most of the bores are in the rural area it could be assumed that their

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

use is domestic and stock water supply. There does not appear to be extensive use of water for irrigation in the catchment.

Consequently, the groundwater take is assumed to be relatively small and unlikely to be a significant component of the catchment water balance.

## 3.0 Assessment

This section describes the outcome of the desktop assessments undertaken and the implications on development.

#### 3.1 Groundwater & baseflow

The monthly water balance shows that there is significant infiltration from April through to October. This is generally where groundwater recharge and baseflow comes from although large storm rainfalls during November to March will also contribute to groundwater recharge. Any change to the water balance components will impact stream baseflow.

In a catchment baseflow originates from springs at specific locations or general bank seepage along the length of a channel. For the most part this baseflow originates from infiltration within the catchment. The exception being sometimes spring flow comes from deeper groundwater and from areas outside of the topographic catchment boundary.

There is no indication in the Peacocke arm of the Mangakotukutuku catchment that baseflow originates from beyond the catchment boundary. This is recommended to be confirmed through more detailed groundwater measurement and modelling. The main Mangakotukutuku arm is likely to be fed partly from the Rukuhia Peat Swamp but the degree to which this is the case is unknown.

The variability of soil properties across the catchment means that infiltration rate and volume is also likely to vary. This could lead to variable bank seepage rates along the channel. Combined with some variability in the underlying geology related to the fluvial deposition process it is likely that there will be preferential underground flow paths that concentrate discharge points as springs. Establishing the sources of baseflow along the channels requires specific flow measurement and the assessment of baseflow recession characteristics which needs to be undertaken as part of stage 2 investigations.

Changing land use changes infiltration properties of the surface. Hard surfaces eliminate infiltration. Engineered soils with urban development also change infiltration characteristics. For example, if 50% of the surface area is converted to hard surface the water balance will change and infiltration will be reduced by approximately 50 % and surface runoff increased. Typically, initial rainfall loss to infiltration ranges from about 20 mm to 32 mm so an increase in impervious surface by 50 % will reduce initial infiltration by 16 mm in a storm event. Ongoing infiltration during any storm will also be reduced. Therefore, changing land use will alter baseflow rate and total volume such that in drier spells the streamflow may deplete more quickly, or it may simply not be sustained for as long so in a drought the stream will dry up more rapidly.

In the Mangakotukutuku catchment the spatial distribution of infiltration is likely to be significant for baseflow given the variable soil properties. In developing the catchment, it will be important to replicate natural runoff processes as close to source as possible. Consequently, the existing volume of water that infiltrates the soil will need to be maintained along with the existing spatial distribution of infiltration for baseflow and a natural low flow recession to be maintained.

# 3.2 Stream flow gauging

Two rounds of stream flow gauging were undertaken in the Mangakotukutuku catchment on 4 May 2018 and 9 May 2018. The gauging locations were agreed with HCC and Morphum prior to undertaking fieldwork. The locations where the stream flow was measured are shown in Figure 6.

A third gauging round was planned but the winter wet weather season began with a series of significant rain events after the 9<sup>th</sup> of May which prevented further useful measurement.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

**Hamilton City Council** 

AECOM

Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

Location G will need adjusting if used for future gauging because access to the stream channel was found to be limited and not ideal. Measurements were undertaken but a more suitable site would be preferred.

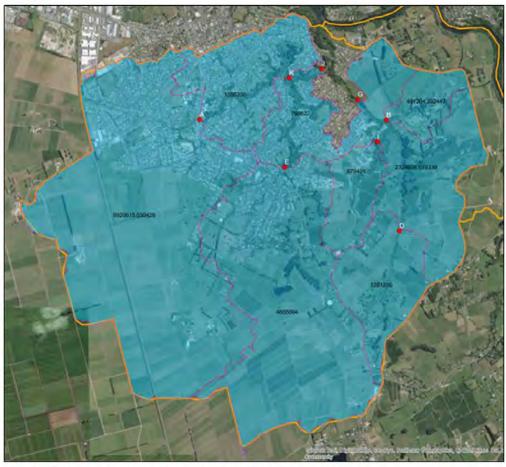


Figure 6 Mangakotukutuku Stream Gauging Locations and sub-catchment boundaries

The purpose of the gauging was to:

- · Establish low flow characteristics within the catchment
- Assess whether spring flow was significant
- Determine at a coarse level whether base flow occurs due to concentrated generation in specific locations (i.e. springs).

The results of the two rounds of streamflow gauging are shown in Table 1.

Table 1 Mangakotukutuku streamflow gauging results

Location	GPS (NZTM)	Flow 4 May (L/s)	Flow 9 May (L/s)
A – Ohaupo Road	E1800897	00.4	53.88
	N5811869	69.1	
B – Plateau Drive	E1803160	1.94	2.34

Revision D = 01-May-2020 Prepared for = Hamilton City Council = Co No.: N/A



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

Location	GPS (NZTM)	Flow 4 May (L/s)	Flow 9 May (L/s)
	N5811861		
D. Otubba Daad	E1803317	44.45	7.00
D – Stubbs Road	N5810521	11.15	7.68
E Delerue Street	E1801926	40.00	20.07
E – Pelorus Street	N5811294	48.23	29.97
C. Dietecu Drive	E1802812	20.0	27.53
G – Plateau Drive	N5812110	39.6	
I Diver Deed	E1803047	7.00	4.32
I – Dixon Road	N5811596	7.06	
L Conford Dark D/C	E1802375	107.4	120.3
J – Sanford Park D/S	N5812481	137.4	
I/ Conford Dark I I/C	N1801983	02.25	67.5
K – Sanford Park U/S	E5812371	83.35	67.5

The results show that flows increase with distance downstream and there doesn't appear to be any significant flow loss zones along the channels. Flows reduced from the 4 May to 9 May in all catchments except for sub-catchment B because there was no significant rainfall between those days.

The gauged flows have been converted to specific discharges in terms of Litres per second per square kilometre (L/s/km²) to further understand the flow characteristics in the catchment. The specific discharges are shown in Table 2.

Table 2 Sub-catchment specific discharges

Sub-catchment	4 May Flow (L/s/km²)	9 May Flow (L/s/km²)			
Western brownfield catchments					
Α	9.98	7.79			
К	9.16	8.76			
A+K	9.83	7.96			
E	10.36	6.44			
J	7.36	28.86			
E+J	9.92	9.70			
A+K+E+J	9.87	8.64			
Eastern greenfield catchments					
В	3.95	4.77			
D	8.70	6.00			
I	10.40	6.36			
G	8.35	5.66			
G+B+I+D	8.09	5.63			

The specific discharges indicate the following:

• The base flow generation across the overall catchment is reasonably similar. This suggests that spring flow inputs are not significant.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



AECOM Mangakotukutuku ICMP
Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

- Sub-catchment B has a lower baseflow than the other sub-catchments. This suggests there is a small amount of groundwater storage in that area.
- Sub-catchments E and I appear to have a higher depletion rate than other sub-catchments. Given they are adjacent to each other it may indicate a faster depletion of groundwater in that area.
- While the total catchment flow at J has decreased only slightly the changes in each of the upstream sub-catchments between the 4th and 9th of May vary.
  - Sub-catchment J was the most significant with an increase from 5.82 L/s on the 4<sup>th</sup> to 22.83 L/s on the 9<sup>th</sup>. The specific discharge had risen significantly.
  - Given the absolute small flows that are involved it could be a gauging error or a combination
    of abstraction or discharge within the catchment. It is unlikely that a spring discharge has
    suddenly started in Sub-catchment J.
  - Additional gauging would be required to know whether the first or second measurement was an issue.

The specific discharges are higher than one would expect for a 5-year low flow. Even though the preceding weather conditions where not 'drought like' the flows suggest that there is a strong base flow component in the catchments. This is consistent with the conclusion that infiltration is impeded by deeper less pervious soil layers so that flow is concentrated into seepage areas along the channel.

The gauging that has been done suggests that the seepages are relatively uniformly spread along the channels and do not concentrate flow in any one particular channel reach. Given the strength of the base flow it suggests that infiltration rates and volumes across the catchment need to be maintained so that the strong base flow can be supported through development rather than reduced or diverted.

### 3.3 Imperviousness & groundwater

## 3.3.1 Introduction

A proportion of rainfall infiltrates into the ground from undeveloped surfaces. Rainfall that does not infiltrate runs off as sheet flow or is concentrated by topography into overland flow paths that eventually form streams and rivers. Development increases hard impervious surfaces, reduces infiltration and increases runoff.

Rainfall is collected and concentrated by the stormwater management system when soakage is used as a primary method of disposal for developed areas. Increased runoff from hard area or poor performing soakage systems can contribute to surface erosion. Soakage can contribute to subsurface erosion such as piping or tomo development in susceptible soils.

Runoff is injected into the soil profile typically at a depth of 1 to 2 metres in developed stormwater devices. There is more stormwater infiltrating in a concentrated location and the natural attenuation through the broader soil matrix is bypassed as a result. If singular or cumulative effects are sufficient, either a loss of matric suction in partially saturated soils, or an increase in pore water pressure in saturated soils can occur. Both can result in land slippage or erosion of slope faces.

The natural hazards associated with stormwater soakage are not always isolated to the source property. Excess water can affect other properties through overland flow and contributing to ponding or existing flood hazards. Changes in groundwater flows because of soakage may also result in slippage, subsidence and erosion on other property.

The behaviour of the infiltrating water depends on the vertical and horizontal permeability of the soils that constitute the slope. If uniform conditions are present, then infiltration is generally downwards with some pluming until the ground water table is encountered. If a high permeability layer overlies a low permeability layer, then infiltration will be vertical until the low permeability layer is reached and horizontal infiltration will be preferable.

#### 3.3.2 Relevance to Mangakotukutuku

Variable permeability is common near Hamilton gullies where the Hinuera formation is the dominant geology. This results in perched water tables and seepages on gully slopes. The Hinuera formation is typically sub-horizontal so flows tend to be horizontal.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

The volcanic ashes (Hamilton Ashes) that typically overlay the Walton Subgroup are typically fine grained. There is a fully saturated zone in fine grained soils but the phreatic surface (upper surface of the water table) can be several metres higher due to capillary actions. This means that pore water pressures can increase in the lower part of the slope without raising the water table because the infiltration intercepts the phreatic surface (Wesley).

For example, an unlined pond in fine grained soils will have a hydraulic connection to the fully saturated soils. The connection will increase the pore water pressures in any underlying adjacent slope. Fissures, pipes and tunnels have all been identified in Hamilton Ash soils, which create preferential horizontal flow paths.

#### Hamilton Ash areas

Hamilton Ash tends to follow the topography unless past slippage has altered the topography. In this instance it is possible to have more sandy layers which have higher permeability that forming a blanket drain within the slope. As there is often colluvium near the toe of the slope the drain has no outlet. Tension cracks and the phreatic surface can result in elevated pore water pressures within the permeable layer and result in slope failure.

The Mangakotukutuku study area is broad and geological conditions are variable. While generalised assumptions regarding geological conditions can be made, local variations will exist. It is also likely that the topography, particularly where ash soils are present, will be highly modified by development works

It is anticipated that areas mapped as Hamilton Ash will not have soakage rates that meet requirements of the New Zealand Building Code for primary stormwater management systems. Soakage is unlikely to be adopted for primary disposal but may be beneficial to maintain the base flow of gully streams. Where the stream baseflow or seepage habitats rely on infiltration it will be important that development allows for soakage.

Another challenge in the built environment may be the proliferation of retaining walls which will have drainage that may intercept horizontal flows. This should be considered in conjunction with bulk earthworks design.

#### Hinuera Formation areas

For Hinuera Formation sites it is likely that anyone undertaking a simple soakage test will conclude that there is adequate soakage and not consider the cumulative effects of discharge to ground, or the erosion and instability potential. We consider the 5m setback from the crest of gullies to be insufficient for soakage systems (refer to analysis Section 3.4 for more details).

## 3.4 Geotechnical analysis scenarios

#### 3.4.1 Introduction

A representative analysis has been undertaken in lieu of site-specific investigations and analysis. The representative analysis is intended to show how typical gully slopes in the catchment may react to rainfall and infiltration. The analysis seeks to estimate development setbacks and the implications of groundwater recharge in the vicinity of slopes.

## 3.4.2 Methodology

A combined seepage and slope stability analysis was undertaken using the software Slide version 7, produced by Rocscience. The purpose was to assess changes in slope stability and identify potential erosion from increased impervious surfaces and soakage systems in close proximity to the gully slopes.

The analysis is noted to be hypothetical for the purpose of comparison and approximation of the conditions in the catchment. Three dimensional effects such as concentration of flow to preferential discharge points due to dipping flow barriers is not addressed in the modelling. Ongoing rainfall will result in additional infiltration which is not accounted for in the high-level assessment undertaken in this report.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

AECOM

Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1 4.4

Typical slope shapes were modelled with simplified geological conditions that represented two cases, barriers to flow or preferential flow. In reality the slope heights and gradients in the catchment are variable. The geological situation is also more complex with perched water tables and multiple barriers to flow likely in reality.

Groundwater seepage was modelled using a finite element method. Initial steady state groundwater was set using a combination of water tables and boundary conditions. Rain infiltration was set using dynamic infiltration boundary conditions on the ground surface and at the base of the soakage trenches. The dynamic groundwater response was assessed at Day 0, Day 1, Day 2, Day 7, Day10 and Day 14. Soil permeability was taken as typical for the soil types e.g. sand, silt or clay based on published values and our experience.

Rain infiltration is based on typical initial losses yielded from rainfall and runoff analysis in Hamilton soils. Soils with SCS Curve Numbers ranging from 61 to 71 yield initial losses in the range of about 20 mm to 32 mm respectively. An initial infiltration loss of 32 mm/day was adopted for this assessment.

The infiltration was applied to the ground model as simple hydrograph occurring in Day 0. The hydrograph starts and finishes at 0 mm/day with a peak of 64 mm/day in the middle of the day (i.e. total infiltration is 32 mm/day). In the post development case (above the slopes only) the infiltration rate was reduced to 10 mm/day to approximate 65 % reduction in impermeable surfaces.

Infiltration through soakage systems was modelled so that the rate peaked at the soil infiltration rate and accounted for a lag. A head of water was represented in the model in order to reach full permeability and soakage. The soakage system was modelled as simple soakage trenches 1 m wide and 1 m below the surficial silt layer.

Slope stability was assessed at each stage of the dynamic groundwater assessment using the GLE Morgenstern-Price method. Soil parameters used for the stability assessment were based on our experience with the local geology and ensure that the steeper slopes were stable in the initial steady state condition. While actual parameters will vary, the intent was to assess changes in stability, rather than actual stability.

Development loads such as fills, and buildings are not included in our modelling and will need to be considered specifically as part of development proposals.

The assessed scenarios are presented in Table 3.

Table 3 Modelled scenarios

Scenario	Depth	Soil type	Permeability (m/s)
Uniform permeability	0 m to 0.6 m	Silt	1 x 10 <sup>-6</sup>
	0.6 m to base	Sand	1 x 10 <sup>-4</sup>
High permeability over	0 m to 0.6 m	Silt	1 x 10 <sup>-6</sup>
low	0.6 m to 9.6 m	Sand	1 x 10 <sup>-4</sup>
	9.6 m to base	Clay	1 x 10 <sup>-8</sup>
Low permeability over	0 m to 0.6 m	Silt	1 x 10 <sup>-6</sup>
high	0.6 m to 9.6 m	Clay	1 x 10 <sup>-8</sup>
	9.6 m to base	Sand	1 x 10 <sup>-4</sup>
Ash mantle	0 m to 3.5 m	Ash clay	1 x 10 <sup>-9</sup>
	3.5 m to 8 m	Pumice sand	1 x 10 <sup>-5</sup>
	8 m to base	Clay	1 x 10 <sup>-8</sup>

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

Scenario	Depth	Soil type	Permeability (m/s)
	N/A	Ash sand lens	1 x 10 <del>-4</del>

#### 3.4.3 Assessment results and discussion

The results of the combined seepage and stability analysis generally agree with the outcomes we anticipated given the local geological conditions. Selected outputs are presented in Figure 7 to Figure 13. The key observations from the assessment are as follows:

- In uniform soils there is slight increase in slope seepage and decrease in stability, however the stability of the slope remained such that failure should not occur, i.e. the minimum factor of safety was greater than 1.0.
- With high permeability over low permeability soils the rain infiltration was sufficient to result in
  instability with and without soakage trenches. Both resulted in high volumes of seepage at the soil
  type interface and the modelled the results were quite similar.
- With low permeability over high permeability soils the slope was marginally stable near the toe of
  the slope during Day 1 and Day 2 with soakage trenches present. In contrast without the soakage
  trenches the slope had higher factors of safety. Overall, these scenarios did not fail, but the factor
  of safety reduced so consideration is still recommended in design.
- With an ash mantle there was no noticeable effect on stability except where there was a sandy
  layer creating a flow path within the ash soil. In both the cases with and without soakage trenches
  the presence of a sand layer or lens was shown to be very adverse to stability.

The high over low permeability result was probably the most surprising. A significant decrease in stability had been expected in upper part of the slope with trenches in place but only a minor decrease was observed (still enough to result in some instability). It was thought that a soakage device would concentrate the discharge and bypass the natural attenuation of dispersed soakage. This may be a limitation of the high-level analysis for the following reasons:

- The high-level scenario may have insufficient infiltration points to represent the reduction in direct surface infiltration. More points may be of benefit in reality to achieve maximum soakage and recharge potential.
- The result of the high-level scenario may be worse if a large infiltration basin (pond) is tested as
  opposed to trenches (i.e. larger soakage footprint).

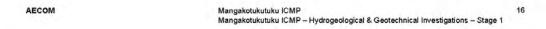
Notwithstanding the potential limitations, the assessment has shown that there is potential for instability if soakage is adopted in close proximity to the gully slopes, in permeable soils. It is possible that larger soakage devices will make the situation worse.

The model has considered what happens in a rainfall event large enough to utilise the initial soakage loss. The assessment has not considered more frequent small events, or extreme rainfall events. Soakage was set back 5 m to 15 m from the crest of the slope in the scenarios and the effects were apparent in all of the analysis outputs.

Overall, the results highlight the importance of understanding the geological model and how development and discharge concentration can result in increased seepage from slopes which could result in instability as a result of increased poor water pressures.

The typical five metre development setback used on HCC development projects is unlikely to be sufficient for long term stability in many instances. It is not possible to define a setback based on the high-level study we have undertaken because variable setbacks will be needed. Setbacks for soakage devices and buildings should be established based on seepage/stability modelling of the pre and post development slopes and post development loadings.

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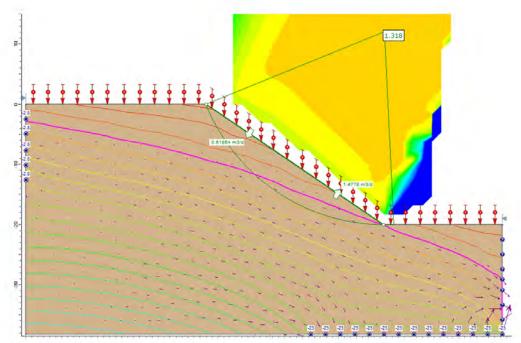


Figure 7 Uniform permeability with no soakage on Day 2

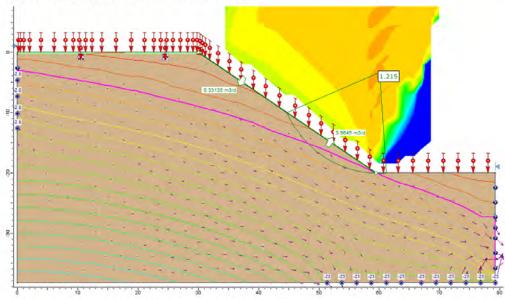


Figure 8 Uniform permeability with soakage on Day 2

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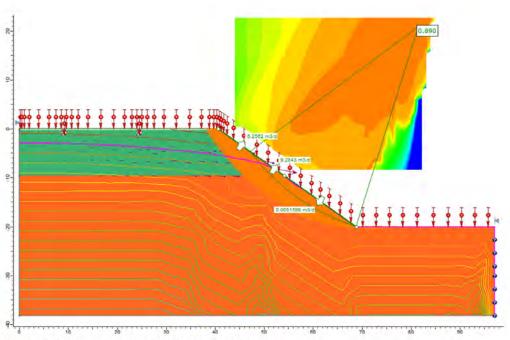


Figure 9 High over low permeability with soakage on Day 2

Note that the high over low permeability case without soakage is similar to the with soakage case that is shown in Figure 9 above.

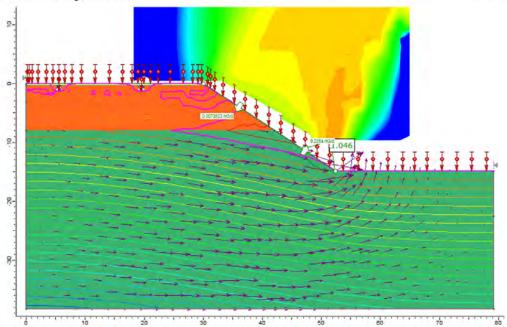


Figure 10 Low over high permeability with soakage on Day 1

Figure 10 yields a minimum factor of safety near the toe of the slope of 1.04 which is close to failure.

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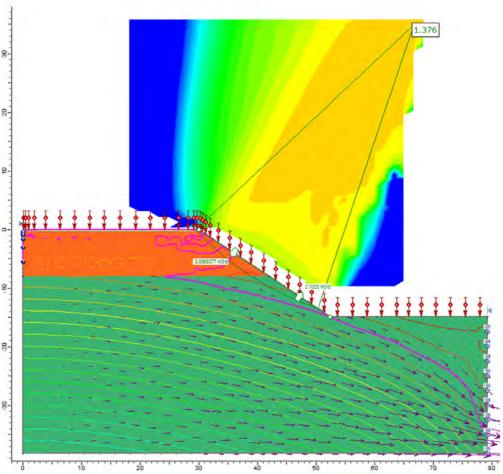


Figure 11 Low over high permeability without soakage on Day 1

Figure 11 yields a minimum factor of safety 1.37 and a shallow failure condition across the entire slope height.

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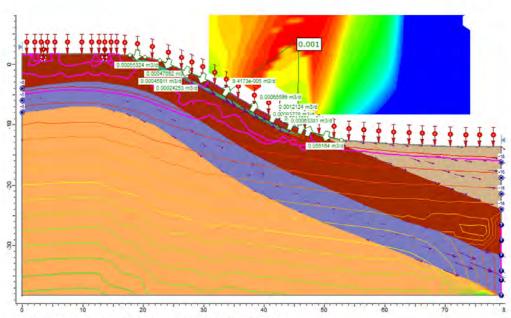


Figure 12 Ash mantle with flow path and soakage trench on Day 1

Figure 12 shows that there may be very low factors of safety with soakage trenches and a sandy flow path present.

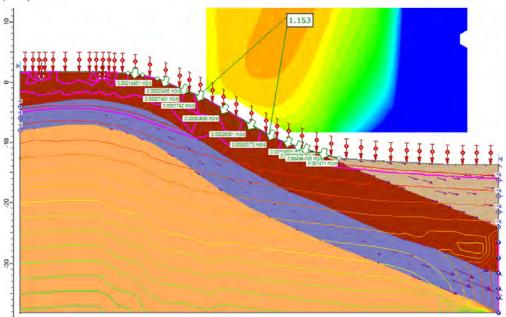


Figure 13 Ash mantle with soakage and no flow path on Day 1

Figure 13 shows increased factors of safety (compared to Figure 12) when soakage is utilised without a flow path present.

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20

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Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

## 3.5 Piped discharges, culverts and overland flow to gullies

Piped discharges, culverts and overland flow to gullies all have the potential to cause, worsen or accelerate erosion or slope instability if poorly designed, constructed or maintained. Individual requirements will vary depending on the nature of the structure, the underlying soil and the frequency of use. Permanent culverts and outlets will have more significant protection than periodic overland flow paths.

Key considerations are as follows:

- Locate structures on less steep slopes wherever possible for example terminate pipeline at stream level or flume flows to the bottom of the gully.
- Determine site specific erodibility of the soils during design. Lab tests can be used to assess erodibility and engineered solutions selected based on individual location risk.
- Sloping trenches in erodible soil should adopt best practice bedding and seepage block design together with monitoring during construction.
- Overland flow paths may need to have protection. Unlined overland flow paths should be avoided
  over slopes where erodible soils are present. Various options exist (green or hard engineered)
  depending on the scale and frequency of the overland flow path.
- Gully slope infrastructure should be located on council reserve, and sufficient provision should be
  made to allow access with the plant that will be required for repair or maintenance. Development
  plans should show sufficient detail to demonstrate maintenance access and safe setback from
  properties and structures. Easements should be avoided in these situations.
- Structures and culverts in the gully base will need to consider foundation conditions and erosion scour potential around or below the structure. In highly erodible soils that could be encountered in some areas of the gullies, extended depth foundations and impervious erosion protection may be required as opposed to simple rock and geotextile solutions. Care will need to be taken when arranging structures that will affect the flow of water and potentially exacerbate erosion.
- In stream structures should be avoided within the normal channel up to the bank full level (if there
  is a defined channel). This could be achieved by bridging, arch culverts with no invert, or
  embedded culverts with a generous width and carefully designed approaches.
- Hard invert structures could be utilised in the lower stream where degradation of the Waikato
  River may cause the stream to degrade. These types of structures act as a bed controls but could
  need periodic works to maintain downstream gradients and fish passage (due to the formation of
  perched outlets).

A single solution cannot be predefined for different structure types due to variability within the soils and qully depth therein, throughout the Mangakotukutuku system.

#### 3.6 Maintaining water balance with development

Urbanisation will increase rapid surface runoff and reduce stream baseflow rate and volume based on the apparent hydrogeology, unless development ensures that the natural process is mimicked through design. To facilitate development while maintaining the water balance to ensure baseflow is going to require consideration of a number of issues as follows:

- What is the existing infiltration rate and volume and how that varies across the catchment?
- What is the best way to collect and engineer infiltration of surface runoff that would otherwise have directly infiltrated the natural soil?
- Will storage of initial runoff in on site tanks for reuse significantly alter groundwater recharge volume and how can this be mitigated?
- What methods are available to spread infiltration or discharge directly to groundwater to mimic the undeveloped environment and ensure that changes to infiltration pathways do not elevate geotechnical risk?

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## 4.0 Summary and recommendations

## 4.1 Summary

The Mangakotukutuku gully system, in particular the undeveloped Peacocke Arm, appears to rely on groundwater infiltration to support baseflows. The Mangakotukutuku arm is also fed from the peat swamp in Waipa District so is less reliant on local groundwater infiltration. Wider groundwater flow contours cannot yet be defined but there is sufficient information to conclude that local infiltration is important.

The geology in the catchment allows rainfall to infiltrate and migrate to gully slopes and streams as seeps and springs which contribute to stream baseflows. The same regime could result in instability particularly if development mitigation involves concentrated infiltration.

The baseflows are higher than one would expect and the seepages appear to be relatively uniformly spread along the channels and not concentrated. Given the strength of the base flow it suggests that infiltration rates and volumes across the catchment need to be maintained so that the strong base flow can be supported through development rather than reduced or diverted.

The catchment will benefit from dispersed infiltration to mitigate the potential effects of development, if the existing stream environment is to be maintained as far as practical. Care will need to be taken to ensure that the method of groundwater replenishment does not increase risk to the built environment through targeted assessment and recommendation of appropriate setbacks.

Geotechnical and hydrogeological recommendations for Stage 2 are discussed in the following sections. An overarching Stage 2 recommendation is to develop an integrated GIS map with multiple detail layers informed by further investigations. The GIS map will allow sites to be ranked and constraints to be highlighted as well as linking into other ICMP mapping later in the project.

## 4.2 Geotechnical recommendations

As part of the resource consent for development it is recommended the effects of the development on groundwater flows, stability and erosion as a result of landform changes, impervious surfaces and soakage infiltration systems is assessed. This will require groundwater modelling in the predevelopment and post-development state.

Therefore, it is important to have an understanding of the baseline groundwater conditions, deep permeability characteristics and rainfall response over an extended period of time that can form the basis of specific assessments.

We recommend that vibrating wire piezometers are established throughout the catchment in both perched water tables and deeper water tables. Two of these should be coupled with rain gauges. The purpose of this will be to determine the rainfall responses of both the perched water tables and the deeper water tables.

The hydraulic conductivity of the aquifer will need to be established by undertaking pump out tests, packer tests or laboratory tests on core recovered from piezometer installation.

We also recommend that seepage/stability modelling guidance is developed so that a consistent approach is adopted in support of resource consents. This would address typical hydraulic properties, infiltration curves for various storms and surface soil conditions and cases to be considered.

#### 4.3 Groundwater and stream flow recommendations

Integrated catchment management pre and post development monitoring is recommended to fully implement objectives associated with best practice. Groundwater needs to be monitored so that groundwater flow can be determined, response to rainfall assessed, and potential development effects identified.

The geotechnical investigation (Section 4.1) has recommended piezometers and rain gauges. The spatial spread of monitoring points needs to cover all of the undeveloped catchment. Additional bores may be of benefit along with the recommended piezometers. In the first instance a review is

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



22

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recommended of whether any of the bores in the WRC database are unused and would make suitable monitoring locations.

Stream flow monitoring is recommended to further assess baseflow, and to support ecological and water quality monitoring. At least one permeant continuous flow recording station should be established in the lower catchment. Spatial variation in base flow can be assessed by occasional summertime flow gauging at upstream sites (existing sites that have been suggested for Stage 2 flow gauging or alternatives that may be identified during the initial gauging runs).

Additional continuous recorder stations may be of benefit in the upper catchment for ecological and water quality monitoring. If any are implemented, it would be appropriate to locate them where proposed Stage 2 gauging is undertaken.

#### 4.4 Provisional development controls and BMPs

Additional investigation and assessment is recommended to set exacting requirements for development and infiltration setbacks. To do so the geotechnical risk should be determined in more detail for scenarios with increased infiltration around slopes and retaining walls. A higher level of assessment will enable the catchment to be mapped in high resolution and variable requirements set, as opposed to a single catchment wide requirement.

To achieve the desired outcome, it is considered that the following Best Management Practices (BMPs) are appropriate:

- Provide appropriate setbacks from slopes and walls for development to reduce risk of instability.
- Provide appropriate setbacks from slopes and walls for enhanced infiltration zones to reduce the risk of instability.
- Utilise swales and subsoil drainage to enhance infiltration at lot and minor road level (dispersed and distant from at risk gully slopes).
- Provide at source infiltration via District Plan mandated on-lot water efficiency measures.
- · Apply similar approach to major roads where possible.
- Locate wetlands where outlet drainage can be connected directly to groundwater using vertical drainage when centralised collection and treatment is adopted.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

23

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# 5.0 Summary of issues and options

Issue Reference	Issue Description	Proposed Further Investigation	Options	Section
Hydrogeology 1	Evapotranspiration is greater than rainfall for the five months from November through to March.	Nil / not applicable	<ul> <li>Maximise groundwater recharge during winter to delay dry weather effects on gully baseflows.</li> <li>Utilise stormwater devices that will maximise soakage and minimise volume discharge and flow variability during dry weather.</li> </ul>	2.1
Hydrogeology 2	Groundwater measured as part of other projects within the catchment has been ad hoc so there is no data that is really suitable for temporal or spatial application.	<ul> <li>Determine the spatial spread of monitoring points needed to cover all of the undeveloped catchment.</li> <li>Additional bores may be of benefit along with the recommended piezometers (refer Geotech 1) and existing WRC bores</li> </ul>	<ul> <li>Do nothing – groundwater may be influenced outside of the catchment and unnecessary control imposed via the ICMP.</li> <li>Determine using existing WRC bores and proposed piezometers – possible data gaps. Utilise any existing available bores first.</li> <li>Determine using existing WRC bores, proposed piezometers and additional bores for full coverage.</li> </ul>	2.5
Hydrogeology 3	Land development practices including cut, fill and compaction along with the conveyance of runoff to specific locations will alter the natural recharge with lower infiltration rates and the concentration of runoff to point sources rather than the dispersed natural recharge pattern.	<ul> <li>At least one permanent continuous flow recording station should be established in the lower catchment.</li> <li>Occasional summertime stream flow monitoring is recommended to assess baseflow, and to support ecological and water quality monitoring.</li> <li>Additional continuous recorder stations may be of benefit in the upper catchment for ecological and water quality monitoring.</li> </ul>	<ul> <li>Utilise swales and subsoil drainage to enhance infiltration at lot and minor road level (dispersed and distant from at risk gully slopes).</li> <li>Apply similar approach to major roads where possible.</li> <li>Provide at source infiltration via District Plan mandated on-lot water efficiency measures.</li> <li>Locate wetlands where outlet drainage can be connected directly to groundwater using vertical drainage when centralised collection and treatment is adopted.</li> </ul>	2.6 / 4.3
Geotech 1	Variable permeability is common in Hamilton gullies. It is important to have an understanding of the baseline groundwater conditions, deep permeability characteristics and rainfall response over an extended period of time that can form the basis of specific assessments.	<ul> <li>Establish vibrating wire piezometers throughout the catchment in both perched water tables and deeper water tables.</li> <li>Couple the piezometers with rain gauges to determine the rainfall responses of both the perched water tables and the deeper water tables.</li> <li>Establish the hydraulic conductivity of the aquifer by undertaking pump out tests, packer tests or laboratory tests.</li> </ul>	<ul> <li>Do not provide specific recommendations to developers</li> <li>Provide a catchment wide recommendation / preferred solution, subject to site specific assessment</li> <li>Provide a suite of acceptable solutions as far as practical, in part to prevent solutions being adopted that are not preferred by HCC, also subject to site specific assessment and suitability.</li> </ul>	3.2
Geotech 2	Increases in slope seepage due to concentrated infiltration near to slopes typically result in a decrease in stability, sometimes to the point of failure (dependant on soil consistency and layering)	<ul> <li>Determine the effects of the development on groundwater flows, stability and erosion as a result of landform changes, impervious surfaces and soakage infiltration systems as part of the resource consent for development.</li> <li>This will require groundwater modelling in the pre-development and post-development state.</li> </ul>	<ul> <li>Provide appropriate setbacks from slopes and walls for development to reduce risk of instability.</li> <li>Provide appropriate setbacks from slopes and walls for enhanced infiltration zones to reduce the risk of instability.</li> <li>Deep vertical soakage to avoid shallow gully slope adverse effects.</li> </ul>	3.4/4.2
Geotech 4	Point discharges may cause erosion of gully slopes.	Nil – site specific investigation and design is recommended	Do nothing – undertake maintenance as required Provide outlet protection measures from the discharge to the stream (low impact or engineered) Flume discharges to the gully base / direct to stream Construct pipelines to the base of the gully	3,5
Geotech 5	Overland flows may cause erosion of gully slopes.	Nil – site specific investigation and design is recommended	<ul> <li>Do nothing – undertake maintenance as required</li> <li>Provide overland flow path erosion protection measures from the discharge to the stream (low impact or engineered depending on frequency and scale)</li> </ul>	3,5
Geotech 6	Culverts and other in stream structures may cause erosion of streams. Careful design is required.	Nil – site specific investigation and design is recommended	Avoid in stream structures (e.g. bridge the normal flow channel, no piers)     Utilise no invert culvert structures (e.g. arch culvert)     Utilise hard invert culverts for bed control (e.g. if needed to control degradation) while maintain fish passage     Generously embed culverts and other structures (wing walls, retaining walls)	3.5
Geotech 7	Many of the catchment hydrogeology and geotechnical issues require site specific investigation and design. Catchment wide solutions will not be practical or viable.	<ul> <li>Develop modelling and assessment guidance so that a consistent approach is adopted in support of resource consents. To address typical hydraulic properties, infiltration curves for various storms, depths and surface soil conditions, soil rehabilitation potential and cases to be considered.</li> </ul>	Rely wholly on developer led investigation and design. Carry out catchment wide pre-development groundwater modelling to form the baseline for developed catchment modelling and assessment. Develop standard guidance as per the recommended further investigations	3.6 / 4.0

Revision D = 01-May-2020 Prepared for = Hamilton City Council = Co No.: N/A

Hamilton City Council
Te kaunihera o Kirikiriroa

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Mangakotukutuku ICMP Mangakotukutuku ICMP – Hydrogeological & Geotechnical Investigations – Stage 1

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- b. 21 Saxbys Road Subdivision Suitability Assessment. AECOM (2016)
- c. 39B Anthony Crescent Slip Preliminary Geotechnical Assessment Report. AECOM (2017)
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- k. Peacocke Stage 1 Catchment Management Plan: Deep Soakage Report (2012)
- I. Southern Links Geotechnical Interpretive Report. AECOM (2012)
- m. The Wandering River Landforms and geological history of the Hamilton Basin. John McCraw (2011)
- n. Wesley, L.D. Unconfined seepage behaviour in coarse- and fine-grained soils.
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#### 7.0 Limitations

The recommendations and opinions contained in this report are based upon data obtained from several historic site investigations (machine auger drill holes, cone penetration tests) and observations made during associated walkover inspections. Inferences about the nature and continuity of subsoil conditions away from drill holes have been made using geological principles and engineering judgement.

Further development of the options and solutions discussed in this shall be subject to further investigation assessment and design.

This report has been prepared for the particular project described in the owner's brief to us and no responsibility is accepted for the use of any part of this report in other contexts or for any other purposes.

Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A



# Appendix A

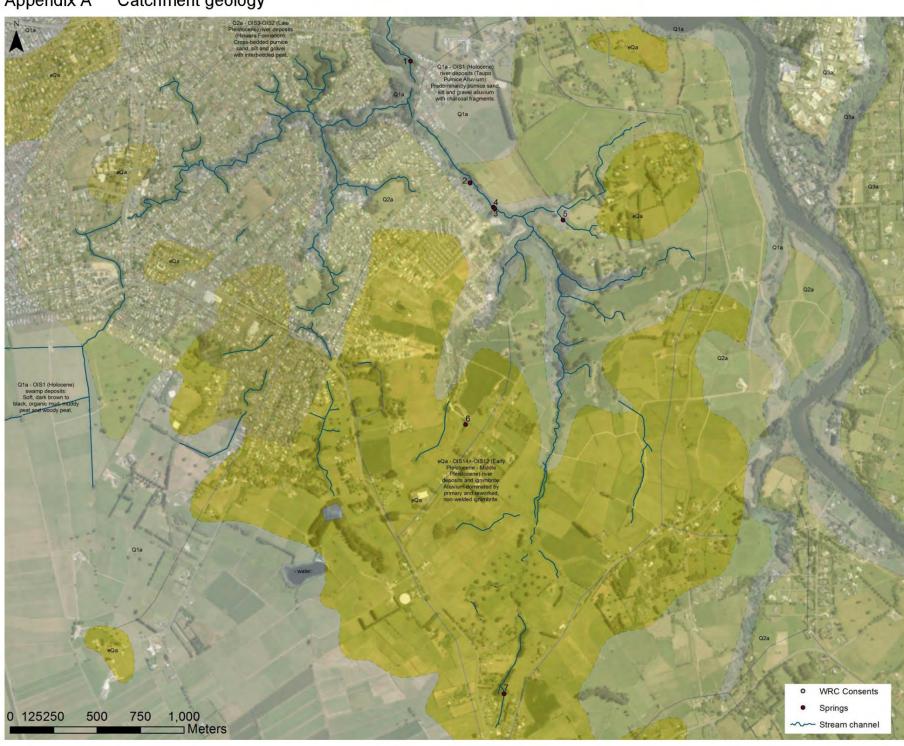
Catchment geology

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A-1

# Appendix A Catchment geology



Revision D – 01-May-2020 Prepared for – Hamilton City Council – Co No.: N/A

Attachment 24





Page 1745 Attachments



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Mangakotukutuku ICMP Addendum Report – Stage 2 - Setback Assessment

# Addendum Report

Stage 2 - Setback Assessment

Client: Hamilton City Council

Co No.: N/A

Prepared by

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02-Oct-2020

Job No.: 60563022

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Reviewed by Russell Allison

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В	01-Nov-2019	Revised as per peer review	Chris Hardy Project Manager	
С	02-Oct-2020	FINAL	Chris Hardy Project Manager	P9 D 1

Revision C = 02-Oct-2020 Prepared for – Hamilton City Council = Co No.: N/A

Attachments



A		

Mangakotukutuku ICMP Addendum Report – Stage 2 - Setback Assessment

## Table of Contents

1.0	introd	luction	- 1
2.0	Backo	ground	1
3.0		ick definition	1
	3.1	Primary Setback Line	1
	3.2	Secondary Setback Line	1
4.0	Asses	ssment methodology	2
	4.1	General	2
	4.2	Ground Model	
		4.2.1 Groundwater	2 3 3 3
	4.3	Mapping of setback lines	3
	4.4	Stormwater soakage considerations	3
5.0	Section	on 32 information	4
6.0	Limita	ations	
	6.1	General limitations	5 5 5
	6.2	Qualifications	5
Apper	ndix A		
	Mappi	ing	A
Appe	ndix B		
	Section	on 32 tables	В

## List of Tables

Table 1	Soil Properties used for the slope stability analysis	2
Table 2	Potential additional items required	4

Revision C = 02-Oct-2020 Prepared for — Hamilton City Council = Ca No.: N/A

Attachments

Hamilton City Council

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Mangakotukutuku ICMP Addendum Report - Stage 2 - Setback Assessment

#### 1.0 Introduction

Hamilton City Council (HCC) engaged AECOM New Zealand Limited (AECOM) to undertake a detailed gully hazard setback assessment of the Mangakotukutuku and Peacocke Catchment as part of the Mangakotukutuku Integrated Catchment Management Plan (ICMP). This detailed assessment focuses on the Peacocke Structure Plan Area.

The scope of this assessment includes

- Preliminary stability assessment of gully and riverbanks within the project area using the ground model developed in the previous assessment and slope geometry obtained from the HCC LiDAR terrain model. Stability assessment was undertaken to obtain setback distances
- Development of two setback lines as follows:
  - Primary setback line (static identified as a red line)
  - Secondary setback line (seismic identified as a green line)
- Undertake a Section 32 assessment for the proposed changes.

AECOM understands that the results of this assessment and the previous report will be considered in a future District Plan Change process for the Peacocke Structure Plan Area.

#### 2.0 Background

This package of work was undertaken because of the outcomes determined in the previous report by AECOM titled 'Mangakotukutuku ICMP Gully Hazard Setback Assessment' to which this report is an

Assessment carried out for the previous report consisted of a high-level assessment of the stability of gully and riverbanks within the area under multiple cases including static, seismic, and elevated groundwater.

#### 3.0 Setback definition

The two setback lines have been developed with the intention that they would be used as a guide to trigger additional investigations and analysis, and not as a strict no-build zone.

The setback lines are intended to guide development to be undertaken in a manner that would consider the potential risks surrounding slope stability.

Final definitions and District Plan rules will be developed by HCC with assistance from AECOM in a technical capacity. This section outlines a broad technical definition of the two lines as they relate to the assessment methodology.

#### 3.1 **Primary Setback Line**

The Primary Setback Line is proposed to be the minimum development setback distance to prevent the gully system being damaged from land development activities.

The Primary Setback Line may also prevent property and assets being located within a potential (nonearthquake) slip hazard areas without further geotechnical consideration. Though development being undertaken within this area would not be desirable, if a developer can prove that the dwelling is able to withstand the predicted slope movement and that the stability of the gully slope is not lowered because of the development, then the objective of the primary setback line has been fulfilled.

#### 3.2 Secondary Setback Line

The Secondary Setback line is proposed to indicate where a development is required to be designed to accommodate potential lateral land movement because of an ultimate limit state (ULS) seismic event.

Revision C - 02-Oct-2020 Prepared for - Hamilton City Council - Co No.: N/A



AECOM

Mangakotukutuku ICMP Addendum Report – Stage 2 - Setback Assessment 2

Development inside the Secondary Setback Line would require analysis to be undertaken based on specific and up to date site investigation data. The secondary setback requirement may be able to be by-passed if the analysis can prove that the site is not at risk of damaging lateral movements.

If the developer is unable to provide specific assessment for the site, then NZS 3604 type foundations cannot be approved within the secondary setback line.

In defining rules, and undertaking consultation, consideration will need to be made as to whether specific building foundation design can mitigate building risk with associated land instability being an accepted risk. AECOM have not provided an opinion in this regard because wide ranging non-technical related aspects need to be considered (e.g. loss of developable land, insurance implications etc.).

AECOM also understands that HCC wish to retain the existing Gully Hazard Zone (GHZ) of 6 m from the crest of the gully slope for purposes outside of the scope of this report. Therefore, the setback lines defined within this report will remain separate entities from the GHZ.

## 4.0 Assessment methodology

#### 4.1 General

The methodology for this assessment has been agreed upon by AECOM and HCC to cover a large area with a comparatively limited amount of site investigation data. Therefore, the setback lines are presented as guidance and do not preclude detailed site investigation.

Site investigation information was obtained through the New Zealand Geological Database, reports provided by HCC, and previous site investigation information held on file at AECOM.

Inferences between ground investigation locations were made in areas where site investigation had not been undertaken or information was not available.

#### 4.2 Ground Model

Because of the inherent variability observed within the Hinuera Formation (interbedded sand and silt) and the underlying Puketoka Formation, a conservative set of soil parameters was required. This has resulted in setback distances that are larger than what may be produced from a detailed analysis undertaken with site specific soil data. It is intended that the setback lines will trigger the need for such a detailed site assessment which should include site specific investigations and analysis.

Table 1 lists the soil properties that were used in the assessments.

Table 1 Soil Properties used for the slope stability analysis

Geological Unit	S <sub>u</sub> (kPa)	γ (kN/m²)	c' (kN/m²)	φ' (degrees)
Hinuera Formation	50	17	2	30
Taupo Pumice Alluvium/ Melville Pumice Member	-	16	0	30
Case Hardened TPA	-	16	5	35
Hamilton Ash Formation	100	16	5	28
Puketoka Formation Alluvium	-	17	0	30
Puketoka Formation Completely Weathered Ignimbrite	50	16	4	30
Case Hardened Puketoka WI	50	60	10	50
Fill (placed in old sand quarry)	-	15	0	28

Revision C - 02-Oct-2020

Prepared for – Hamilton City Council – Co No.: N/A



AECOM Mangakotukutuku ICMP
Addendum Report – Stage 2 - Setback Assessment

3

The cross sections used within the assessment were chosen at regular points along the stream chainage of each branch of the gully system. The cross sections attempt to capture the changes in the bank morphology throughout the gully system.

The ground model for each cross section was developed by studying all nearby ground investigation data. Because this data is not uniformly spread across the catchment, there will be numerous cross sections that have had the ground model inferred from other cross sections nearby where ground investigation data was available.

The seismic case was modelled under ULS (ultimate limit state) conditions using the parameters listed in Section 8.4.4 in the 'Mangakotukutuku ICMP Hydrogeology and Geotechnical Stage 2 - Gully Hazard Assessment' report dated 10 May 2019.

#### 4.2.1 Groundwater

Groundwater levels used within the analysis were taken from the nearby site investigation data. There is not enough investigation data to give a comprehensive and full understanding of groundwater levels over the catchment.

Due to the variability of geological materials and topography we feel that estimating groundwater levels should be kept to a minimum and site-specific investigations should be used to obtain groundwater data.

#### 4.3 Mapping of setback lines

Ground surface topography was obtained from HCC. The 2008 Digital Elevation Model (DEM) generated from LIDAR data was used for this assessment. LIDAR data used was at a 1 m resolution and corrected for vegetation.

Sections were cut through the DEM to obtain the geographic information needed to draw a section in Slide (v2018; 8.010). The calculation method used for each section is GLE / Morgenstern-Price.

Static and seismic (ULS) cases were modelled and the distances of the farthest slip circle was measured from both the gully shoulder and end of the section. These were plotted in ArcMap and setback lines created from joining the space between each section. The Factor of Safety at each setback line is:

- Primary (static) case 1.5 FoS
- Secondary (seismic) case 1.2 FoS

Setback lines were reverted to the existing HCC 6 m gully hazard setback line in areas where slope stability results from this assessment was deemed to pose no risk.

Mapping outputs detailing the project extent, setback lines, cross section locations, ground investigation locations, and local geological maps are presented in Appendix A. The existing HCC 6 m gully setback line is presented for comparison with the proposed setback lines.

#### 4.4 Stormwater soakage considerations

The slope stability scenarios have been assessed based on anticipated normal groundwater conditions. Stormwater disposal by soakage could result in an increased risk of instability. Soakage stability scenarios were considered in Stage 1 but have not been considered in this assessment due to the practicality of assessing multiple scenarios at each cross-section location.

Based on existing available information and the assessment carried out to date the following is noted regarding stormwater soakage:

Stormwater disposal by soakage can be reasonably excluded from within the Primary Setback.

HCC could elect to make soakage acceptable with detailed site-specific investigation and design. However, precluding soakage does not represent a large area given the relative scale of the Primary Setback compared to the original 6 m setback.

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4

Stormwater disposal by soakage within the Secondary Setback could worsen the risk of instability
but is of negligible additional risk in comparison to the design seismic event. Soakage does not
need to be excluded from this area but if it is proposed it should be incorporated into any specific
seismic assessment and design that is undertaken.

## 5.0 Section 32 information

This section presents information to inform the Section 32 process.

# 1 – Does the Primary setback Line being pushed farther out than the existing 6 m line mean a higher cost for development?

No - a property adjacent to a gully or riverbank would normally have an assessment undertaken anyway. The proposed setback line provides a better indication of the potential risk.

#### 2 - Does the Secondary setback line trigger more cost?

The Secondary (seismic) Setback Line has the potential to incur more cost. In some areas the distance of the secondary stability line from the gully crest will mean additional stability assessment would be triggered for development. Assessment is likely to include the following additional works and associated costs:

Table 2 Potential additional items required

Item	Estimated Cost*
Bank survey	\$2,500
Deep soil investigations i.e. CPT testing or borehole	\$1,500 per CPT or \$7,000 per 25 m borehole
Stability analysis and reporting	\$2,000 to >\$5,000

<sup>\*</sup>Estimated costs will vary depending on investigation quantities and depths. Contractor availability and travel from other cities will have a direct effect on estimated prices. Costs associated to consenting are likely to be involved which have not been taken into consideration.

#### 3 - Do the proposed setback lines result in a change in the developable land area?

No - if the analysis can prove that slope stability is not an issue or can be mitigated through specific engineering then there would no loss in developable land. Development can therefore still proceed within the bounds of the setback lines as long as it is back up by evidence it will not be impacted by or negatively impact slope stability of the gully.

Conversely, loss of land would only be the result of slope stability being too expensive to mitigate through engineering design and solutions. This assessment does not consider the cost of seismic engineered solutions on the basis that they would have been identified and undertaken anyway.

Note that the amount of developable area should remain the same. It is the intention of this report that development being undertaken within the areas that may pose an increased risk to property and assets is backed up by site specific engineering.

#### 4 - What is the chief benefit?

- Increased hazard awareness regarding the potential risk of slope stability around the gully and
  river banks. Better protection of both public land areas with natural value (e.g. the gully system
  amenity) and private property.
- Additional foresight to design houses to be able to accommodate lateral land movements associated with large seismic events.

Changes to insurance, property value, and LIMs because of the outcomes of this report have not been included within the Section 32 assessment and are specifically excluded from the scope of this report as advice is being sought from the legal team at HCC.

Refer to Appendix B for tables that present further information regarding Section 32 requirements of the Resource Management Act. The Appendix tables have been populated in association with HCC using information from this report and HCC planning input.

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Limitations 6.0

#### 6.1 **General limitations**

- AECOM has prepared this report and/or the setback lines in accordance with the usual care and thoroughness of the consulting profession for the use of Hamilton City Council and only those third parties who have been authorised in writing by AECOM to rely on the report.
- It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the variation dated 5 June 2019.
- This report was prepared between 5 June 2019 and 25 July 2019 and is based on the information available and reviewed at the time of preparation. The methodology adopted, and sources of information used by AECOM are outlined in this report.
- Where this report indicates that information has been provided to AECOM by HCC and/or third parties (including any model topography or data), AECOM has made no independent verification of this information unless required as part of the agreed scope of work. AECOM assumes no liability for any inaccuracies in or omissions to that information.
- To the extent permitted by law, AECOM expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this report and/or the setback lines. AECOM does not admit that any action, liability or claim may exist or be available to any third party.
- Except as specifically stated in this section, AECOM does not authorise the use of this report and/or the setback lines by any third party. The report was commissioned by HCC solely for its own purposes and is in a form intended for use only by HCC for its own purposes and is not intended to be used or relied on by third parties.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice.

#### 6.2 Qualifications

The assessment undertaken to define the setback lines is interpretative based on a desktop assessment and preliminary assessment using readily available information. The following shall be

- The required setback extent may differ from the setback line presented in this report. Setback requirements could be closer or further away from the gully top of bank where actual ground conditions differ from those used in this assessment.
- This assessment provides a reasonable estimate of the required setback for the two design scenarios in the context of the input data and the concept design undertaken. The modelled setback does not necessarily reflect the greatest extent of setback required to protect against slope instability or earthquake effects that may be suffered in the future.
- The assessment outlined in this report is for general information purposes only and is intended to provide Hamilton City Council with information that may be used to assist with HCC in deciding how to communicate and present this information to the public, and how to present district plan rules regarding implementation and assessment for development. The acceptance or use of these categories and boundaries for any purpose is the decision of the HCC, not AECOM.
- It is recommended that public consultation is undertaken prior to deciding how to utilise this information. The level of risk that both HCC and landowners are prepared to accept may affect the way in which the setback data is used.

Revision C - 02-Oct-2020

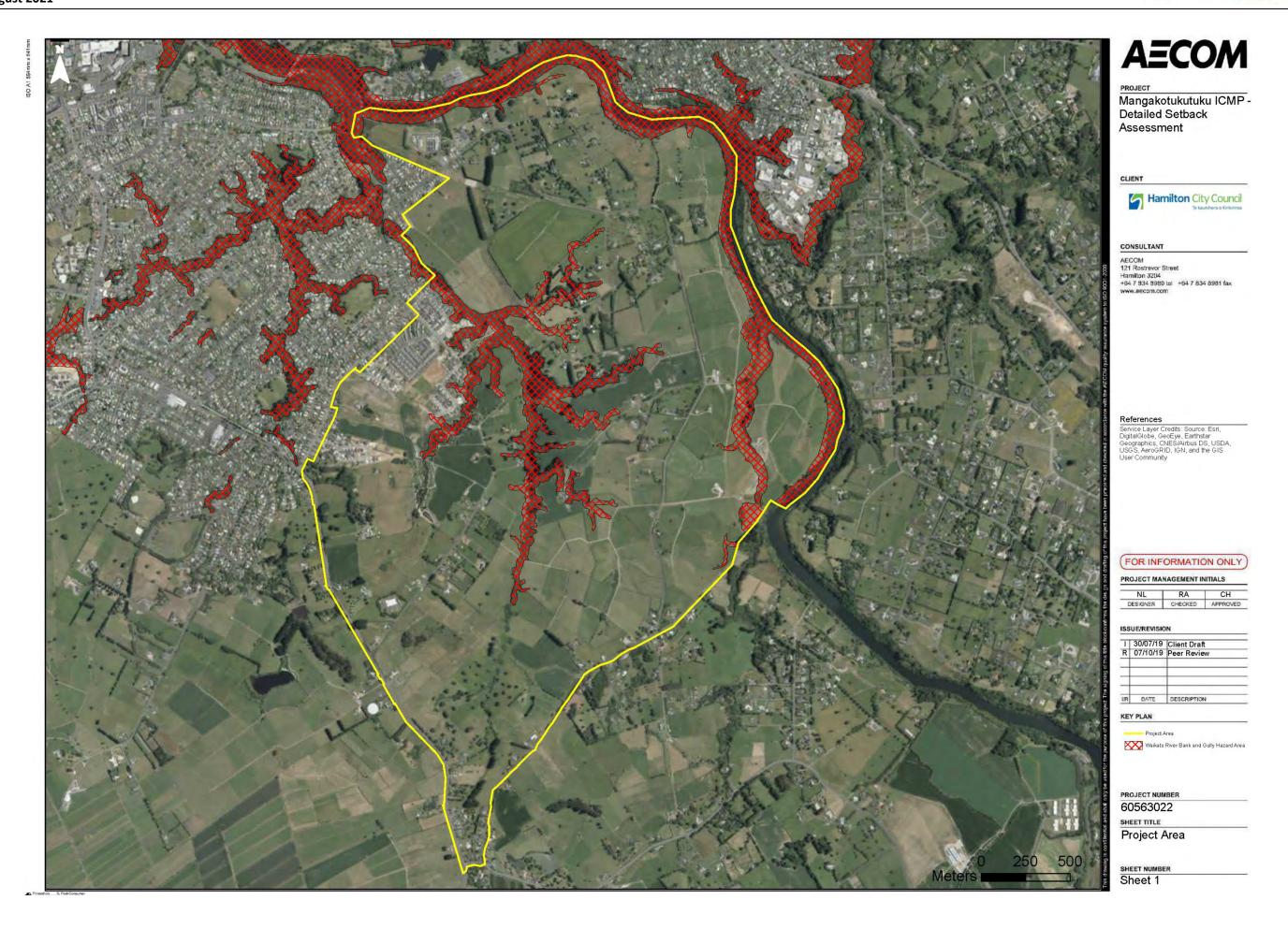
Prepared for - Hamilton City Council - Co No.: N/A



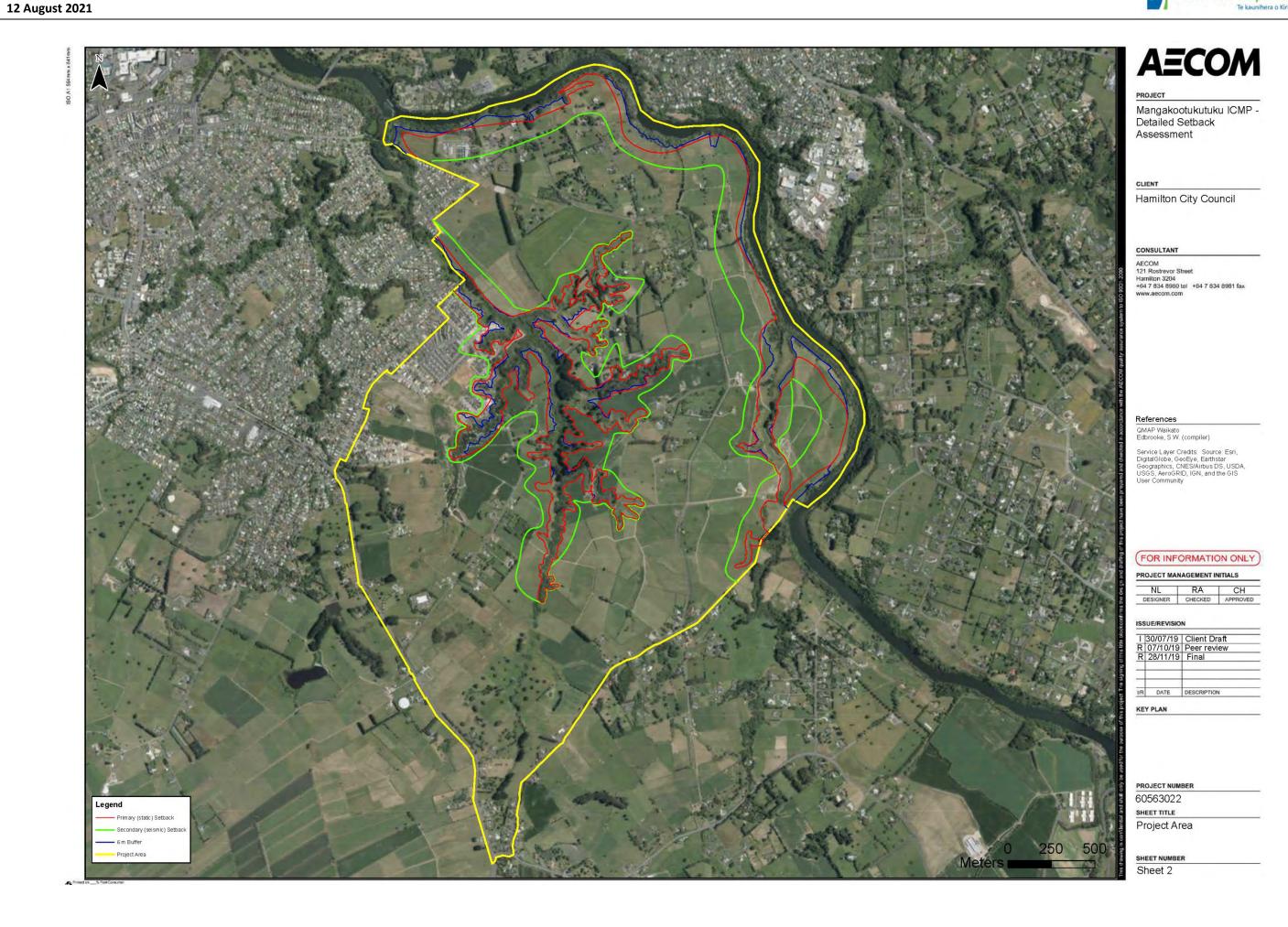
# Appendix A

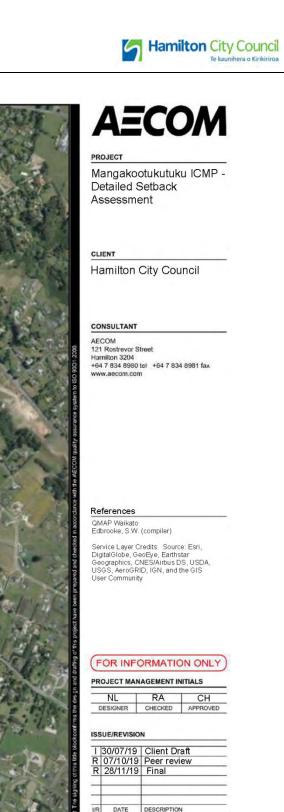
Mapping



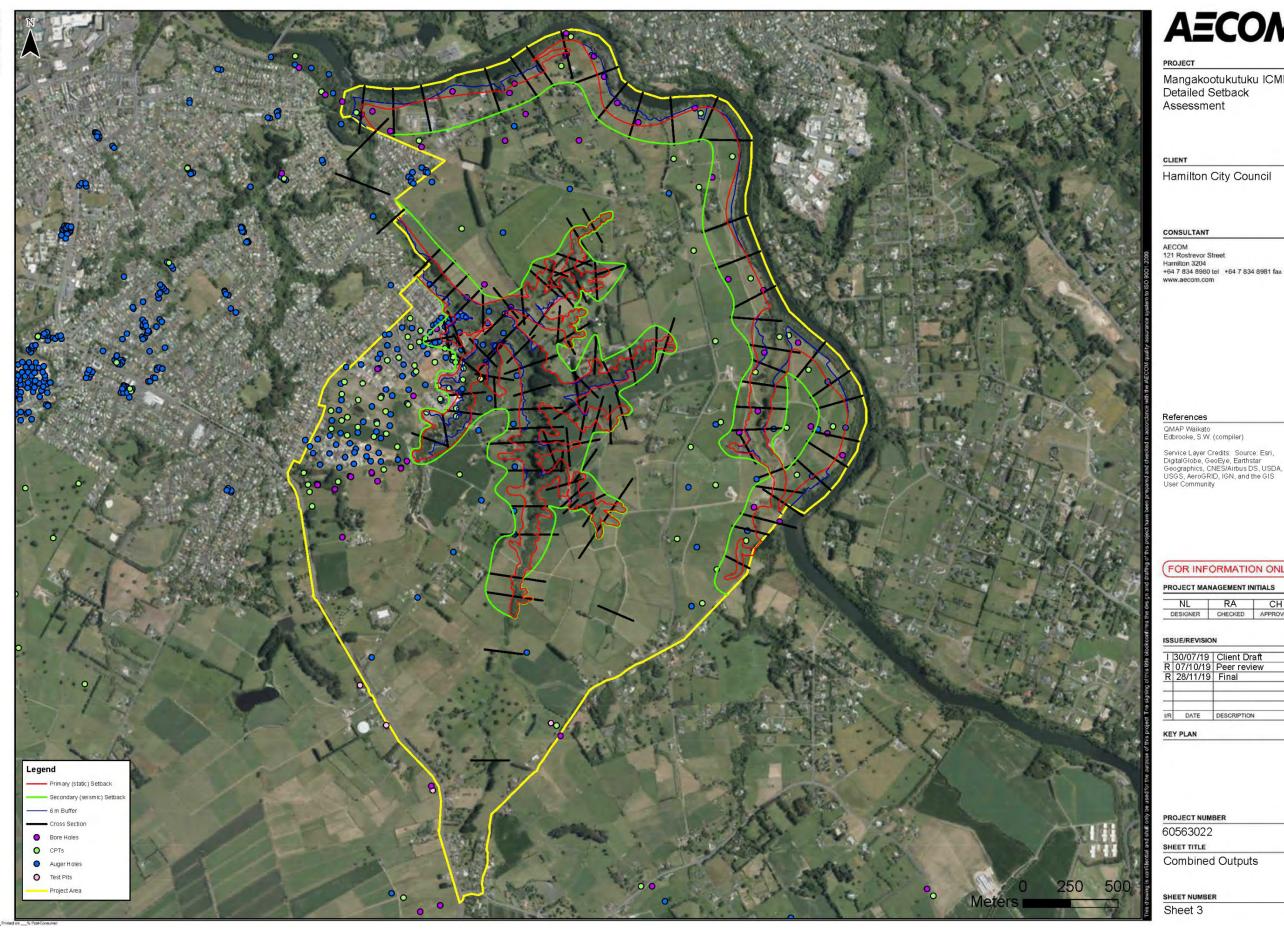




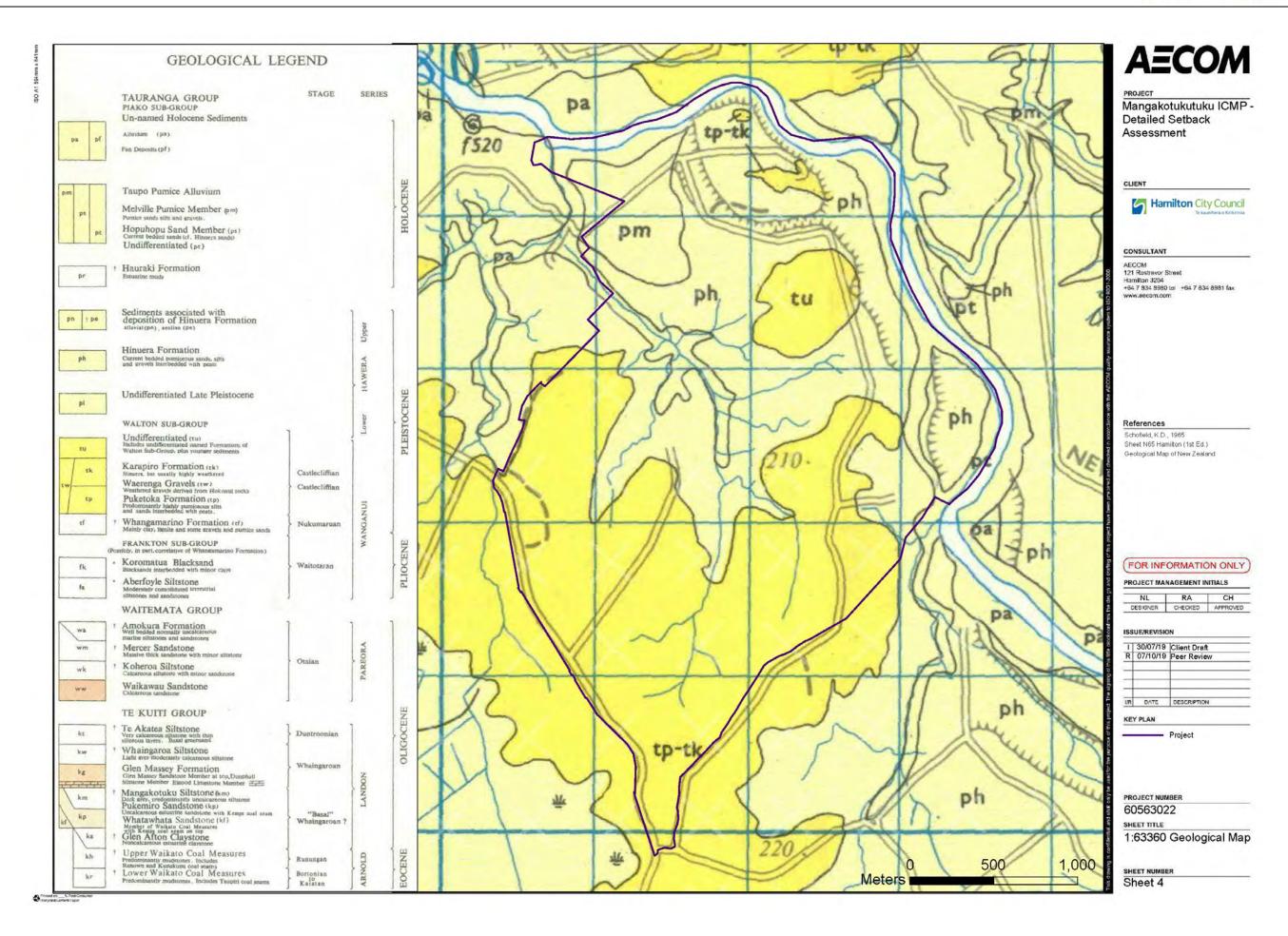




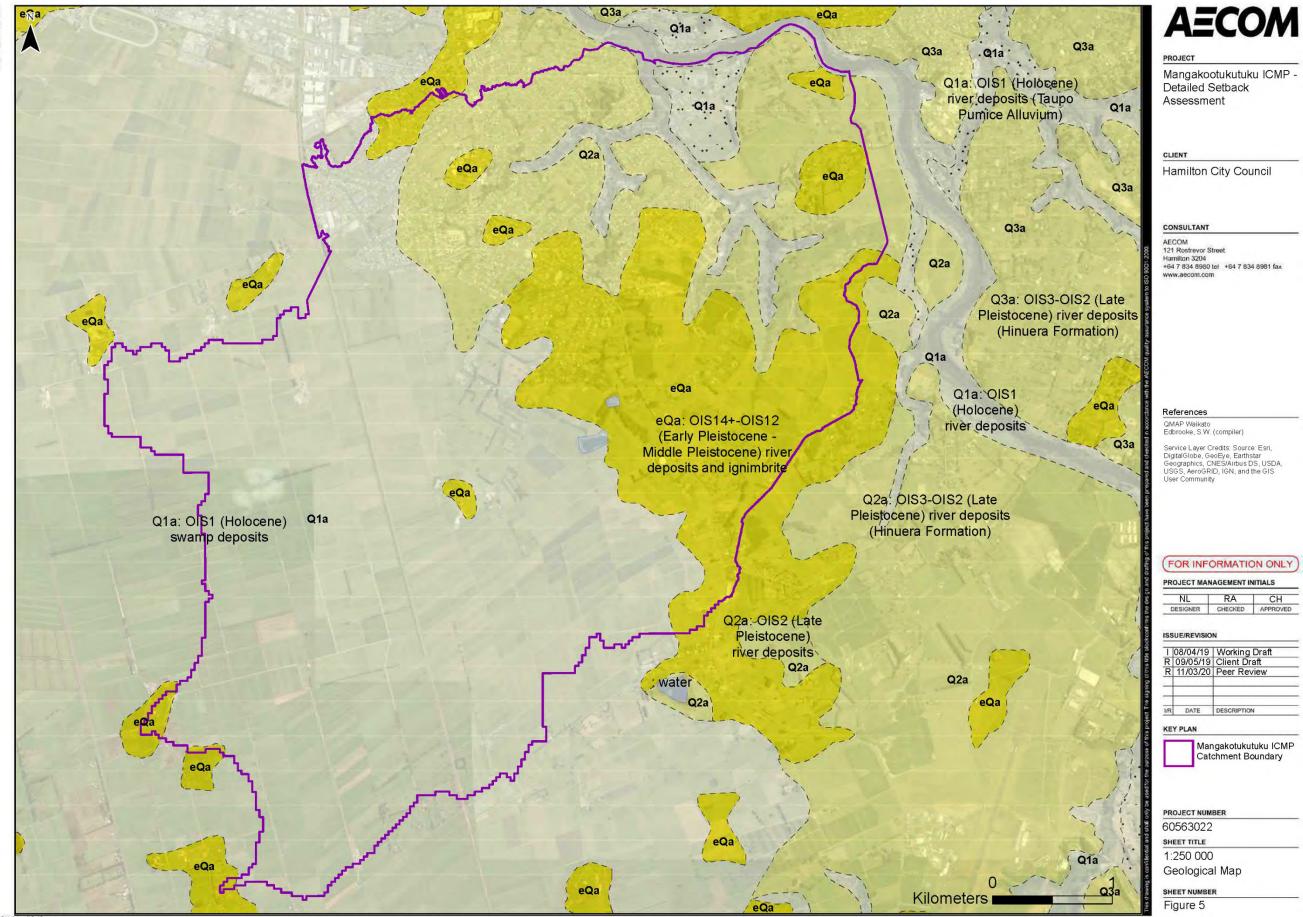
T	30/07/19	Client Draft
		Peer review
R	28/11/19	Final
_		
I/R	DATE	DESCRIPTION







Hamilton City Council





# Appendix B

Section 32 tables

12 August 2021



# Mangakotukutuku Geotech Report in Support of Plan Change

Issue	- The current 6 m build District Plan) is limite	d and does not consider di		ogy.	(Rule 16.4.4 of the Operative
Objectives	Objective 4.2.3 – Residenti Objective 4.2.4 – The deve Objective 4.2.9 – Buildings development anticipated in Objective 21.2.1 – The aco Objective 21.2.4 – The hea Objective 22.2.1 – Managi from natural hazards, in or response and recovery fror Objective 23.2.1 – To ensu Objective 23.2.5 – Subdivis Objective 25.1.2.2 – Any d	and activities at the interfanthe adjacent zone.  Ilogical, amenity, landscape  Ilth and wellbeing of the Wang activities to avoid or mit  Inder to increase community  In natural hazard events.  In that risk to people, the estion occurs in a manner tha	good on-site amenity, and neighbourhood amenity as one of Residential Zones with and cultural values of the rivalikato River and gully system igate adverse effects on, and resilience, reduce the risks invironment and property is a trecognises historic heritage and out in a manner which refered out in a manner which which was a manner which which which was a manner		
<b>Options</b> Approach to achieve objectives	Description (brief) Describe the option and acknowledge the source of this option (if there is one e.g. feedback from consultation, suggestions from	Relevance How effective provisions are in achieving the objective(s)	Feasibility Within council's powers, responsibilities and resources, degree of risk and uncertainty of achieving objectives, ability to implement, monitor and enforce	Acceptability Level of equity and fair distribution of impacts, level of community acceptance Where possible identify at a broad level social,	Recommendation Discard or evaluate further (with brief explanation) [REJECT/SUPPORT]

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Attachment 25

	workshops with elected members etc)			economic, environmental, cultural effects	
Option 1 – Do Nothing	Retain the existing 6 m building setback from the gully hazard zone.	The existing regulation covers the entirety of the gully and river bank area although differing geological conditions and seismic cases are not considered.	The existing setback does not require any additional resources to monitor, implement or enforce.	There may be a low level of political acceptance to this option as it will miss the opportunity to improve the effectiveness and efficiency of the Plan and lower development risk.	Discard Leaving the option for residential development to occur within an area of an increased hazard risk is not best practice.
Option 2 – Amend the ODP to include an increased development setback from the gully hazard zone.	Revised slope stability setback line (Primary Hazard Line) based on a broad assessment of slope and soil types in the Peacocke Structure Plan area. AECOM NZ Ltd. Geotechnical Investigation and Detailed Setback Assessment, July 2019	This option would address the risk of slope instability associated with development in the greenfield area with more certainty than the current 6m setback line.	It will not require any additional resources to monitor, implement or enforce the provision.  Building consent assessments would rely on engineering assessment and advice as per usual practise.	There will be a degree of acceptance to this change at a political level as it will improve the awareness of the potential risk to stability within the catchment and minimise the risk of development adversely affecting the gully landform.  There may be a low level of acceptance from developers and current land owners regarding the potential loss of developable land if the new line is adopted as a hard restriction.  There could be uncertainty over	Support This option encourages development to account for the potential risks present with building in proximity to gully and river banks and maintains a reasonable separation in line with non-building objectives.





## **Evaluation of Rules**

#### Appendix 5.3 Evaluation of Rules (section 32(2))

#### Chapter 4 - Residential Zones

This section assists to identify the provisions (i.e. policies, rules and methods) that are the most appropriate to achieve the objectives related to the Residential Zones.

The specific provisions subject to this Plan Change	Effectiveness	and Efficiency	
which are most appropriate to provide clear direction to achieving the Residential Zone are as follows:	Relevant objectives:  Objective 4.2.2 – Efficient use of land and infrastructure.  Objective 4.2.3 – Residential development produces good on-site amenity.  Objective 4.2.4 – The development contributes to good neighbourhood amenity as the area matures.  Objective 4.2.9 – Buildings and activities at the interface of Residential Zones with other zones will be compatible with the form and type of development anticipated in the adjacent zone.  Objective 21.2.1 – The ecological, amenity, landscape and cultural values of the river corridor and gully system are restored and protected.  Objective 21.2.4 – The health and wellbeing of the Waikato River and gully systems shall be restored and protected.  Objective 22.2.1 – Managing activities to avoid or mitigate adverse effects on, and minimise risk to: people, property, and the environment from natural hazards, in order to increase community resilience, reduce the risks from natural hazards, and support effective and efficient response and recovery from natural hazard events.  Objective 23.2.1 – To ensure that risk to people, the environment and property is not exacerbated by subdivision.  Objective 23.2.5 – Subdivision occurs in a manner that recognises historic heritage and natural environments.  Objective 25.1.2.2(a) – Any development of land is carried out in a manner which reflects the physical constraints		
	on its use and development and minimises any adverse Benefits	Costs	
Rule 16.4.4 – Building Setbacks	Environmental:	Environmental:	
	More scrutiny regarding the allowable proximity of development to gullies and river banks will protect these natural assets from potential adverse effects of residential development.	None identified.	



	Increased development setback including limiting stormwater disposal by soakage will lower the likelihood of erosion and instability of gully and river banks.  The unmodified gully zone will be extended which has other consequential benefits (e.g. visual, public access, ecological)	
	Economic: Lower repair costs due to increased foundation resilience to slope instability.  Potentially less EQC claims and lower insurance costs where risks have been demonstrably reduced (CONFIRM BY INSURANCE ADVICE).	Economic: Increased time and costs associated with preparing and processing resource consents.  Increased costs for assessing the site's suitability for development (seismic). Increased design and construction costs for dwellings within seismic setback zone.  Potential increased insurance costs due to an identified risk not previously differentiated (CONFIRM BY INSURANCE ADVICE).  Possible adverse effects on existing homes that are located within the proposed setback zones.
	Social: Increased access to gully amenity, larger open areas.	Social: Variability in setback distance could create confusion with District Plan interpretation.
	Cultural: None identified.	Cultural: None identified.
Opportunities for economic growth and of These provisions will not compromise econoptions less or not as appropriate to ach	employment nomic growth and employment opportunities.	Trene institution.

Page 1767



Refer to options assessment. Doing nothing or retaining the existing provisions will potentially leave future developments exposed to increased risk.

#### Risk of acting or not acting

There is some risk involved with not acting. The existing provisions are adequately meeting the objectives of the Plan but do not address the potential for regression of gully and river banks and instability due to seismic events.

The risks of acting are:

- There may be increased costs incurred on developers from potentially more detailed site investigations and assessment (seismic).
- There may be increased costs incurred on developers and/or private landowners for foundation design and construction costs for properties further back from the gully and river banks but within the seismic setback zone (more-so than the current 6 m setback).
- Inconsistencies of setback distance may create confusion with ODP interpretation.

#### **Effectiveness and Efficiency**

#### Effectiveness

- The assessment used to determine the setback lines was undertaken using conservative soil parameters; this is conservative regarding potential risks. At risk areas can be more confidently considered to be included within the setback zones.
- The proposed setback lines provide more confidence that dwellings within the seismic setback zone will have foundations that are designed to be able to accommodate some lateral spreading and are otherwise not located within areas at risk of general slope instability in the near term.
- The proposed static setback takes the differing geological units into account so does not place restrictions where they are not necessary, as far as is practical without undertaking detailed site-specific investigations.
- Provisions will be put into place to protect gully and river bank slopes from oversaturation caused by ground soakage devices installed near slope crests. This has been shown to increase the likelihood of bank erosion and loss of property.
- The proposed solution provides a two-line system so that development is restricted near slopes where the potential frequency of instability is higher. Less frequent seismic risk areas are identified but may be mitigated through assessment and design so that developable land is not reduced by HCC and the assessment of economic viability remains with developers (provided that potential landowners are made aware of potential development costs prior to land purchase).

The proposed provisions will be efficient in achieving the relevant objectives as it identifies potential risks to development, and results in a greater assessment and design standard for areas at risk from erosion within the catchment.

There could be an impact on efficiency for developers who will need to prove that they have adequately assessed the site conditions including topography, soil profile, and post development stability (along with the existing provisions in place protecting the gully and river corridor as a natural resource) as part of the resource and building consent processes.

The development of new district plan rules will need to carefully consider the responsibilities of developers so that land within the seismic zone (Secondary Setback Line) cannot be approved for development without either;

• Broad scale mitigations having been carried out by the developer prior to sale of the land (at subdivision consent), and/or

Attachments



• Adequate disclosure of information, prior to purchase, for private persons who will be responsible for building on the site and any further mitigations required (at building consent).

#### **Draft Provisions**

What we're proposing to put into the plan.

#### General slope stability (Primary Setback Line)

- Restricted development area (i.e. no development permitted)
- Stormwater soakage devices not permitted

#### Seismic stability (Secondary Setback Line)

- Identified risk area, no defined restriction
- Development subject to site specific investigation, assessment and design
- Defined responsibilities for land developers (subdivision consent) and individual owners (building consent) TO BE CONSIDERED AND DISCUSSED

em 12



# **APPENDIX Z**



Watercourse Assessment Report

# Mangakōtukutuku Catchment

Final V4

Prepared for Hamilton City Council by Morphum Environmental Ltd



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**Hamilton** City Council



## Document Control

Client Name: Hamilton City Council

Project Name: Mangakōtukutuku Watercourse Assessment Report

Project Number: P01235

Document: Mangakōtukutuku Catchment Watercourse Assessment Report

## Revision History

Status	Date Issued	Author	Reviewed By	Released By
Draft	20/09/2017	E. Reeves, A. Rieger, K. Fredrick, H. Klein	R. Ingley	D. Young
Final V1	29/05/2018	E. Reeves, A. Rieger, K. Fredrick, H. Klein	R. Ingley	D. Young
Final V2	24/01/2019	R. Yeates, K. Parmar & S. McArthur	G. Lees, O. Ferrick	D. Young
Final V3	18/12/2019	J. McCord & R. Yeates	G. Lees	D. Young
Final V4	29/05/2020	J. McCord & R. Yeates	O. Ferrick	D. Young

## Reviewed by:

Reviewer: Oliver Ferrick Signature:

Released by:

Reviewer: Damian Young Signature:

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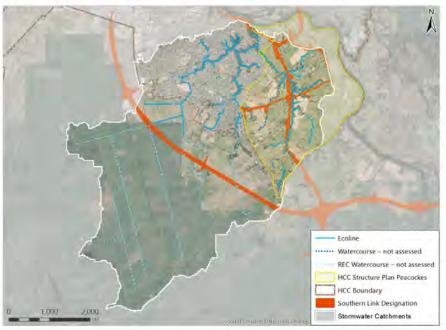
Final V4

# **Executive Summary**

The purpose of the watercourse assessment and this report is to inform the Mangakötukutuku integrated catchment management plan (ICMP), provide baseline data to consultants working in the catchment, support management of the watercourse and stormwater conveyance, and inform best practice Greenfield development in Peacocke sub-catchment. The report summarises the data collected, concept projects and management recommendations within the catchment.

The total length of open watercourse assessed is approximately 26 km. the field assessment was carried out between April 2017 – June 2017. The methodology followed in the Mangakötukutuku watercourse assessment is the ICMP Receiving Environment Module developed by Morphum (Hamilton City Council [HCC], 2015). All interpretation of data should be used in conjunction with this document.

The Mangakōtukutuku catchment is approximately 2,677 ha and is located south of the Hamilton city centre. It is bound to the north and east by Peacocke catchment. Half of the hydrological catchment is within the Hamilton City Council (HCC) boundary. Mangakōtukutuku stream drains towards the north, with a single discharge point to the Waikato River downstream of Peacockes Road. An overview of the catchment is provided in the map below which identifies the extent of watercourse that was assessed. The farm drainage network, beyond the Hamilton City boundary, was not assessed and the NIWA River Environment Classification (REC) layer was used to identify the watercourse location.



Mangakōtukutuku catchment overview

#### Management zones

Future urban growth is proposed in the eastern sub-catchment of the Mangakōtukutuku which is currently rural land use. The Peacocke Structure Plan, as per the Partly Operative District Plan (PODP) at the time of writing this report, will rezone the rural area to residential with an indicative future reserve area focused around the gully and designated transport corridors. Furthermore, the designation of the New Zealand

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Attachments Page 1771

Attachment 26

i



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Transport Authority (NZTA) Southern Links roading project in the eastern sub-catchment means that the Mangakōtukutuku catchment will experience a substantial change in land use over the next few decades. The new set of highways and linkage roads will help provide better access to support the planned growth in the catchment and link up several state highways.

The pressures and impacts of growth on the eastern Peacocke sub-catchment are of particular importance with the changing landuse where there is opportunity and consenting requirements to enhance part of the stormwater network. The main pressures and impacts identified in the eastern sub-catchment as a result of recent and proposed Greenfield development include:

- Change in land use and the associated contaminants of concern;
- Increased imperviousness and associated changes in hydrograph and impacts on watercourses, including increased potential for channel erosion and reduced base flows;
- Further potential barriers to fish passage with the development of more roads and associated culvert structures; and,
- Loss of riparian connectivity through the main gully channel.

Many of the existing reports prepared to support the development of the eastern catchment (including the Peacocke Structure Plan as per the PODP at the time of writing of this report) propose similar and overlapping recommendations. At a high level, these include:

- Protection and enhancement of ecological values including the protection of existing open watercourse, and planting of riparian corridors within the gully; and,
- Stormwater management including, at source, to manage effects on the receiving environment, to mitigate and regulate baseflows, and to maintain ecological and biodiversity values.

For the western and central sub-catchments some of the existing common pressures and impacts result from historical and existing land use including:

- Loss of riparian margin vegetation;
- Stock access to waterways;
- Contaminants entering waterways; and,
- Barriers to fish passage.

#### **Erosion mitigation projects**

The erosion mitigation projects areas identified in this watercourse assessment report are currently of concern, as well as areas within the Brownfields which may experience increased erosion in the future and provide remediation options to address localised issues. The 15 current erosion mitigation projects and 16 future erosion mitigation projects have been developed at a high level and consist of remediation types including; grade control, erosion planting and toe protection. The majority of the current projects are located along the main channels of the central and western Mangakōtukutuku sub-catchments. These subject reaches were identified as the most prone to erosion during the watercourse assessment, with several reaches showing high erosion scarring, and unstable undercut banks. These reaches currently receive flows from the stormwater network via several outlet structures and overland flow, with inputs and flows expected to increase with development in the area. It is recommended that erosion mitigation projects in these areas be prioritised.

Current erosion mitigation projects (EMP\_1 to EMP\_15) are largely based in the Brownfield development areas, with the exception of projects EMP\_10 and EMP\_11, which are located in Greenfield development areas in the eastern sub-catchment. The future erosion mitigation projects (EMP1\_16 to EMP\_31) are located in the Greenfields development areas in the eastern Mangakōtukutuku sub-catchment.

The total estimated costs including contingency of the physical works for the proposed erosion mitigation projects is approximately \$12,532,000. It should be noted that the unit costs used to calculate these values

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ii



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Final V4

represent high-level estimates only. To define the specifics of downstream impacts, including costs and methods, will require further investigation into the stormwater management in the catchment and be informed by ongoing monitoring of these erosion sensitive reaches. It is therefore recommended that identification of watercourse works and pricing is undertaken as part of the ICMP.

These erosion mitigation projects and their high-level costs is summarised in the table below and expanded on in section 5.2 of this report. Refer to Appendix 1, Map 5 for the location of these sites.

	Summary of erosion mitigation projects in the Mangakōtukutuku ca	atchment
Project ID	Proposed erosion mitigation works	Total including 20% Contingency
EMP_01	<ul> <li>Provide toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Replacement of weeds (tradescantia and Japanese walnut) with natives and consideration of staged willow removal</li> </ul>	\$ 1,088,000
EMP_02	Keystone boulders to provide toe protection	\$ 156,000
EMP_03	<ul> <li>Provide toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Replacement of weeds such as willows, tradescantia and Japanese walnut with natives</li> </ul>	\$ 581,000
EMP_04	<ul> <li>Provide toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Replacement of weeds such as willows, tradescantia and Japanese walnut with natives</li> <li>Mitigate fish barrier to climbing species at culvert outlet beneath path crossing MGk_C_Trib1_2 by installing a fish ladder or spat rope.</li> </ul>	\$ 1,037,000
EMP_05	<ul> <li>Increased channel heterogeneity of cobbles and rocks to support fish habitat</li> <li>Significant weeding and replanting with natives</li> <li>Naturalisation/removal of the lined channel along MGK_W_Trib5_7</li> </ul>	\$ 632,000
EMP_06	<ul> <li>Weeding and planting of natives 5m either side of reach to support the regraded banks</li> </ul>	\$ 77,000
EMP_07	<ul> <li>Toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Planting of native understory along regraded banks</li> </ul>	\$ 356,000
EMP_08	<ul><li>Toe protection to banks</li><li>Regrading of banks</li><li>Planting of native understory along regraded banks</li></ul>	\$ 341,000
EMP_09	<ul><li>Newbury Rock riffle</li><li>Keystone boulders</li><li>Grade control</li></ul>	\$ 166,000
EMP_10	<ul> <li>Weeding and planting of native understory along regraded banks</li> </ul>	\$ 84,000

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iii



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Final V4

EMP_11	<ul> <li>Toe protection along channel</li> <li>Weeding and planting of natives 5m either side of reach to support the regraded banks</li> </ul>	\$ 438,000
EMP_12	<ul> <li>Bank batter to regrade banks to a 3:1 slope</li> <li>Erosion planting</li> <li>Retaining</li> <li>Toe protection</li> </ul>	\$ 164,000
EMP_13	<ul><li>Bank batter</li><li>Erosion planting</li><li>Toe protection</li></ul>	\$ 883,000
EMP_14	<ul><li>Bank batter</li><li>Erosion planting</li><li>Toe protection</li></ul>	\$ 868,000
EMP_15	<ul><li>Bank batter</li><li>Erosion planting</li></ul>	\$ 26,000
SubTotal		\$ 6,897,000
EMP_16	<ul> <li>Erosion planting</li> <li>Bank regrading</li> <li>Toe protection</li> <li>Grade control structures</li> </ul>	\$1,164,000
EMP_17	<ul><li>Bank batter</li><li>Toe protection</li><li>Grade control structures</li></ul>	\$259,000
EMP_18	<ul> <li>Erosion planting</li> <li>Bank regrading</li> <li>Toe protection</li> <li>Grade control structures</li> </ul>	\$514,000
EMP_19	Erosion planting	\$116,000
EMP_20	<ul><li>Erosion Planting</li><li>Bank batter</li><li>Grade control</li></ul>	\$191,000
EMP_21	<ul><li>Bank batter</li><li>Toe protection</li></ul>	\$192,000
EMP_22	<ul><li>Erosion planting</li><li>Bank batter</li></ul>	\$289,000
EMP_23	<ul><li>Erosion planting</li><li>Bank Batter</li><li>Toe protection</li></ul>	\$215,000
EMP_24	<ul><li>Bank batter</li><li>Toe protection</li></ul>	\$534,000
EMP_25	<ul><li>Erosion planting</li><li>Bank batter</li><li>Toe protection</li></ul>	\$397,000
EMP_26	<ul><li>Erosion planting</li><li>Bank batter</li></ul>	\$151,000
EMP_27	<ul><li>Bank batter</li><li>Toe protection</li></ul>	\$617,000
EMP_28	Erosion planting     Bank batter	\$653,000

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iv



iku Catchment Watercourse Assessment Report imilton City Council	Final V4
Toe protection	
<ul><li>Erosion planting</li><li>Bank batter</li></ul>	\$145,000
<ul><li>Erosion planting</li><li>Bank batter</li><li>Toe protection</li></ul>	\$106,000
<ul><li>Erosion planting</li><li>Bank batter</li><li>Toe protection</li></ul>	\$92,000
	\$ 5,635,000
	\$ 12,532,000
	Toe protection  Erosion planting Bank batter  Erosion planting Bank batter  Erosion planting Bank batter  Toe protection  Erosion planting Bank batter

#### **Enhancement opportunity projects**

A total of 19 enhancement opportunities have been proposed within the Mangakōtukutuku catchment. These projects highlight enhancement opportunities for the developer, private land owners and Council, to increase the ecological and amenity values of the watercourse, whilst enhancing flow conveyance and improving resilience against further changes to surrounding land use. The estimated cost of the enhancement projects is approximately \$ 35,282,000. The final costings presented in this report should be considered as indicative only with further refinement required at the detailed design stage. The purpose of the costs provided in this report is to indicate relative costings for the purpose of decision making. Refer to Appendix 1, Map 6 for the location and spatial extent of these proposed enhancement opportunities.

The enhancement opportunities focus primarily on enhancement planting along stream corridors. The majority of enhancement opportunities focus on ecological planting in the Eastern sub-catchment. These projects can be incorporated into the Southern Links implementation works, as part of an Ecological Monitoring and Management Plan (EMMP), as required by the conditions of the Southern Links designation. The consent condition for the designation require 11.8 hectares of restoration. A full cost estimate for projects EO17 – EO19 has not been provided due to the scale and complexity of the proposed works. These projects highlight the opportunity to naturalise ponds. It is recommended that an options assessment and landowner liaison is undertaken prior to cost estimates being undertaken.

#### **Recommendations for the ICMP**

Through the development of this Watercourse Assessment Report, the requirements for additional investigations and considerations have been identified to inform the wider ICMP. These include:

- 1. Hydrogeology investigation in the eastern Peacocke sub-catchment to understand groundwater processes of springs and seepages with objectives to maintain baseflows for ecological outcomes and inform geotechnical risk.
- 2. Further investigation into the interaction between increased volumes and the erosion risk in the eastern Peacocke sub-catchment.
- 3. Flood storage within the gully and impact on road crossings including investigating issues such as inadvertent dam failure risk under flood conditions.
- 4. Top of gully bank management including possible set back of development for geotechnical risk and management of stormwater for overland flow.

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5. Management and control of stormwater discharge within the gully including outfall erosion protection.

The Mangakōtukutuku Watercourse Assessment and this report provides Hamilton City Council with valuable knowledge and understanding of the existing state of the Mangakōtukutuku watercourse.

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vi

Attachments

Mangakōtukutuku Catchment Watercourse Assessment Report Prepared for Hamilton City Council

Final V4

# Contents

Execu	utive S	ummary	/	i
Conte	ents			vii
Table	es			
1.0	Intro	duction		1
	1.1	Overvi	ew	1
	1.2	Scope.		1
	1.3	Reach	Naming Convention	2
2.0	Catcl	nment C	Overview	3
	2.1	Catchn	nent Location and Drainage	З
	2.2	Future	Land Use	5
	2.3	Ecolog	ical Values	5
		2.3.1	Significant Natural Area	8
		2.3.2	Significant Trees	8
		2.3.3	Archaeological, Historic or Cultural Heritage Sites	9
		2.3.4	Waikato River Bank and Gully Hazard Area	9
	2.4	Comm	unity Involvement and Stewardship	11
	2.5	Gully R	Reserves Management Area	11
3.0	Meth	odology	y	12
	3.1	Receivi	ing Environment Assessment Methodology	12
	3.2	Limitat	ions	12
		3.2.1	Watercourse Classification	12
		3.2.2	Temporal Variations	13
		3.2.3	Assessment Methodology	13
4.0	Findi	ngs		14
	4.1	Reach	Descriptions	14
		4.1.1	Mangakōtukutuku Main	17
		4.1.2	Central Sub-catchment	18
		4.1.3	Western Sub-catchment	24
		4.1.4	Eastern Sub-catchment	29
	4.2	Fish Su	rvey and Barriers	43
		4.2.1	Main Channel	45
		4.2.2	Western Sub-catchment	
		4.2.3	Central Sub-catchment	48
		4.2.4	Eastern Sub-catchment	50

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vii



			City Council	Final V4
	4.3	Wetla	nds/Ponds	53
	4.4	Erosio	n and Scour	54
		4.4.1	Erosion Scarring and Erosion Hotspots	54
		4.4.2	Main Channel	55
		4.4.3	Central Sub-catchment	55
		4.4.4	Western sub-catchment	58
		4.4.5	Eastern Sub-catchment	61
		4.4.6	Upper Bank Erosion Susceptibility	62
5.0	Opt	ions and	Actions	65
	5.1	Manag	gement Zones	65
		5.1.1	Management Zone 1 – Eastern Main Channel and Wetlands	67
		5,1,2	Management Zone 2 – Eastern Modified Tributaries	68
		5.1.3	Management Zone 3 - Western and Central Tributaries - Erosion Reme	ediation 68
		5.1.4 Conve	Management Zone 4 – Western and Central Main Channels – Bio	of the second se
		5.1.5	Management Zone 5 – Western and Central Farm Drains	69
		5.1.6	Management Zone 6 – Eastern Tributaries and Wetlands	70
		5.1.7	Management Zone Summary	71
	5.3	Enhan	cement Opportunities	78
6.0	) Issu	es and C	Opportunities Prioritisation	83
7.0	Cos	t allocati	on of Erosion Mitigation Projects	84
8.0	Con	clusions	бативышанинынамизмизмизмизмизмизмизмизмизмизмизмизмизм	85
	8.1	Recon	nmendations for the ICMP	86
9.0	) Refe	erences.		87
Ap	pendix	1 Ma	ps	
	Mag	0 1 – Cat	chment Overview	
	Mag	2 - Eng	gineering Assets and Erosion	
	Mag	3 – Rip	arian Overhead Cover	
	Ma	o 4 – Fish	Barriers and Fish Survey	
	Maj	5 - Ero	sion Mitigation Projects	
	Mag	6 - Enh	nancement Opportunity Projects	
	pendix	2 Cos	st and Unit Rates for Mitigation Options	
Ap			sion Mitigation Projects Preparation and Planning Breakdown Cost	

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Viii

Mangakötukutuku Catchment Watercourse Assessment Report

Final V4

Hamilton City Council
Te kaunihera o Kirikiriroa

# **Tables**

Prepared for Hamilton City Council

Table 1: Significant Natural Areas in the Mangakōtukutuku Catchment (Schedule 9C, Volume 2, Appendix 9, PODP 2016)8
Table 2: Significant Trees identified in Mangakōtukutuku Catchment (Schedule 9D, Volume 2, Appendix 9, PODP 2016)8
Table 3: Significant Archaeological, Historic and Cultural Sites as per the PODP 20169
Table 4: WRCP watercourse types
Table 5: WRCP watercourse classification12
Table 6: Summary of physical variables across the extent of watercourse surveyed
Table 7: Summary of fish observations during assessment within the Mangakōtukutuku catchment 44
Table 8: Summary of anthropogenic fish barriers identified in the Mangakōtukutuku catchment45
Table 9: Summary of Pfankuch bank stability assessment of the main channel (m)
Table 10: Summary of Pfankuch bank stability assessment of the central sub-catchment (m)63
Table 11: Summary of Pfankuch bank stability assessment of the western sub-catchment (m)63
Table 12: Summary of Pfankuch bank stability assessment of the eastern sub-catchment (m)63
Table 13: Summary of Management Zones71
Table 14: Proposed Erosion Mitigation Works in the Mangakōtukutuku catchment73
Table 15: Proposed Future Erosion Mitigation Works in the Mangakōtukutuku catchment74
Table 16: Proposed erosion mitigation works costs (\$ rounded to nearest \$000)76
Table 17: Proposed future erosion mitigation works costs (\$ rounded to nearest \$000)76
Table 18: Summary of enhancement opportunities and their prioritisation
Table 19: Summary of enhancement opportunity costs (rounded to nearest \$000)82
Table 20: Fregion cost allocation for Mangakōtukutuku

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ix

Mangakotukutuku Catchment Watercourse Assessment Report Prepared for Hamilton City Council

Final V4

# 1.0 Introduction

#### 1.1 Overview

Hamilton City Council (HCC) has been developing integrated catchment management plans (ICMPs) to support management of catchments, facilitate growth and to comply with Hamilton City Council's Comprehensive Stormwater Discharge Consent (CSDC).

In 2015, Waikato Regional Council approved the first ICMP. During this time, a set of method guidance 'modules' were developed to help standardise data collection, modelling, data presentation and reporting for future ICMPs. One of these modules is the Receiving Environment Module [REM] which sets out a baseline assessment methodology for watercourses (HCC, 2015).

This report and associated field assessments have been conducted as per the REM and to support the development of the Mangakotukutuku ICMP.

#### 1.2 Scope

Morphum Environmental Ltd (Morphum) was engaged by the Hamilton City Council (20/12/2016) to undertake a watercourse assessment of the Mangakōtukutuku catchment in Hamilton. The scope included a walkover assessment, the development of this report, and delivery of all spatial datasets collected during the assessment. This report summarises the data collected, identifies concept projects and management recommendations within the catchment.

The purpose of the watercourse assessment and report is to inform the Mangakotukutuku ICMP, provide baseline data to consultants working in the catchment, support existing management of the ecological values of watercourses and stormwater conveyance, and inform best practice Greenfield development in the Peacocke sub-catchment.

This report has primarily been informed by rapid field assessment undertaken in accordance with the ICMP Receiving Environment Module method (see section 3.0). A literature review of previous assessments undertaken in the catchment was outside the scope of this report.

The scope of works included the following:

- · Field assessment of 26 km of open watercourse within the Hamilton City boundary.
- Preparation of a watercourse assessment report including issues and opportunities for enhancement.
- The identification of erosion mitigation projects to address existing and potential future erosion issues within the catchment.
- Selection and development of enhancement opportunities and potential management options and actions.

The extent of the watercourse assessment was defined by Morphum and agreed with Council prior to the assessment survey being conducted. It should be noted that an extensive farm drainage network exists upstream of the Hamilton City boundary which was not part of this assessment scope. In some instances, sections of watercourse within the scoped extent were not assessed where consent to access was not provided by the land owner. The extent of the watercourse assessed is summarised in the catchment overview map in Appendix 1.

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#### 1.3 **Reach Naming Convention**

The Mangakōtukutuku Watercourse Assessment Report provides the context for the survey, summary of findings, watercourse management zones and concept projects for consideration in the Mangakōtukutuku ICMP.

The document provides references to reach/tributary using a tributary code. The numbering convention is determined based on the number of tributaries entering the main reach throughout the sections. For

- MGK C Main 1 is the 1st reach of the main channel in the central Mangakōtukutuku sub-catchment.
- MGK\_E\_Trib3\_5 is the 5th reach of the third tributary (heading upstream) of the eastern Mangakōtukutuku sub-catchment.
- MGK\_W\_Trib1\_Fork1\_ is the first fork of the 1st tributary (heading upstream) of the western Mangakōtukutuku sub-catchment.

The tributary codes are mapped against the reaches in Appendix 1

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# 2.0 Catchment Overview

# 2.1 Catchment Location and Drainage

The Mangakotukutuku catchment is approximately 2,677 ha in area and is located south of Hamilton's city centre. It is bound to the north and east by Peacocke catchment and Waitawhiriwhiri catchment to the west. Half of the hydrological catchment is within the Hamilton City boundary (subject catchment). Mangakotukutuku stream drains towards the north, with a single discharge point to the Waikato River below Peacockes Road. The catchment overview map is provided in Figure 1.

Mangakōtukutuku is one of the largest Hamilton gully systems in the region and is identified as a 'gully reserve network' under the Gully Reserves Management Plan (Turner & Craig, 2007). The gully system is divided into three main sub-catchments:

- The west sub-catchment is defined as the area upstream of the Manor Place/Keitha Place cul de sac.
  The land use within the subject catchment is predominately residential with several commercial
  pockets and one area of industrial land use to the west. The land use in the wider catchment, in the
  Waipa district is rural and is made up of a significant farm drainage network. The area has previously
  been referred to as the Deanwell sub-catchment.
- The central sub-catchment is defined as the area upstream of the Lewis Street and Bruce Ave corner.
   The land use within Hamilton City boundary is predominantly residential and the area has previous been referred to as the Glenview sub-catchment. The land use in the wider catchment is rural.
- The east sub-catchment is defined as the area upstream of Waterford Road. The catchment is rural and is located within the Peacocke structure plan. The structure plan will rezone the entire rural area to low-medium density residential. Furthermore, the designation of the Southern links roading project in the eastern sub-catchment identifies this area to be one that will experience a high degree of change over the next few decades.

The Mangakotukutuku catchment is characterised by steep gullies with extensive confined floodplains and seepage wetlands on the banks above the floodplain. Much of the gully network, in the western and central sub-catchment, has a consistent riparian width set back from the gully. There is a small number of existing road crossings of the gully network where the watercourse has been culverted.

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Final V4

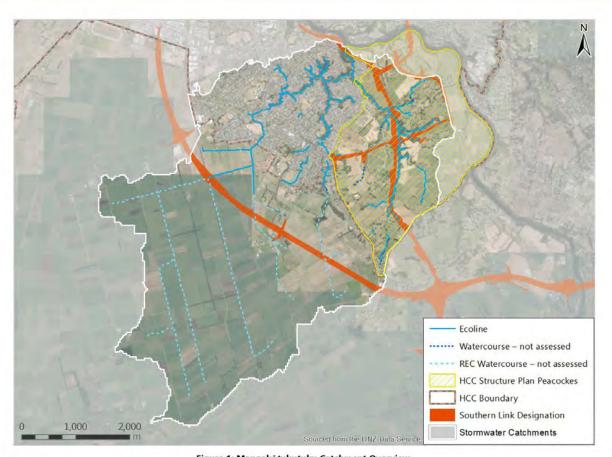


Figure 1: Mangakōtukutuku Catchment Overview.

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4

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#### 2.2 Future Land Use

Hamilton is currently experiencing rapid urban expansion through infill housing and new developments on the city fringes. Most of the city fringe growth is concentrated around the four HCC Structure Plans detailed in the Partly Operative District Plan (PODP) (HCC, 2015) these being; Rototuna, Rotokauri, Ruakura and Peacockes.

The eastern branch of Mangakōtukutuku is within the Peacocke Structure Plan area. This area of land was incorporated into Hamilton City in 1989 from Waipa District Council with the main purpose to provide an area for growth and eventually a community hub. The dominant zoning will be residential with an indicative future reserve zoning approximately 20 m from centre of the Mangakōtukutuku stream. Walkways and cycle ways will allow for increased access to gully systems and the river corridors. Residential development has started to occur in the western edge of the structure plan around Dixon Road.

The Peacocke Structure Plan objectives and policies related to the Mangakōtukutuku Gully are provided below:

- 6. Objective: "Protect and enhance significant natural areas."
- 7. Policies:
  - **"3.4.1.1a** Protect the physical integrity and ecological and stormwater function of the Mangakōtukutuku Gully and Waikato River margins.
  - **3.4.1.1b** Provide an undeveloped open space buffer zone beyond the top edge of the Mangakōtukutuku Gully and Waikato River to improve legibility from all parts of the growth cell.
  - 3.4.1.1c Encourage lower density development (lot sizes of 800m<sup>2</sup>+) along the gully network.
  - 3.4.1.1d Provide for revegetated gullies and river margins.
  - **3.4.1.2a** Provide green corridors between the major arms of the Mangakōtukutuku Gully and Waikato River.
  - **3.4.1.4d** Seek ways to reduce the impact of major movement barriers such as major arterial roads, the Mangakōtukutuku Gully and the Waikato River".

The NZTA Southern Links project is also a significant part of the changing land use occurring in the Mangakōtukutuku catchment. The new set of highways and linkage roads will help provide better access to support the planned growth in the catchment and link up several state highways. The designation for the new set of highways is provided in Figure 1. As part of the designation conditions issued by HCC (HCC, ND), an Ecological Management and Monitoring Plan is required to be prepared which includes identifying at least 11.8 ha of land for restoration. A selection of the projects identified in this report will be incorporated into Southern Links implementation works as part of the Ecological Management and Monitoring Plan. Preparation of this Plan in underway at the time of writing.

### 2.3 Ecological Values

The Mangakōtukutuku catchment is one of the largest gully systems within the Hamilton City boundary. The central and western sub-catchments within the subject catchment have consistent riparian extent along the gully banks and the catchment has been identified by several regional studies for its ecological values.

The Mangakōtukutuku catchment is noted for its high biodiversity (EPT taxa richness, and fish diversity), and good water quality (MCI scores) compared to the other sampled locations (Kirikiriroa and

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5

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Final V4

Mangaonua, Waitawhiriwhiri and Te Awa O Katapaki) (Aldridge and Hicks, 2006; Collier *et al.* 2009). Native fish observed include torrentfish, banded kokopu, giant kokopu, koura, smelt, and shortfin and longfin eels (Aldridge and Hicks, 2006).

Environment Waikato (now Waikato Regional Council) undertook 30 stream ecological valuations (SEVs) across Hamilton watercourses in 2009 (Collier *et al.*, 2009). Ten of these were located in the Mangakōtukutuku catchment. Three SEV sites were located in the western sub-catchment, four in the central sub-catchment, two in the eastern sub-catchment and one along the main channel near the confluence with the Waikato River. The SEV scores ranged from 0.42 to 0.62, indicating fair – good ecological values.

The Mangakōtukutuku has the richest native fish assemblages in the Hamilton City area (not including the Waikato River itself) with records of torrentfish, banded kokopu, giant kokopu, koura, smelt, shortfin and longfin eel (Aldridge and Hicks, 2006).

There are a number of significant natural areas, significant trees, and cultural sites identified as part of the PODP at the time of writing this report. These significant areas are discussed below and mapped in Figure 2

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**Item 12** 

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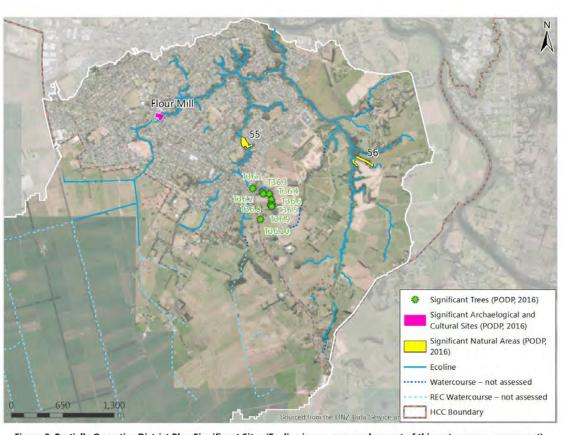


Figure 2: Partially Operative District Plan Significant Sites (Ecoline is area surveyed as part of this watercourse assessment).

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7

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Page 1786



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# 2.3.1 Significant Natural Area

There are two sites identified as Significant Natural Areas in the Mangakōtukutuku catchment under the WRC Policy Statement criteria for ecological significance (Table 1). One of the key sites (SNA 56) is located in the eastern sub-catchment along MGK\_E\_Trib4\_1 which is made up of two locations. The second location (SNA 55) is located in the central sub-catchment along MGK\_C\_Main\_3. Both areas were identified due to their rare or exceptional representation of species (criterion 10), SNA 56 is also noted for the provision of habitat for threatened or endemic species (criterion 3).

Table 1: Significant Natural Areas in the Mangakōtukutuku Catchment (Schedule 9C, Volume 2, Appendix 9, PODP 2016).

		,		
SNA No.	Name	Main Vegetation Type	Criteria	Area (m²)
55	Mangakōtukutuku Gully, Te Anau Park	Eucalyptus, Pine (Kahikatea)/ Treefern, Privet forest	10	6,095
56	Kanuku Patch, Mangakōtukutuku Gully, Peacocke	Kanuku/Privet, Grey Willow forest	10, 3	956,3,070

# 2.3.2 Significant Trees

Ten significant trees were identified in the Mangakōtukutuku catchment as per the significant trees layer from the 2016 PODP (Table 2). All of these are located within close proximity to each other within the central sub-catchment along MGK\_C\_Fork2\_Trib1\_1 near the Carbourne wetlands at Northview Farm – 3019 Ohaupo Road. It should be noted that these areas are situated in close proximity to the site of the proposed Southern Links highway.

Table 2: Significant Trees identified in Mangakōtukutuku Catchment (Schedule 9D, Volume 2, Appendix 9, PODP 2016).

Reference Number	Common Name	Botanical Name
T36.1	English Oak	Quercus robur
T36.2	Pin Oak	Quercus palustris
T36.3	Pin Oak	Quercus palustris
T36.4	Pine	Pinus sp.
T36.6	Fir	Abies sp.
T36.5	Pin Oak	Quercus palustris
T36.7	London Plane	Platanus acerifolia
T36.8	Pin Oak	Quercus palustris
T36.9	Eucalyptus	Eucalyptus sp.
T36.10	Elm	Ulmus

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# 2.3.3 Archaeological, Historic or Cultural Heritage Sites

Only one significant archaeological or cultural heritage site is identified in the PODP within the Mangakōtukutuku catchment (Table 3). The site is a historic flour mill located within the western subcatchment along MGK\_W\_Main\_8, downstream of Ohaupo Road near Urlich Ave.

Table 3: S	Significant Archaeolo	gical, Historic and Cultural S	Sites as per the PODP 2016.	
Name	Type	Site No.	NZ Archaeological	
Name	туре		Association number	
Mangakōtukutuku	Flour Mill	A104	S14/102	

# 2.3.4 Waikato River Bank and Gully Hazard Area

The PODP identifies areas near the Waikato River and gullies that may have some hazard associated with them. Chapter 22 discusses natural hazards and section 22.2.1 states:

"New use and development which is vulnerable to the adverse effects of land instability shall avoid the Waikato Riverbank and Gully Hazard Area, where the adverse effects and risks have not been minimised to an acceptable or tolerable level."

Objectives and Policies in chapter 22 that relate to the Waikato River Corridor and Gully Systems are provided below:

21.2.1a "An integrated, holistic and co-ordinated approach to management shall be used to protect, enhance and restore the natural, physical, cultural and historical resources and character of the river corridor and gully system. The management approaches referred to in 21.2.1a include significant natural areas, scheduled cultural sites, the High, Medium and Low Flood Hazard Areas, Temple View Flood Hazard Area, Culvert Block Flood Hazard Areas, the Waikato Riverbank and Gully Hazard Area and Open Space Zone."

Existing development practices in Hamilton City generally require approximately 6 metres set back approximately from the Waikato River Bank and Gully Hazard Area (as per PODP). Increasing the length of this set back should be considered as part of the ICMP investigations and is discussed further as part of the management objectives. The Waikato River Bank and Gully Hazard Area for the Mangakōtukutuku catchment are displayed in Figure 3.

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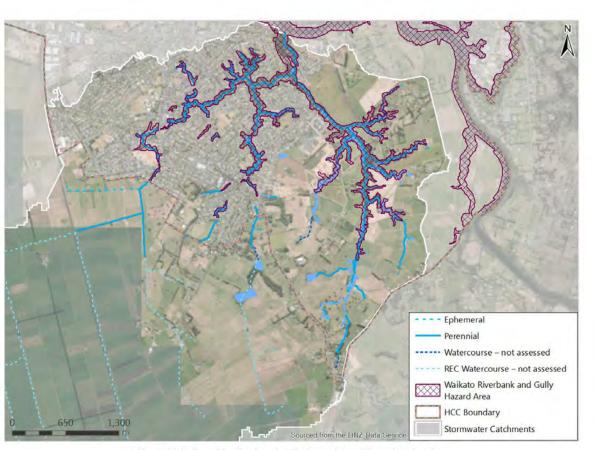


Figure 3: Waikato Riverbank and Gully Hazard Area Mangakōtukutuku.

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10

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# 2.4 Community Involvement and Stewardship

The Mangakōtukutuku Stream Care Group (MSCG) are an active community led group with a vision to improve the ecological values of the stream and increase community awareness supported by the Mangakōtukutuku Puna Koiora Trust.

The MSCG have done a considerable amount of native planting and weeding in the catchment since 2007. Much of the activity to date has been focused along the main channel in the Gully Management Area along Sandford Park and Saxbys Road and includes the installation of a fish passage device (ramp with baffles) to facilitate movement through the culvert at Peacockes Road.

MSCG prepared the Peacockes Riparian Restoration Plan (MSGC, n.d.) which aims to restore native intact riparian vegetation to the main channel and tributaries of the eastern Peacocke sub-catchment. The project targets headwater streams, gully wetlands, and seeps. Planned riparian planting areas in the eastern catchment have been discussed with HCC and the wider Southern Links consortium of consultants. The locations of these proposed planting areas are referenced in the relevant enhancement projects in section 5.3.

# 2.5 Gully Reserves Management Area

A Hamilton City Gully Reserves Management Plan was initially prepared in 2001 and updated in 2007 (Turner & Craig, 2007). The plan outlines management of six areas of gully which are owned and maintained by HCC and provide some indicative management actions for the portions of gully located on private land.

The main channel of the Mangakōtukutuku watercourse and the lower western sub-catchment (located within Sandford Park) is identified as part of the Gully Reserves Management Plan (totaling 21.3 ha). Priorities and programs for the Mangakōtukutuku Gully are described below:

"Short to medium-term management priorities:

- Consolidation of existing planting efforts to ensure weeds are controlled and correct balance of species is present.
- Progressive restoration of areas currently dominated by exotic forest, shrubs, weeds and vines. A
  progressive approach is particularly important along the riparian margin where the existing shading
  provided by exotic trees should only be reduced as native trees achieve significant cover.
- Retain existing areas of mown grassland.
- Audit culverts, particularly the one under Peacockes Road, to assess suitability for fish passage.
- Audit large mature trees to assess threat to gully slope stability.
- Introduce shading to streams.
- Provide signage to mark way to and from the Waikato River and give information on the values of the gully.

Long-term priorities for management:

- Development of picnic and car park facilities.
- Progressive replacement of plantations with native vegetation.
- Removal of Tradescantia from forest/plantation floor.

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# 3.0 Methodology

# 3.1 Receiving Environment Assessment Methodology

The methodology used in the Mangakotukutuku watercourse assessment is the ICMP Receiving Environment Module developed by Morphum Environmental for Hamilton City Council (HCC, 2015). All interpretation of data should be used in conjunction with this document. The Waikato Regional Council Plan (WRCP) classifications were used to define watercourse types (Table 4) and watercourse classification (Table 5).

	Table 4: WRCP watercourse types	
Watercourse type	Definition	
River	A stream or modified watercourse that does not include any artificial watercourse.	
Modified watercourse	An artificial or modified channel that may or may not be on the original watercourse and which has a natural channel at its headwaters.	
Farm drainage canal	An artificial watercourse on a farm that contains no natural portions from its confluence with a river or strean to its headwaters and includes a farm drain or a farm canal.	

Table	5: WRCP watercourse classification
Watercourse classification Definition	
Perennial	A stream that flows all year round assuming average annual rainfall.
Ephemeral	A stream that flows continuously for at least three months between March and September but does not flow all year.

Several components of the full ICMP Receiving Environment Module were excluded from this survey and are not included in this report as follows:

- Water quality, sediment quality, macroinvertebrate survey and fish survey (undertaken by others).
- A literature review of available information and datasets in the catchment was not undertaken. A
  literature review was previously undertaken as part of the Draft Mangakötukutuku Stream Assessment
  of Ecological Values to inform an ICMP prepared by Boffa Miskell (2014). The report covers the entire
  hydrological catchment however walkover assessment was limited to portions within the Hamilton
  City boundary in the central and western sub-catchments only.

### 3.2 Limitations

### 3.2.1 Watercourse Classification

The watercourse assessment provides a field estimate of stream classification only and this classification is not specifically intended for Resource Consent purposes. Although specific and detailed assessment is required prior to consent approval for any works within a subject reach, the details contained in this

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12



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Final V4

document can be used to guide associated investigations for a resource consent application. Failure to identify a stream reach during this Watercourse Assessment process does not indicate that a stream is not present or that any such stream is ephemeral. The assessment has been based on the regional plan definitions. It should be noted that these definitions are open to considerable interpretation.

# 3.2.2 Temporal Variations

Watercourse assessment undertaken as per this methodology must be considered within the seasonal context. Variables such as water depth and velocity are dependent on the level of base flow, and stormwater influx prior to the assessment. Factors that are more variable over diurnal time scales such as temperature are not recorded as part of this assessment as time series data is required for meaningful results.

### 3.2.3 Assessment Methodology

It is acknowledged that the ICMP Receiving Environment Module method is a 'rapid' assessment of engineering assets, as well as, biological and geomorphological stream state for the purpose of informing effective management of stream ecology stormwater infrastructure and stormwater conveyance. Therefore, this methodology may lack some parameters of more detailed assessments such as MCI. However, where this information exists it will be considered as appropriate.

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Final V4

# 4.0 Findings

The watercourse assessment for the Mangakōtukutuku catchment was undertaken in March 2017. This watercourse assessment follows the receiving environment module method (Hamilton City Council, 2015).

This section provides a description of each reach assessed and provides general information on the fish survey results, the wetlands and ponds in the catchment, and the extent of erosion and scouring found.

Stream reaches are divided into 'ecolines' based on significant changes in watercourse morphology, riparian vegetation, land use, or other variables. Each reach was assigned a unique tributary code, refer to Appendix 1 Map 01 for an overview of tributary codes referred to throughout this report.

# 4.1 Reach Descriptions

The purpose of this section is to provide an overview of the reaches (ecolines) assessed during the survey. Reaches are defined where there are significant changes in riparian cover, channel morphology, erosion and any other parameter considered to change which has an effect on the stream ecology and stream flows. Physical variables of all reaches assessed are summarised in Table 6 below. The Waikato Regional Council Plan classifications are also summarised in Table 6.

The main channel of the Mangakōtukutuku, from the confluence with the Waikato to the confluence with the eastern, central and western sub-catchments is a wide (2 m to 8 m) uniform channel that meanders through Sandford Park.

The western and central sub-catchment main channels are approximately 2 m in width and the steep gullies have good riparian corridors averaging 25 m wide (Figure 4). The corridor is constrained by residential dwellings/buildings located at the top of the gully banks.

Channel modification in the western and central subject catchment includes culverting for road crossings and several areas of bank lining. These remedial works in the form of bank lining would suggest bank failure and erosion has been a historical issue. Additionally, in these bank lining locations, upper bank erosion susceptibility was considered high and there was presence of seepage springs.

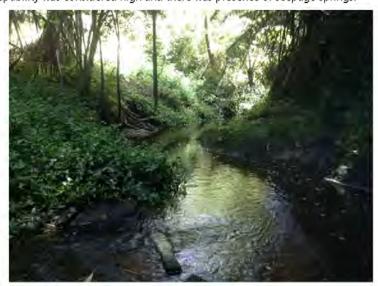


Figure 4: Typical reach along central main channel.

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14



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Final V4

In the wider catchment, within Waipa District, the western and central sub-catchment headwaters are a combination of Waipa District maintained drains and modified farm drains. There are areas of community planting and fencing along sections of the watercourse (Figure 5).



Figure 5: Community planting in the Waipa District

The eastern sub-catchment main channel has steep gully banks (15 - 20 m) and a wide confined floodplain typically between 10 - 25 m, with seepage wetlands prevalent along the floodplain and upper banks. The eastern catchment is modified by the presence of several online artificial ponds, predominantly damming headwaters of the main channel and extensively along the length of tributary 2 (MGK\_E\_Trib2).

Majority of main channel in the eastern sub-catchment has high overhead cover and riparian vegetation within the floodplain. Some areas are heavily impacted by invasive weed species which are threatening regenerating native bush (Figure 6). Majority of the tributaries are located in farm land and are dominated by grazed grasslands or shrub with sparse vegetative cover. Fencing of waterways varies throughout the eastern sub-catchment with areas of stock access and damage more likely in the tributary headwaters where the banks are gently sloping.

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Final V4



Figure 6: Extensive cover of weed species along gully floor in the eastern sub-catchment.

Table 6: Summary of physical variables across the extent of watercourse surveyed.	
Length of Surveyed Watercourse	25.8 km
Total No. Ecoline Segments	160
Average Wetted Width	1.29 m
Average Depth	0.21 m
Average Lower Bank Angle	66°
Average Lower Bank Height	1.25 m
Average Dominant Substrate	Silt/Sand/Mud
Maikata Pagianal Plan Stroam	2114 24114/1144

Waikato Regional Plan Stream Classification		Permanent			Ephemeral		
length of stream (m)		20,146			2,793		
% of total stream length	of total stream length		(88%)			(12%)	
Bank Erosion Scarring	0%	≤20%	20-	40%	40-60%	≥60%	
length of stream (m)	801	12,903	7,418		1,603	157	
% of total stream length	4%	56%	32%		7%	1%	
Overhead Cover	<10%	10-30%	30-50%	50-70%	70-90%	<90%	
length of stream (m)	2,097	1,767	3,101	2,853	6,987	6,075	
% of total stream length	9%	8%	14%	12%	31%	27%	

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16

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Final V4

# 4.1.1 Mangakōtukutuku Main

#### Lower Mangakötukutuku (1.2 km) MGK\_Main\_1-5

The lower Mangakōtukutuku stream is located within Peacockes Esplanade (public reserve) extending from the confluence with the Waikato River (MGK\_Main\_1) towards Sandford Park (MGK\_Main\_5).

The lower channel (MGK\_Main\_1 to 2) has a 7 m wide wetted width and predominantly soft bottomed with varying bank height. The upper true right bank is typically steep dominated by mature pines and exotic vegetation whilst a large floodplain extends from the true left bank with mowed grass and a public walkway. The most significant native vegetation observed included a stand of kahikatea and mahoe seedlings on the left bank likely to be approximately 10 years old. Two erosion hotspots were located on the outside of meanders (both approximately 30 m²) with high sediment deposition in the lower reaches (Figure 7). There is a channel modification structure at MGK\_Main\_2 which is providing grade control and dissipation (Figure 8).

Upstream of the culvert at Peacockes Road, the channel (MGK\_Main\_3 to 5) is fairly uniform with an average channel width of 1 m and 1 m high banks. There is native regeneration planting along the banks (Figure 9.). There are isolated sections of channel modification along MGK\_Main\_5 which include stacked concrete sacks and placed rocks as bank lining (Figure 10).



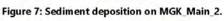




Figure 8: Channel/bed modification structure at MGK\_Main\_2.



Figure 9: Channel MGK\_Main\_5.



Figure 10: Toe protection at MGK\_Main\_5.

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17



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Final V4

### 4.1.2 Central Sub-catchment

#### Lower Main Channel (1.3 km) MGK\_C\_Main\_1-4, MGK\_C\_Trib4

The lower reaches of the central sub-catchment extend to the State Highway 3 culvert. The channel ranges in width between 0.8 m and 3 m defined by steep upper banks and good riparian extent (Figure 11). Several large erosion hotspots (approximately 20 m²) were identified along the true left bank of MGK\_C\_Main\_2 (Figure 12) downstream of Splitt Ave (refer to section 4.4 for more information). Upstream of Splitt Ave there is a considerable planting restoration project around the watercourse and on nearby land likely undertaken by active local residents (Figure 13).

Further upstream in Te Anau Park, there are several seepage wetlands along the floodplains and upper banks (Figure 15). Most of the vegetation is native dominated by tree ferns through the understorey. There are also several bank lining assets along the watercourse in Te Anau Park which consist of stacked tyres or concrete sacks (Figure 16).

There is a small tributary, (MGK\_W\_Trib4) downstream of the Pelorus Street culvert, which has a deeply incised 100 m section with good overhead cover and sparse bank vegetation providing excellent potential fish habitat (Figure 17). The tributary receives stormwater discharge from a developed area and provides an example of how increases in flow volume and discharge can affect channel stability, in particular where the channel material has poor sheer strength. The observed erosion is likely to be ongoing.



Figure 11: Channel at MGK\_C\_Main\_1.



Figure 12: Erosion hotspot along MGK\_C\_Main\_2.



Figure 13: Restoration effort on the true left bank of MGK\_C\_Main\_3.



Figure 14: Channel along MGK\_C\_Main\_3.

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18



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Final V4





Figure 15: Wetland seepage area on true left bank of MGK\_C\_Main\_4.

Figure 16: Bank lining along MGK\_C\_Main\_4.



Figure 17: Incised and unstable tributary MGK\_C\_Trib4\_1.

#### Tributary 1 (0.6 km) MGK\_C\_Trib1

The confluence between tributary 1 and the central main channel is located between MGK\_C\_Main\_1 and 2. Tributary 1 extends east towards Fitzroy Park (Figure 19).

The average channel wetted width is 0.6 m and the average depth is 0.2 m with high upper banks (20 m in the lower reaches and 5 m in the upper reach). There is good riparian extent, diversity, and overhead cover which improves overall bank stability, however, several small active landslips (that did not meet the criteria for erosion hotspots due to small size) were observed which may be caused or exacerbated by seepage and springs located on the mid to upper banks (Figure 18). Near the landslips and along the gully floor there is active sediment deposition (Figure 20), being mainly fine sands and silts. Further upstream the reach is a meandering channel through a low-lying floodplain with extensive cover of tradescantia (Figure 21) which has established on the fine sediments deposits observed throughout. Downstream of the outlet at Waterford Road, there is significant down cutting of the channel which is discussed further in section 4.4.1 (Figure 22).

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Final V4



Figure 18: Landslip on true right bank on MGK\_C\_Trib1\_1.



Figure 19: Channel on MGK\_C\_Trib1\_2.



Figure 20: Sediment deposition within channel on MGK\_C\_Trib1\_1.



Figure 21: Extensive tradescantia cover along MGK\_C\_Trib1\_3.



Figure 22: Active down-cutting and bank slumping of channel along MGK\_C\_TRIB1\_4.

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Final V4

#### Fork 1 (1.2 km) MGK\_C\_Fork1

Upstream of Te Anau Park, the main channel of the central sub-catchment diverges. The reach on the right (looking upstream), Fork 1, extends under State Highway 3 and Sunnyhills Ave for 240 m to Dawn Rise with a small tributary located near Lorraine Place (MGK\_C\_Fork1\_Trib1\_1).

Downstream of the outlet under the State Highway (MGK\_C\_Fork1\_1), there is a triple culvert with timber lining (above the culvert wingwall) on the upper true left bank (Figure 23 and Figure 24). The bank lining has vegetation growing and rubbish present between the timber planks. The structural integrity of the lining is compromised and the top end is leaning towards the watercourse. The lining is assessed to have a high likelihood of collapsing and maintenance or further assessment is required to remedy this.

Upstream of the inlet to the State highway, there is a 40 m section of timber bank lining (1 m height) on both banks (see Figure 25) along MGK\_C\_Fork1\_1. This lining is likely to restrict flows given the large upstream catchment and there is risk to neighboring properties. Further upstream (a timber bank lining structure has recently been erected on the true left bank approximately 3 m in height (Figure 26).

The watercourse extending towards John Webb Drive is a meandering stream with average bank height 1.5 m and dense tradescantia cover (Figure 27). There are areas of scour and erosion with the most significant area identified as an erosion hotspot just downstream of the John Webb Drive outlet (Figure 28).

Upstream of John Webb Drive (MGK\_C\_Fork1\_3), the channel is a straightened watercourse which flows along the east and south of the Resthills Sports Park (Figure 29). The watercourse has been planted by Mangakōtukutuku Stream Care Group. Upstream of the Resthills Park, beyond the Hamilton City boundary, the watercourse is a network of modified farm drains which is not included in this assessment, as it's outside the subject area.



Figure 23: Bank lining above culvert at MGK\_C\_Fork1\_1.



Figure 24: Bank lining above culvert at MGK C Fork1 1.

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21

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Mangakötukutuku Catchment Watercourse Assessment Report Prepared for Hamilton City Council

Final V4



Figure 25: Bank lining extending 40 m at MGK\_C\_Fork1\_2.



Figure 26: Timber bank lining along property at MGK\_C\_Fork1\_2.

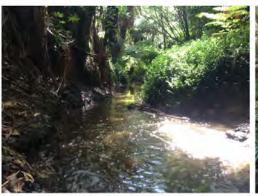


Figure 27: MGK\_C\_Fork1\_2.



Figure 28: Erosion hotspot on MGK\_C\_Fork1\_2.



Figure 29: Channel along Resthills Park MGK\_C\_Fork1\_3.

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Final V4

#### Fork 2 (1.3 km) MGK\_C\_Fork2

The reach to the left (looking upstream) of the confluence of the central main channel, fork 2, extends towards Dixon Road, under State Highway 3 and beyond the Hamilton City boundary. The channel downstream of the state highway culvert is an incised with thick tradescantia cover with a large willow lying across the channel and debris build-up evident from previous high flows (Figure 30).

There is a small tributary (MGK\_C\_Fork2\_Trib1\_1) that extends under Dixon road which includes a series of weirs along the constructed wetlands identified as the Carbourne Wetlands (Figure 31).

Upstream of the state highway 3 culvert and to the Hamilton City boundary, there is a section of 120 m of weedy uniformly straightened watercourse (MGK\_C\_Fork2\_2) with residential houses in close proximity to the banks. Upstream of the boundary, the watercourse maintains the uniform shape and there is high sediment deposition and some good overhead cover from immediate bank vegetation (Figure 32). The land is un-grazed paddocks with a fenced off channel and several ephemeral tributaries drainage seepage wetlands.

Further upstream along MGK\_C\_Fork2\_4, the channel meanders through a floodplain. There is good riparian cover from pine canopy with weed infestations of blackberry, woolly nightshade and arum lily (Figure 33) in the understorey. The headwaters of the reach are two farm ponds, identified as Alderton A and B which were not assessed as part of this survey.



Figure 30: Willow fallen across incised stream at MGK C Fork2 1.



Figure 31: Carbourne Wetland with structure in background.



Figure 32: Fenced off straightened channel MGK C Fork2 3.



Figure 33: Floodplain and weedy infestations along MGK\_C\_Fork2\_4.

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23



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Final V4

#### 4.1.3 Western Sub-catchment

#### Lower Main Channel (1.7 km) MGK W Main 1-8

The lower reaches of the western sub-catchment extend from the western/central confluence to MGK\_W\_Main\_8 where the channel morphology changes. The gully banks are typically very steep and > 15 m (Figure 34). The bottom of the gully is wide with a large, frequently engaged floodplain narrowing to a more constrained gully with steep immediate banks from MGK\_W\_Main\_4 to 7 (Figure 35). The watercourse channel is fairly uniform, with a consistent width averaging between 2.5 m and 4 m and an average depth of 0.5 m.

There are several natural cascades acting as partial barriers to swimmers with riffles and debris jams providing good habitat complexity and substrate heterogeneity for fish species and macroinvertebrate fauna (Figure 36). Vegetation along this section of watercourse is dominated by tradescantia along the banks with patches of blackberry and a mixed canopy.



Figure 34: Channel along MGK\_W\_Main\_2.

Figure 35: Channel along MGK\_W\_Main\_4.



Figure 36: High velocity and turbulence over natural cascade in bedrock on MGK\_W\_Main\_5.

#### Lower Tributaries (1.4 km) MGK\_W\_Trib1-3

There are several tributaries located in the lower reaches of the western sub-catchment downstream of MGK\_W\_Main\_4. The lower reaches of the first tributary (MGK\_W\_Trib1\_1) are defined as a narrow-incised channel with high sediment deposition and high erosion scarring (Figure 42).

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24

Further upstream, the watercourse diverges into two reaches. The reach to the right of the confluence (looking upstream), continues as an incised channel with steep gully banks (Figure 37 and Figure 38). The headwaters received piped discharge from the surrounding residential area and there is a small wetland area immediate downstream of the piped network outlet. The reach downstream of the wetland is likely to be ephemeral (Figure 39).

The reach to the left of the confluence also received piped discharge from the stormwater network. The reach is infested with weeds including tradescantia and blackberry (Figure 40 and Figure 41).

Tradescantia dominates the second tributary covering the entire extent along the upper banks (which are > 15 m high) (Figure 43). There is significant bank scarring (40-60% on both banks) along the reach particularly in locations where the channel is highly incised. The tributary receives piped discharge from the stormwater network on either side of Ansford Place.

High gully banks > 20 m define the channel of Tributary 3 resulting in moderate incision and a high percentage of active bank scour affecting upper bank stability (Figure 44). Further information on erosion assessed along this reach is discussed in section 4.4. There are a series of timber weirs along the channel which extend along the banks as timber lining (Figure 45).



Figure 37: Upper bank along MGK\_W\_Trib1\_Fork1\_2.



Figure 38: Incised channel on MGK\_W\_Trib1\_Fork1\_2.



Figure 39: Wetland at the headwaters of MGK\_W\_Trib1\_Fork1.



Figure 40: Channel along MGK\_W\_Trib1\_Fork2\_1.

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25

Attachments

Page 1804

Mangakötukutuku Catchment Watercourse Assessment Report Prepared for Hamilton City Council

Final V4



Figure 41: Channel and floodplain on MGK\_W\_Trib1\_Fork2.



Figure 42: MGK\_W\_Trib1\_1.



Figure 43: Tradescantia cover along MGK\_W\_Trib2.



Figure 44: Example of channel along MGK\_W\_Trib3.



Figure 45: Timber weir along MGK\_W\_Trib3.

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Final V4

#### Main channel (0.9 km)

The western main channel immediately downstream of the State Highway 3 crossing and upstream towards the Hamilton City boundary (MGK\_W\_Main\_9 to MGK\_W\_Main\_13) has a channel averaging between 2 and 3 m wide wetted width and approximately 0.3 m deep. The upper bank height along these reaches is variable with the lower reaches typical of the steep gullies identified upstream. Further upstream in MGK\_W\_Main\_10 to 12 the bank height decreases to between 1.2 and 2 m high. Recent native riparian planting was identified along both banks of MGK\_W\_Main\_10 which was planted by Mangakōtukutuku Stream Care Group approximately 3-5 years ago (Figure 46).

A new residential development is located on the upper banks of the true left bank around Stan Heather Drive (MGK\_W\_Main\_12). There is an area of exposed loose sediment along the true left bank below the construction site which is pictured in Figure 47 and is recorded as an erosion hotspot, however, it is unlikely this was caused by the watercourse. Local residents have suggested that recent storm events have contributed to tree fall resulting in bank instability and sedimentation. The reach was assessed as fair for the overall bank stability score (Figure 48).

Riparian vegetation along this reach is dominated by exotic species with patches of native tree ferns, however, an infestation of tradescantia dominated both banks from Saxbys Road culvert to the end of MGK\_W\_Main\_13 (Figure 49).



Figure 46: Native planting along MGK\_W\_Main\_10.



Figure 47: Erosion hotspot on true left bank MGK\_W\_Main\_12 (Stan Heather development).



Figure 48: Channel at MGK\_W\_Main\_12.



Figure 49: Upstream of Saxsbys Road at MGK\_W\_Main\_13.

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27

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Final V4

#### Tributary 5 (0.8 km)

Tributary 5 is a modified perennial watercourse located on the true left bank of the main channel between MGK\_W\_Main\_4 and 5. The tributary has steep gully banks (>20 m high) for majority of the extent with two isolated erosion hotspots on the immediate banks. These are located on the true right bank of MGK\_W\_Trib5\_2 where the bank has recently slumped along the outside meander (see Figure 50) and MGK W\_TRIB5b\_1. Most of the channel had good riparian cover dominated by tree ferns (which provide good fish habitat as per Figure 51) however other areas were dominated by thick tradescantia, blackberry and bindweed which limited access to the channel (Figure 52).

In the lower reaches, there are several cascades over bedrock which present barriers to fish passage and are discussed further in section 4.2.

A 70 m long section in the upper reaches of the tributary is lined with concrete as shown in Figure 53.





Figure 50: Erosion hotspot at MGK\_W\_Trib5\_2.

Figure 51: Good fish habitat on MGK\_W\_Trib5.



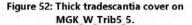




Figure 53: Concrete lined channel on MGK W Trib5 7.

#### Headwaters of Main Channel (2.8 km) MGK\_W\_Main\_14, MGK\_Main\_Fork1-2

The headwaters of the western sub-catchment are straightened and deepened farm drains which are part of a large network extending well beyond the Hamilton City boundary outside the subject area. The main channel diverges into two reaches after MGK\_W\_Main\_14. Much of the upstream network is impacted by unconsolidated sediment, dark brown peat-stained water and surface sheens and scums. The majority of

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28



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Final V4

these farm drains were fenced with 3 hot-wired fencing and planted with a narrow margin of native riparian vegetation on both banks approximately three years old (Figure 54).

The reach to the right of the diverging confluence includes areas planted and fenced with signage highlighting a community water quality enhancement project, supported by Waikato Regional Council (Figure 55). Further along this reach, the watercourse becomes ephemeral and is extensively culverted for farm crossings by landowners (Figure 56). The reach to the left of the confluence is also planted (Figure 57) and further upstream the channel is dominated by large macrocarpa and blackberry.



Figure 54: Fenced riparian planting on MGK\_W\_Main\_14.



Figure 55: Planting and fencing on MGK\_W\_FORK1\_2.



Figure 56: Channel at MGK\_W\_Fork1\_4.



Figure 57: Native riparian planting on MGK\_W\_Fork2\_2.

### 4.1.4 Eastern Sub-catchment

# Lower main channel (0.7 km) MGK\_E\_Main\_1-3

The eastern sub-catchment confluence with the Mangakōtukutuku main channel is located between MGK\_Main\_3 and 4. The lower reaches are divided up into three separate ecolines due to significant changes in the channel morphology.

The lower reach (MGK\_E\_Main\_1) extends from the confluence with the main to the Waterford Road culvert. It is a small confined channel with 90-degree banks and steep upper banks approximately 15 m high with residential houses near the top of the banks on the true right bank (identified as a risk and

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Final V4

discussed further in section 5.1.1 and 5.2) (Figure 58). Some sections of the banks are well vegetated (albeit with weed infestations), whereas other areas have bare banks and high mass wasting. A section of the true right bank has had wool matting placed which is deteriorating (Figure 59).

Upstream of the Waterford Road culvert, along MGK\_E\_Main\_2, the watercourse continues as an incised channel with steep gully banks (>20 m) at approximately 60 degrees. The watercourse and upper banks are covered in thick tradescantia, privet and climbers which are smothering native tree ferns and carex grasses (Figure 60).

On MGK\_E\_Main\_3, the channel remains incised with steep gully banks however there is a 15 m wide floodplain on the true left bank with several seepage wetlands and springs (Figure 61). There is mature pine canopy on the true right bank and new developed residential on the upper true left bank.



Figure 58: Incised channel on MGK\_E\_Main\_1.



Figure 59: Wool matting on true right bank of MGK E Main 1.



Figure 60: Tradescantia cover of banks and channel at MGK\_E\_Main\_2.



Figure 61: Wetland on floodplain on true left bank of MGK\_E\_Main\_3 and informal walkway in the background.

### Main channel (2.1 km) MGK\_E\_Main\_4-11, MGK\_E\_Trib2\_1

The central reaches of the Mangakotukutuku eastern catchment including MGK\_E\_Main\_4 to 11 and the downstream reaches of the first two tributaries (MGK\_E\_Trib1 on the true right bank of the main and MGK\_E\_Trib2 on the true left bank of the main) share similar channel morphology and vegetation. These reaches are characterised as defined gully systems with steep gully banks (>20 m), wide wetland floodplains (20 m) and meandering channels along the gully floor. The most significant factor about these

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30

Attachments Page 1809



Final V4

watercourses are the seepage wetland and springs located along the gully floor and mid to upper banks. These are likely to contribute to baseflow as well as increasing the overall erosion susceptibility of the upper banks.

The vegetation along this section of watercourse differs between understorey of grey willow and areas with weed infestations and carex grasses/rush wetlands. The extensive coverage of weed species from groundcover to emergent trees are interspersed with patches of native vegetation. Exotic smothering type species such as old man beard pose a major threat to regenerating native bush (Figure 64 and Figure 66). The canopy at the confluence of MGK\_E\_Main\_4 and Tributary 1 and 2 is shown on Figure 62.

There are several pools and runs along the watercourse as well as areas of stagnant water with duckweed (Figure 63). Some sections of channels are undercut and scoured; often these areas have sparse ground cover and high overhead cover (shown in Figure 65 and Figure 67).

The land use of the upper banks is rural with areas of fenced farm land and maize production.



Figure 62: Confluence of MGK\_E\_Main\_4 and Tributary 1 and 2.

Figure 63: Stagnant water and willow cover at MGK\_E\_Main\_3.



Figure 64: Floodplain on gully floor of MGK\_E\_Trib2\_1.



Figure 65: Gully floor of MGK\_E\_Main\_7.

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Final V4





Figure 66: Photo take on upper true right bank of MGK\_E\_Main\_10.

Figure 67: Gully floor of MGK\_E\_Main\_10.

### Tributary 1 (1.6 km) MGK\_E\_Trib1\_2-9

The first tributary of the eastern Mangakōtukutuku sub-catchment is located on the true right bank between MGK\_E\_Main\_5 and 6. The lower 170 m is described as part of the central sub-catchment above. Further upstream the watercourse transitions to a confined channel and the riparian extent is minimal or absent with overhead cover provided only from the steep upper banks or overhanging grasses. This tributary is shown in Figure 68 (MGK\_E\_Trib1\_2).

Upstream of MGK\_E\_Trib1\_2, the watercourse passes through a 5 m long culvert providing an informal vehicle access. A tributary is located on the true left bank (MGK\_E\_Trib1a\_1) which extends to the southeast. The tributary channel is small and incised with steep upper banks covered in kikuyu (Figure 69). The tributary is spring fed with many small cool pools and water pepper and watercress are prevalent on the immediate banks. The headwaters of the tributary are two ephemeral reaches, the confluence is shown in Figure 70.

The main channel upstream of the 5 m culvert is a small incised channel with steep upper banks approximately 10 m (Figure 71). Exotics grasses provide shading to the watercourse. The watercourse passes through two culverts along this reach. Local residents identified that these are often blocked and cause flooding upstream however, there has been no damage to buildings.

A 100 m section of the watercourse was not surveyed as consent was not provided. Further upstream, along MGK\_E\_Trib1\_8, the watercourse is ephemeral with lower bank height and weed infestations of buttercup and bindweed (Figure 72 and Figure 73).

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Figure 68: Transitional reach MGK\_E\_Trib1\_2.



Figure 69: Channel and upper banks of MGK\_E\_Trib1a\_1.



Figure 70: Ephemeral reach at MGK\_E\_Trib1a\_Fork1.



Figure 71: Channel and upper banks at MGK\_E\_Trib1\_4.



Figure 72: Weed infestation across ephemeral channel at MGK\_E\_Trib1\_8.



Figure 73: Ephemeral reach at MGK\_E\_Trib1\_9 taken from road at 20 Peacockes Lane.

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### Tributary 2 and ponds at 143 Hall Road (1.6 km) MGK\_E\_Trib2\_2-5

The second tributary of the eastern Mangakōtukutuku sub-catchment is located on the true left bank between MGK\_E\_Main\_6 and 7. The lower 200 m and a small tributary (MGK\_E\_TRIB2a\_1) are included in the description of the central sub-catchment above (Eastern Tributary 1). The next upstream section of tributary 2 is a watercourse with a small meandering channel through a buried culvert (MGK E Trib2 5) with little understory or canopy cover. There is active sediment deposition and debris along the floodplain as shown in Figure 74 and Figure 75. A 140 m section of the upstream watercourse was not surveyed as consent was not provided.

Upstream of MGK\_E\_Trib2\_5, at 143 Hall Road, 800 m of the watercourse has been extensively modified by the landowner using concrete dam structures to provide a series of eight amenity ponds (Figure 76 to Figure 80). Many of the culvert and dam structures between the ponds were in poor condition.

There is a 400 m reach upstream of the 143 Hall Road property that was not surveyed as access was not permitted. Looking upstream from the boundary of 143 Hall Road, this appears to be a straightened modified channel no riparian cover on the true left (Figure 81).



Figure 74: Buried culvert under farm crossing with wetland floodplain downstream.



Figure 75: Watercourse upstream of the buried culvert MGK E Trib2 5.



Figure 76: Downstream pond in series at 143 Hall Road.



Figure 77: Concrete dam structure.

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34

Attachments Page 1813



Final V4





Figure 78: Sixth pond in series at 143 Hall Road.

Figure 79: Bridge crossing and recent earthworks near sixth pond in series at 143 Hall Road.





Figure 80: Eighth pond in series at 143 Hall Road recently constructed.

Figure 81: Looking upstream from 143 Hall Road boundary.

### Tributary 3 (0.9 km) MGK\_E\_Trib3\_1-6

The third tributary along the eastern main channel is located on the true right bank between MGK\_E\_Main\_7 and 8. The 200 m lower reach near the confluence (MGK\_E\_Trib3\_1) is a small incised channel with steep upper banks. The channel meanders across the gully floor where the soft sediment is highly erodible and contributes to sedimentation downstream (Figure 82). There is a floodplain on both sides of the channel with sparse ground cover, fern and grey willow understorey and pine canopy on the upper banks.

Further upstream, beyond the pine canopy block, the channel (MGK\_E\_Trib3\_2) meanders across the wide floodplain. There is sparse canopy cover and carex grasses as well as tradescantia, ragwort and blackberry (Figure 83).

The watercourse at MGK\_E\_Trib3\_3 maintains steep upper banks and a wide gully floor. The channel meanders across the floodplain with notable springs on the upper banks. There is good canopy cover from upper bank vegetation as well as willows, tree ferns and tradescantia along the gully floor (Figure 84).

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Final V4

There is an informal farm crossing between MGK\_E\_Trib3\_3 and 4 which currently provides access between two halves of the property. Upstream of the crossing is a large pond (Figure 85) which transitions into a wetland area (Figure 86).

Further upstream the watercourse is likely ephemeral with seepages running along the true right bank. There is a decrease in upper bank height (approximately 10 m). This section of watercourse has wetland species and no canopy and understory (MGK\_E\_Trib3\_5 pictured in Figure 87). A driveway cuts the watercourse at a perpendicular angle with a culvert (Figure 89). Downstream and upstream of the driveway, there is a planted and fenced off area of native and mixed vegetation with upper banks approx. 2 m high (Figure 88).



Figure 82: Incised channel on gully floor on MGK\_E\_Trib3\_1.

Figure 83: Gully Floor on MGK\_E\_Trib3\_2.



Figure 84: Good overhead cover at MGK\_E\_Trib3\_3.



Figure 85: Pond upstream of informal farm crossing MGK E Trib3 3.

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Figure 86: Upstream of pond at MGK\_E\_Trib3\_4.

Figure 87: wetland reach at MGK\_E\_Trib3\_5.



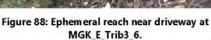




Figure 89: culvert under driveway of MGK\_E\_Trib3\_6.

### Tributary 4 (0.5 km) MGK\_E\_Trib4\_1-2

The fourth tributary on the eastern main channel is located on the true right bank between MGK\_E\_Main\_8 and 9. The tributary has steep upper banks (>20 m) and a wide floodplain gully floor. The channel meanders across the wetland flood plain (see Figure 91). There is significant seepage wetlands located midway on the upper banks. The lower reach (MGK\_E\_Trib4\_1) is shaded by willows growing along the floodplain. The dominant vegetation in upper reaches is carex and exotic grasses (Figure 90).

Upstream of MGK\_E\_Trib4\_2, the watercourse flows through a culvert below an informal farm which is restricting flows resulting in a ponded area upstream. The culvert is in very bad condition with most of the asset already rusted away (Figure 92). There two additional culverted ponds upstream of the driveway (Figure 93).

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Final V4



Figure 90: Wetland floodplain on gully floor at MGK\_E\_Trib4\_1.

Figure 91: Floodplain on gully floor at MGK\_E\_Trib4\_2.





Figure 92: Culvert in poor condition upstream of MGK\_E\_Trib4\_2.

Figure 93: Pond upstream of MGK\_E\_Trib4\_2.

### Tributary 6 (1.1 km) MGK\_E\_Trib6\_1-4

The sixth tributary of the eastern sub-catchment is located on the true right bank of the main channel between MGK\_E\_Main\_10 and 11.

The gully at MGK\_E\_Trib6\_1 and the upstream pond have steep upper banks (> 15 m) with a meandering channel along the floor. The gully has had extensive native planting restoration on both banks undertaken by the landowner (Figure 94). There are however; large infestations of weeds present along the gully floor (Figure 95).

Upstream of the pond (which is pictured in Figure 96), there is a healthy rush wetland with gently sloping upper banks (approximately 5 m high) (Figure 97). Further upstream the channel becomes more incised with dense macrophyte cover and high sediment deposition (>1 m) (Figure 98 and Figure 99). These reaches (MGK\_E\_Trib6\_2 to 4) appear to have been straightened along a farm track and are culverted.

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Figure 94: Native planting along MGK\_E\_Trib6\_1.

Figure 95: Native planting with weed infestations along MGK\_E\_Trib6\_1.



Figure 96: Pond with native planting upstream of MGK\_E\_Trib6\_1.



Figure 97: Rush wetland along MGK\_E\_Trib6\_2.



Figure 98: Channel along MGK\_E\_Trib6\_2.



Figure 99: Channel along MGK\_E\_Trib6\_4.

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39

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Final V4

### Upper channel (1.9 km) MGK\_E\_Main\_12-15, MGK\_E\_Art\_1, MGK\_E\_Trib7\_1-2

Upstream of the defined gully systems, the main channel and tributaries have smaller gully bank heights (<10 m). There are continuous seepages along one or both banks from MGK\_E\_Main\_12 to 15 with high sediment deposition and a mix of run and pools (Figure 100). There is an artificially excavated channel along MGK E Main 13 which has been named MGK E Art 1 (Figure 101) and a seepage wetland along the true left bank of the artificially channel (Figure 102). It is likely that these channels surcharge and combine as one during high flows. The vegetation along these reaches is grey willow canopy with an understorey of aquatic weeds such as willow weed and alligator weed.

The seventh tributary of the eastern main channel (MGK\_E\_Trib8) is located on true left bank. The downstream reaches of the tributary are a spring fed rushland with deep pools and high sediment deposition (Figure 103). Further upstream from this rushland, within a deer farm, there is significant pugging and erosion on the banks and channel (Figure 104). The pugged wetland drains a significant sized pond at the top of the tributary (Figure 105).

The eighth tributary of the eastern main channel is located on the true right bank upstream of MGK\_E\_Main\_15. The tributary (MGK\_E\_Trib8) is a narrow channel which meanders across a wide floodplain with upper banks approximately 3 m high (Figure 106). The tributary is spring feed with seeps located mid-way up the upper banks. There is some pugging and slumping due to the reach being unfenced and large weed infestations (Figure 107).



Figure 100: Channel along MGK\_E\_Main\_12.



Figure 101: MGK E Main 13 and MGK E Art 1.



Figure 102: Seepage wetland on MGK\_E\_Art\_1.



Figure 103: Pools along MGK\_E\_Trib7\_1.

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40

Attachments Page 1819

Final V4





Figure 104: Pugging of rush wetland with gorse along MGK\_E\_Trib7\_2.

Figure 105: Pond upstream of MGK\_E\_Trib7\_2.



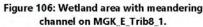




Figure 107: Weed infestations along MGK\_E\_Trib8\_1.

### Headwater Pond series (0.9 km) MGK\_E\_Main\_15-16

There are a series of culverted ponds along the main channel between MGK\_E\_Main\_15 and 17 (Figure 108 and Figure 109) as well as the entire tenth tributary (MGK\_E\_Trib10). These ponds have good canopy cover from mature riparian planting and have grasses growing in shallow areas of the ponds. Majority of the ponds are fenced with a 3 hot wire fence making access difficult.

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Final V4





Figure 108: Pond in series at MGK\_E\_Trib10.

Figure 109: Culverted pond in upper headwaters of eastern catchment.

### Headwaters (0.4 km) MGK\_E\_Main\_17-19

The lower reaches of the eastern sub-catchment headwaters have a wide floodplain and gently sloping upper banks. The channel is well defined along MGK\_E\_Main\_17 where the watercourse has likely been excavated (see Figure 110). Further upstream there is no discernible channel and the floodplain has a dense cover of macrophytes, pasture grasses and carex grasses. The floodplain is entirely fenced with gently sloping upper banks (Figure 111). Upstream of this section the channel has a similar morphology but with dense cover of grey willows and fern undergrowth with patches of weed infestations (Figure 112 and Figure 113).

The upper section of watercourse is likely an ephemeral drain with no defined channel and gently sloping banks. This section was not surveyed as consent was not provided but images are provided from the upstream and downstream end in Figure 114 and Figure 115.







Figure 111: Wetland floodplain with gently sloping upper banks along MGK\_E\_Main\_19.

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Figure 112: Grey willow cover and fern undergrowth along MGK\_E\_Main\_20.



Figure 113: Weed infestations along MGK\_E\_Main\_21.



Figure 114: Looking upstream from MGK\_E\_Main\_21.



Figure 115: Looking downstream from 2131 Ohaupo Road.

# 4.2 Fish Survey and Barriers

During the survey, there were confirmed sightings of five native fish species (additionally one unidentified galaxiid and unidentified eel) and two exotic fish species. The native fish sightings include:

- Long finned eel (Anguilla dieffenbachia)
- Short finned eel (Anguilla australis)
- Banded kokopu (Galaxias fasciatus)
- Giant kokopu (Galaxias argenteus)
- Inanga (Galaxias maculatus)

The summary of fish sightings during the survey is provided in Table 7. It should be noted that the Mangakōtukutuku catchment has previously been identified for its diverse and significant sightings of native fish which also include torrentfish (*Cheimarrichthys fosteri*), banded kokopu, koura (*Paranephrops*), smelt (*Osmeridae*) (Aldridge and Hicks, 2006). There are also historical records of native black mudfish (*Neochanna diversus*).

Restoration efforts by Waikato Regional Council and Mangakōtukutuku Stream care group have included installing several tuna or eel townhouses along the main channel within Sandford Park which are known

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43

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Final V4

to be home to long finned eel and restoring a native wetland upstream of Peacockes Road and introducing black mudfish.

Table 7: Sur	nmary of	fish observa	itions during	j assessment	within the l	Mangakōtukı	ıtuku catch	ment.
	Long finned eel	Short finned eel	Unidentified eel	Banded kokopu	Giant kokopu	Unidentified Galaxid	Koi Carp	Mosquito- fish
Main							✓	
Western Sub- catchment								
Lower		✓						
Mid	✓	✓			✓			
Central Sub- catchment								
Lower			✓	✓				
Mid			✓		✓			
Upper		✓		✓				
Eastern Sub- catchment								
Lower	✓			✓		✓		
Mid			✓					
Upper								✓

There were 32 fish barriers identified during the watercourse assessment. These barriers are a result of both anthropogenic (man-made) assets (such as weirs, culverts, aprons) and natural features (such as cascades) and are assessed as partial or complete barriers to fish species based on typical climbing ability: swimmers e.g. inanga, bullies; climbers e.g. banded and giant kokopu, or anguilliformes e.g. eels. It is noted that where a barrier is considered to be a partial barrier to climbers, it is also assumed to be a complete barrier to swimmers.

Overall, there are a small number of existing road crossings in the central and western catchment, this reduces the number of culverts or other structures in the stream channel that may form potential barriers to fish passage. There are also a small number of existing crossings along the main channel in the eastern sub-catchment with the majority of the barriers identified in the headwaters of the tributaries.

Fish passage barriers identified within the catchment have been prioritised for potential mitigation and remediation actions to improve passage over the structure based on the extent and quality of upstream habitat, consideration of nearby fish passages, and proximity to native fish sightings (Table 8).

High priority fish barrier mitigation works include the culvert outlet below Waterford Road in the eastern sub-catchment, a wooden weir structure upstream of Splitt Avenue in the central sub-catchment and an undercut apron below a private driveway in tributary 5 of the western sub-catchment.

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44

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The section below provides a commentary on the fish sightings, fish passage barriers, any fish pass structures and areas of good fish habitat within each sub-catchment.

Tributary Code	Barrier Impact	Type of Impact	Priority	
MGK_E_MAIN_1	Complete	Swimmers	High	
MGK_E_TRIB6_1	Complete	Swimmers	High	
MGK_E_TRIB2_6	Partial	Climbers	High	
MGK_C_MAIN_3	Complete	Swimmers	High	
MGK_W_TRIB5_1	Complete	Climbers	High	
MGK_C_FORK1_2	Partial	Climbers	High	
MGK_E_TRIB1_5	Partial	Climbers	Medium	
MGK_E_TRIB1_4	Partial	Climbers	Medium	
MGK_C_TRIB1_2	Complete	Climbers	Medium	
MGK_E_TRIB3_3	Complete	Climbers	Medium	
MGK_E_TRIB3_3	Complete	Anguilliformes	Medium	
MGK_E_TRIB4_2	Complete	Anguilliformes	Medium	
MGK_C_FORK2_TRIB1_1	Complete	Climbers	Medium	
MGK_C_FORK2_1	Partial	Climbers	Medium	
MGK_C_FORK2_TRIB1_1	Partial	Climbers	Medium	
MGK_C_FORK2_1	Complete	Swimmers	Medium	
MGK_C_TRIB3_1	Partial	Climbers	Low	
MGK_W_TRIB3_2	Partial	Climbers	Low	
MGK_E_MAIN_17	Partial	Climbers	Low	
MGK_E_TRIB3_6	Partial	Climbers	Low	

### 4.2.1 Main Channel

Along the main channel of the Mangakōtukutuku watercourse, near the confluence with the Waikato River (MGK\_Main\_2), two koi carp were identified near a debris jam (Figure 116).

The Peacockes Road culvert on the main stream was considered to be a barrier to upstream fish passage under most flow conditions (Aldridge & Hicks, 2006). However, the diversity of species previously recorded above this culvert suggests that native species can negotiate this culvert by climbing wetted margins (e.g. eels and banded kokopu) and occasionally by swimming (e.g. inanga and smelt). Species with only moderate climbing ability such as giant kokopu and common bullies also appear to have been able to pass upstream. In 2010, MSCG undertook works on the downstream apron of the Peacockes Road

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45

Attachments Page 1824



Final V4

culvert to improve fish access to upstream habitat for migrating juvenile fish such as giant and banded kokopu (funded by Waikato Catchment Ecological Enhancement Trust and Hamilton City Council).



Figure 116: Debris jam where Koi Carp were sighted along MGK\_Main\_3.

# 4.2.2 Western Sub-catchment

In the lower reaches and tributaries of the western catchment, there were sightings of shortfin eel and a sighting of an unidentified eel. There is a natural cascade causing a barrier to swimming species to 400 m of good habitat along tributary 2. Further upstream another cascade is restricting access for swimmers to an additional 50 m. Along the lower reach of tributary 3 near the main channel, a cascade over bedrock is restricting access to swimmers and a timber weir is a partial barrier to climbing species with approximately 70 m of upstream habitat.

In the mid reaches of the western catchment there were several sightings of longfin and unidentified eels and one sighting of a giant kokopu on the lower reaches of tributary 5. Upstream of these sightings (on the main channel and the lower reach of tributary 5) there are several natural barriers to swimming species (Figure 117 and Figure 118) and a barrier to climbers caused by a culvert apron under a driveway (Figure 119). The culvert apron is severely undercut limiting access for most climbing species to approximately 650 m of good potential habitat and is identified as high priority for remediation.

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Figure 117: Fish passage barrier to swimming species along MGK\_W\_Trib2\_1.



Figure 118: Fish barrier at MGK\_W\_Trib5\_1.



Figure 119: Culvert under driveway causing a fish barrier at the apron MGK\_W\_Trib5\_1.

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Final V4

### 4.2.3 Central Sub-catchment

In the lower reaches of the central sub-catchment (the main channel and tributary 1), there were sightings of banded kokopu and an unidentified eel. A fish passage barrier identified along the lower reach of tributary 1 is restricting access for swimming species to 300 m of excellent fish habitat. Upstream a culvert provides a fish passage barrier to climbers and restricts access to an additional 200 m of excellent fish habitat (Figure 120). Tributary 1 provides good spawning habitat for banded kokopu.

Along the main channel (MGK\_C\_Main\_3), a small weir structure is restricting fish passage to swimming species (Figure 121) to at least 1.6 km of good upstream habitat (before additional barriers are encountered). In the mid reaches of the central catchment, climbing species including the giant kokopu (MGK\_C\_Main\_5) and banded kokopu (MGK\_W\_Trib4) (Figure 122).

Along the first fork in the central sub-catchment, there were sightings of banded kokopu along a small tributary (MGK\_C\_Fork1\_Trib1\_1).

The culvert under John Webb Drive (MGK\_C\_Fork2-3) is slightly perched (less than 100 mm) at the outlet resulting in a fish passage barrier to climbers in low flows pictured in Figure 123. There is good potential habitat above this culvert along the perimeter of Resthills Park. This fish barrier is considered high priority for mitigation.

Along the second fork in the central sub-catchment, MGK\_C\_Fork2\_1, the apron of the culvert outlet which extends under State Highway 3 is restricting swimming species to at least 800 m of satisfactory habitat assuming that there is no network barrier under State Highway 3, however, there the timber weir structure along MGK\_C\_Main 3 is already restricting swimming species.

Along the small tributary off Fork 2 (MGK\_C\_Fork2\_Trib1\_1), the Carbourne wetlands and weir structures present a barrier to climbing species of fish (Figure 124). There is no significant upstream habitat upstream of the Carbourne Wetlands under the current development flows.



Figure 120: Perched culvert presenting a fish barrier in low flows.

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48

Attachments Page 1827



Final V4



Figure 121: Weir structure upstream of Splitt Ave along MGK\_C\_Main\_3.



Figure 122: Banded kokopu caught on MGK\_C\_Trib4\_1.

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Final V4



Figure 123: Fish barrier under John Webb Drive.



Figure 124: Carbourne Wetlands fish barrier.

#### 4.2.4 Eastern Sub-catchment

In the lower reaches of the eastern sub-catchment on MGK\_E\_Main\_1 and 2, a number of unidentified galaxid were spotted in the scoured pool below Waterford Road outlet (Figure 125). The scoured pool is good habitat for fish with overhead cover from canopy and a substantial amount of debris in the pool. The culvert apron is causing a fish barrier with a drop of 0.1 m to water surface and 0.4 m to the channel

MGK\_E\_Main\_3 provides excellent fish habitat with undercut banks, overhanging vegetation, and large woody debris. During the walkover survey, there were sightings of banded kokopu and longfin eel.

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50

Attachments Page 1829



Final V4

The defined gully system along the main channel provides excellent habitat for fish with several deep pools, large woody debris and areas of undercut banks (Figure 126). Shortfin eel were the only species identified along these reaches however there were sightings of banded kokopu and longfin eel in the lower reaches of the tributaries upstream (MGK\_E\_Trib3\_3 and MGK\_E\_Trib4\_1).

There are two fish passage barriers along tributary one of the eastern sub-catchment. These culverts present partial barriers to climbing species due to their drop height on the outlet. Much of the upstream habitat is likely to be ephemeral.

Culvert damming of ponds upstream of MGK\_E\_Trib2\_6 has been undertaken over 950 m of stream. The dams have formed several barriers to fish passage. The most downstream concrete earth dam structure presents a barrier to anguilliforms. Further fish passage barriers were not assessed during the assessment of ponds and culverts upstream of here.

Along tributary three, there is good habitat for fish with a mix of runs riffles and pools with large amount of debris and some bank undercut. During the survey, there were sightings of banded kokopu and longfin eel in the channel. A twin culvert below the informal crossing between MGK\_E\_Trib3\_3 and 4 presents a fish passage barrier to climbing species (Figure 127). There is good upstream habitat along MGK\_E\_Trib3\_4.

Along tributary 4, a poor condition culvert upstream of MGK\_E\_Trib 4\_2 presents a complete barrier to all fish species (Figure 92). There is good upstream habitat for fish including a large pond and wetland.

Along tributary 6, the channel has large pools and riffles and provides excellent habitat for fish. During survey banded kokopu and longfin eel were identified along the lower reaches of this tributary. There is a fish passage barrier downstream of the large pond along the tributary which looks to be fitted with a spat rope (Figure 128).

In the headwaters of the eastern catchment the culverted ponds along MGK\_E\_Main\_15 and 17 and MGK\_E\_Trib10 have high abundance of the invasive mosquito fish. A full assessment of culverts along these ponds was not undertaken due to the 3 hot-wired fencing.



Figure 125: Outlet of Waterford Road culvert.

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51

Attachments Page 1830

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Final V4



Figure 126: Defined gully floor providing good fish habitat.



Figure 127: Fish barrier at perched culvert under farm crossing upstream of MGK\_E\_Trib3\_3.

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Figure 128: Spat rope fitted at culvert upstream of MGK\_E\_Trib6\_1.

### 4.3 Wetlands/Ponds

Ninety-one wetlands or ponds have been recorded in the Mangakōtukutuku catchment which farm ponds, aesthetic ponds and culverting damming as well as seepage springs fed natural wetlands (Figure 129)

The most common types of artificial ponds observed in the catchment were culverted ponds with a significant chain of ponds at 144 Hall Road and the headwaters of the eastern sub-catchment.

The most common type of natural wetlands observed in the catchment was seepage wetlands along gully floors and upper banks. Springs and seepages contribute to the baseflows of the watercourses and can alter the stability of upper banks. This is discussed further in section 4.4.2.

Much of the gully floor along the eastern catchment is a wide floodplain with a meandering channel and is classed as a riverine wetland. Dominant vegetation includes substantial areas of willows and carex, rush wetland species. The riverine wetland and seepage wetlands, although impacted by invasive weeds and stock access, provide important habitat and ecosystem service functions, such as, habitat for macroinvertebrates and avian wildlife, and water quality and quantity functions. The gully floors provide excellent spawning habitat for fish species such as banded kokopu.

All wetlands also provide some level of ecological value including provision of habitat for aquatic macroinvertebrates, fish, and/or water fowl. However, online farm ponds and aesthetic ponds also contribute to negative environmental impacts such as: potential barriers to fish passage; reduced low dissolved oxygen levels; thermal stratification and discharge of higher temperature water.

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Final V4

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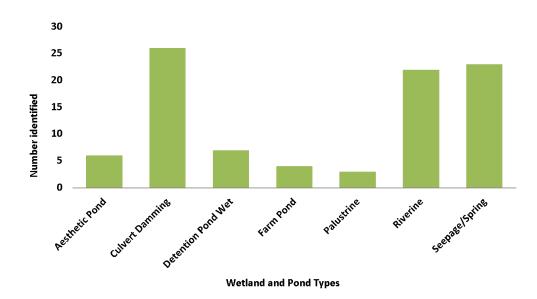


Figure 129: Number of wetlands and ponds identified in the Mangakōtukutuku catchment.

#### 4.4 **Erosion and Scour**

Streams naturally erode and change course over time. Overall, the presence of erosion scarring along the banks of the Mangakōtukutuku catchment is generally low with <20% bank scarring along banks considered typical of a natural watercourse. Much of the bank erosion scarring is located along small contributing reaches leading from the stormwater network to the main channels as well as isolated sections along the main channels. Upper bank stability scores range between 'good' to 'poor' with no reaches returning an 'excellent' score.

#### 4.4.1 **Erosion Scarring and Erosion Hotspots**

Erosion scarring of the reach is assessed as a percentage of the total length of each reach for each bank separately. Erosion scarring is assessed as the area of exposed earth (or recently exposed with some herbaceous vegetation cover) on the stream bank that resulted from bank slumping or scour.

Erosion hotspots are identified as discrete locations of severe erosion causing environmental, infrastructure, and/or health and safety risk. An erosion hotspot is defined as severe erosion located within the channel and or, lower or upper banks, resulting in slumping and exposed soil surfaces and must be;

- actively eroding,
- exceed 2 m in length or have a total surface area of >5 m<sup>2</sup>,
- be detrimental to stream health or causing significant and/or immediate safety or infrastructure

Two assessment criteria provide the overall risk value of the erosion hotspot; instability score (3 or 4) and asset risk score (1 to 4). Overall, if the sum of stability score and asset score is great than 6, the hotspot is considered high risk.

Locations of bank scarring >60% and 40-60%, bank lining assets and high/medium risk erosion hotspots are discussed below for each sub-catchment.

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54

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Final V4

### 4.4.2 Main Channel

Along the main channel, near the Waikato River confluence, there are two erosion hotspots which present a significant area of bank slumping and scour along the true left bank. These areas are within close proximity to the public access track which exists on the upper bank and were therefore assessed as high risk (asset risk score of 3 and erosion score of 3). One of the erosion hotpots is shown in Figure 130.

Further upstream along MGK\_Main\_4 and 5, there is erosion scarring along 20 – 40% of the banks. This reach also has some bank lining assets which consist of toe protection as shown in section 4.1.1. Recent planting and regrading along the reach has been undertaken by the Mangakōtukutuku Stream Care Group (designed by T&T) in an effort to manage erosion (among other objectives) along this reach (Quilter & Miller 2014).



Figure 130: Erosion Hotspot along MGK\_Main\_2.

### 4.4.3 Central Sub-catchment

There are several areas of saturated banks causing erosion hotspots along the central main channel. These generally correspond with areas where seepage locations have also been identified on upper banks. An example of this is along the reaches MGK\_C\_Main\_4 and 5 shown in Figure 131.

Bank erosion scarring at MGK\_C\_Trib1\_2-4 was observed to be 40-60% along both banks (Figure 132). There were several areas of bank slumping and vegetation falling across the channel. In the upper reach, MGK\_C\_Trib1\_4 the channel is actively down-cutting and undercutting banks and there is extensive sediment deposition.

During a follow up walkover of selected reaches in June, an erosion hotspot was identified along MGK\_C\_Trib1\_2 where slumping along the true left bank resulted in a ponga tree and debris to fall across the channel. The erosion score was assessed as 4, however, the asset risk score was 1 therefore the overall risk score is medium. Scouring was evident along this area and there was high sedimentation downstream (Figure 133).

MGK\_C\_Trib2\_1 is 35 m long and with a highly incised channel, steep upper banks (10 m) and high bank erosion scarring (> 60% on both banks) (Figure 134). There are debris jams along the 35 m reach with

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55

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Final V4

areas of thick tradescantia. The reach receives discharge from the piped network via a 600 mm culvert. The outlet has corrugated iron and rocks as a dissipating structure however there is evidence of powerful flows along this reach.

The fourth tributary of the central main channel (MGK\_C\_Trib4) is a highly incised 100 m reach which is assessed as >60% erosion scarring on both banks (Figure 135). The reach receives pipe discharge from the stormwater network through a 425 mm pipe. The immediate banks along the reach are vertical or near vertical and approximately 2.5 m high. The gully banks are steep with an overall stability score of poor. There is extensive planting along the reach with native understory and good overhead cover however, the reach has poor density of vegetation and root mass.



Figure 131: Erosion hotspot on MGK\_C\_Main\_4.

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Figure 132: Down-cutting along MGK\_C\_Trib1\_4.



Figure 133: Bank slumping and scour along MGK\_C\_Trib1\_2 assessed during June 2017 walkover.

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Final V4

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Figure 134: Erosion and scour along MGK\_C\_Trib2.



Figure 135: Incised reach at MGK\_C\_Trib4.

#### 4.4.4 Western sub-catchment

The first tributary of the western channel (MGK\_W\_Trib1) is assessed as having 40-60% erosion scarring along both banks and high sediment deposition was observed. The headwaters of the tributary are two reaches which receive discharge from the stormwater network via several outlets near Bader Street and Pine Avenue.

The reach to the right of the confluence (looking upstream) is a deeply incised channel with active downcutting and bank undercutting along the channel (Figure 136 and Figure 137). The reach has steep upper banks with pine canopy and little understory or ground cover to provide bank stability.

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The reach to the left of the confluence (looking upstream) is a small watercourse with reaches alternating between incised channel to shallow meandering channel (Figure 138). The reach has steep upper banks dominated by weeds including tradescantia.

Further downstream, the channel widens but maintains high erosion scarring along banks with several minor bank slumps and soft erodible soil. Where the tributary meets the main western sub-catchment channel, there is an erosion hotspot with an overall risk value of medium which identified undercutting of the bank. During the June 2017 walkover, the bank had failed and a ponga tree and debris had fallen into the channel.

An isolated section (25 m) of the third tributary along the western main channel (MGK\_W\_Trib3\_1) has >60% bank erosion on both banks. The section of stream is incised with steep gully banks >20 m and evidence of high flows from the amount of debris deposited on the upper banks (Figure 139). There was high sediment deposition with little to no flow during survey. There is limited vegetation on the immediate banks however there was good cover from the surrounding canopy. Upstream, a series of wooden weirs and bank lining structures were observed which may contribute to the erosion identified further downstream (see Figure 140).



Figure 136: Incised channel and erosion scarring along MGK\_W\_Trib1\_Fork1\_2.

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Final V4



Figure 137: Bank undercutting along MGK\_W\_Trib1\_Fork1\_1.



Figure 138: Incised channel along MGK\_W\_Trib1\_Fork2.

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Figure 139: High erosion reach along MGK\_W\_Trib3\_1.



Figure 140: Wooden weir structures upstream of high erosion reach MGK\_W\_Trib3\_1.

### 4.4.5 Eastern Sub-catchment

Overall, the eastern sub-catchment had fair to good stability scores with erosion scarring typically below 40%.

There is one location identified as an erosion hotspot where there is active down-cutting of the channel bed, and slumping of the immediate banks. The banks are highly erodible and often saturated indicating the presence of seepages or springs along the floodplain. The erosion hotspot has an overall risk of medium as there is no risk to public infrastructure or assets (Figure 141). However, given the location of this erosion hotspot within Greenfield land, appropriate management of stormwater inputs should be

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61

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sought as per Management Zone 1 (section 5.1.1). The reach has good cover from pine forest and mixed native and exotic understory.



Figure 141: Erosion hotspot along MGK\_E\_Trib3\_1.

## 4.4.6 Upper Bank Erosion Susceptibility

Upper bank erosion susceptibility is assessed using the Ecoline feature per reach. The assessment uses the Upper Bank stability assessment as per Pfankuch (1975). The upper banks are defined as the "portion of the topographic cross section from the break in the general slope of the surrounding land to the normal high-water line. Terrestrial plants and animals normally inhabit this area".

Each assessment reach of the Mangakōtukutuku Watercourse was assessed for land slope, mass wasting, debris jam and bank vegetation and given a score of Excellent, Good, Fair or Poor. These each correspond with a number and a final score is calculated as the overall stability score (Table 9-12).

The overall upper bank stability in the Mangakōtukutuku varies between poor and good with no reaches returning an excellent score. Areas with poor upper bank stability are located;

- within the central sub-catchment along the main channel (MGK\_C\_Main\_2) (Figure 142),
- the first tributary in the central sub-catchment (MGK\_C\_Trib1),
- . the first fork along the first tributary in the western sub-catchment (MGK\_W\_Trib1\_Fork1) and,
- the small (<100 m in length) tributaries in the central catchment (MGK\_C\_Trib2 to MGK\_C\_Trib4) also have poor upper bank stability (Figure 143).

These areas also correspond with areas of active erosion as discussed in section 4.4.1.

The main channel upstream of the confluence with the Waikato River, the main reaches of the eastern catchment, selected areas of the western sub-catchment and the remaining middle and lower reaches of the central catchment have an overall stability score of fair. For the majority of these reaches, land slope of the upper banks are assessed as poor as the gully banks are steep and between 10 and 25 m high. An example of the upper bank height in the eastern catchment is given in Figure 144.

Of particular concern are the observed upper bank stability scores of poor and fair along the main channel of the eastern sub-catchment. The height (20 m) and angle (above 50 degrees) of the gully banks considered with the presence of seepages and springs along the banks present a real hazard for future

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62

Attachments Page 1841



Final V4

development. The saturated nature of the soil along the banks increases the mobility of the bank material and the likelihood of mass slumping and undercutting.

Table 9: Summary of Pfankuch bank stability assessment of the main channel (% of total stream length).

	Excellent	Good	Fair	Poor
Land Slope	0	0	48%	52%
Mass Wasting	0	0	93%	7%
Debris Jam	0	52%	48%	0
Bank Vegetation	0	100%	0	0
Overall Stability Index	0	0	100%	0

Table 10: Summary of Pfankuch bank stability assessment of the central sub-catchment (% of total stream length).

		•		
	Excellent	Good	Fair	Poor
Land Slope	11%	34%	33%	22%
Mass Wasting	0	61%	30%	9%
Debris Jam	0	74%	9%	16%
Bank Vegetation	0	73%	18%	9%
Overall Stability Index	0	56%	40%	4%

Table 11: Summary of Pfankuch bank stability assessment of the western sub-catchment (% of total stream length).

	Excellent	Good	Fair	Poor
Land Slope	27%	7%	7%	60%
Mass Wasting	12%	17%	27%	44%
Debris Jam	5%	36%	33%	26%
Bank Vegetation	0	40%	54%	6%
Overall Stability Index	0	27%	50%	22%

Table 12: Summary of Pfankuch bank stability assessment of the eastern sub-catchment (% of total stream length).

	Excellent	Good	Fair	Poor
Land Slope	11%	50%	18%	22%
Mass Wasting	8%	64%	20%	7%
Debris Jam	12%	47%	32%	8%
Bank Vegetation	0	40%	33%	27%
Overall Stability Index	0	37%	59%	4%

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63

Page 1842

Attachments

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Final V4



Figure 142: MGK\_C\_Main\_2 assessed as poor land slope, poor mass wasting, poor debris jam and good vegetation. Overall stability score is poor.



Figure 143: MGK\_C\_Trib3\_1 assessed as poor land slope, poor mass wasting, fair debris jam, and fair bank vegetation. Overall stability score is poor.



Figure 144: Confluence of eastern sub-catchment main channel and tributary.

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# 5.0 Options and Actions

# 5.1 Management Zones

Management Zones (MZ) are spatially defined areas based on similar land use pressures, environmental values and geographic/network context. Options for erosion mitigation, enhancement and management have been outlined for these areas. It is anticipated that these management zones will form the basis of management actions to be considered in the Mangakōtukutuku ICMP, which is under development at the time of writing.

Six overarching management zones have been defined and mapped for the 26 km of watercourse surveyed in the Mangakotukutuku catchment (Figure 145) and summarised in Table 13. These are described following and include:

- 1. Eastern Main Channel and Wetlands (MZ1)
- 2. Eastern Modified Tributaries (MZ2)
- 3. Western and Central Tributaries (MZ3)
- 4. Western and Central Main Channels (MZ4)
- 5. Western and Central Farm Drains (MZ5)
- 6. Eastern Tributaries and Wetlands (MZ6)

For each of the MZ's outcomes have been defined to support management actions. Outcomes are generally grouped in the following manner:

- Terrestrial ecological outcomes
- Freshwater ecological outcomes
- Stormwater outcomes

For the western and central sub-catchments some of the existing common pressures and impacts result from historical and existing land use including:

- Loss of riparian margin vegetation;
- Stock access to waterways;
- · Contaminants entering waterways; and,
- Barriers to fish passage

Management zones 3, 4 and 5 are located within the central and western sub-catchment, as the Brownfields watercourses and headwaters. The pressures and impacts on the watercourse in the central and western sub-catchment are identified and considered as part of this report. The opportunities identified are both consenting requirements (fish passage barrier mitigation as part of the CSDC), conveyance of stormwater and increasing the biodiversity value of reaches. This may include providing support to community groups for weeding and planting (such as those identified by the Mangakōtukutuku Stream Care Group).

Management zones 1, 2 and 6 are located within the eastern sub-catchment. The pressures and impacts of growth on the eastern Peacocke sub-catchment are of particular importance with the changing land use where there is opportunity and consenting requirements to enhance part of the network. The main pressures and impacts identified in the eastern sub-catchment as a result of recent and proposed Greenfield development include:

- Change in land use and the associated contaminants of concern;
- Increased imperviousness and associated changes in hydrograph and impacts on watercourses, including increased potential for channel erosion and reduced base flows; and,

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65

Attachments Page 1844



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Final V4

- Further potential barriers to fish passage with the development of more roads and associated culvert structures.
- Loss of riparian connectivity through the main gully channel.

Guiding objectives for the management of the catchment are:

#### Terrestrial Ecological:

- Protection and enhancement of areas of significant habitat incorporating buffers to protect sensitive habitats, weed control, and facilitate natural regeneration processes;
- Encourage diversity in motorway plantings to increase the habitat potential of these large areas of restoration plantings;
- Encourage use of native tree species plantings (e.g. street trees) to connect with riparian networks.

#### Freshwater Ecological:

- · Protection of natural drainage through the catchment;
- Provide riparian margins through development setbacks;
- · Provide for recreational and amenity values through protection of watercourses;
- Enhancement of streams and wetlands, especially those with no riparian vegetation;
- · Removal of exotic riparian species (in stages if required), and replace with native species;
- Mitigation of barriers to fish passage, through removal/upgrading/retrofitting of culverts.

#### Stormwater Outcomes

- At source (or as close as possible) stormwater management methods are preferred to mimic natural hydrology. Where specific site constraints require centralised devices their proposed efficiency should be considered;
- · Encouraging developers to consider a water sensitive design process;
- · Treatment of high contaminant generating areas.

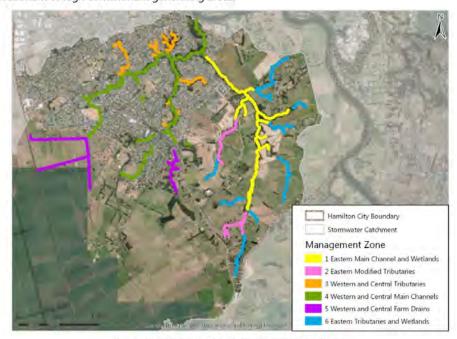


Figure 145: Mangakótukutuku Management Zones.

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66



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#### 5.1.1 Management Zone 1 – Eastern Main Channel and Wetlands

The undeveloped eastern sub-catchment has steep upper banks and a wide floodplain gully floor forming riverine wetlands dominated by rushes and sedges. The main channel through these wetlands is sinuous. Riparian vegetation is variable ranging from areas dominated by grey willow, mature pines, or minimal canopy and dominated by weed infestations including tradescantia and blackberry. High sediment deposition was commonly observed in reaches dominated by mature pines. The upper bank stability scores along these reaches are generally poor or fair.

There is wetland seepage located along the upper banks or along the floodplain areas in several locations. These seepage springs cause the ground to be saturated (increasing erosion susceptibility) and are considered a highly sensitive environment for both hydrology and biodiversity reasons.

Through the development process of the eastern sub-catchment, the main channel watercourse is likely to experience increased volumes of stormwater runoff (and if not attenuated then also increased peak flows). The Mangakōtukutuku gully is likely to have enough capacity to deal with large volumes given the width and depth of the channel however this would be at a cost to the stability of the banks as the majority of these reaches are assessed as fair bank stability. Currently, erosion scaring was observed over less than 40% of reaches. Increased flows and volumes are likely to increase scour of gully floor and fluvial erosion of the lower stream banks resulting in undercutting of banks and stream widening. The presence of seepages and springs further reduces the overall bank stability and may result in a higher risk of bank failure.

Following development, erosion is expected to increase due to increased flow volume and the potential for increased peak flow velocities. This will result in downcutting and widening of the stream, an increase in sediment loss and the potential loss of ecological value if wetland engagement reduces. The effects of erosion will worsen over time, and is anticipated to require remediation works in approximately 5 to 10 years from the time of development.

As part of the management of these reaches and the overall development strategy of the Peacockes structure plan implementation, an adequate set back of infrastructure should be identified from the top of the banks. This should be supported by a hydrogeology and geotechnical investigation.

The riverine wetland and seepage wetlands, although impacted by invasive weeds and stock access, provide important habitat and ecosystem service functions, such as, habitat for macroinvertebrates and avian wildlife, and water quality and quantity functions. The gully floors provide excellent spawning habitat for fish species such as banded kokopu. Several banded kokopu and longfin eel were sighted throughout or upstream of this management zone.

Maintaining baseflow is important to protect and sustain the riverine wetland and seepage wetland ecology. This should be further investigated through the hydrogeology investigation.

Structures forming a barrier or restricting fish access throughout the gully area should be considered for removal or mitigation. These include the twin culverts beneath a farm crossing along MGK\_E\_Trib3\_3 (ID 009 and 010) and outlet below a driveway crossing at MGK\_E\_Trib6\_1 (ID 012).

Planting works should be prioritised for the areas within Hamilton City Council owned land and considered for community engagement or public purchase for the privately-owned areas.

Much of the land is predominantly privately owned however; as part of the Southern links designation, several properties corresponding with this management zone will be acquired by council. Council may be in a position to acquire land that is deemed suitable for the Ecological Monitoring and Management Plan restoration locations during Greenfields development.

Suggested actions and objectives specific to Management Zone One are to:

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67

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Final V4

- Plant native riverine wetland species along the gully floor and appropriate native riparian buffer on banks prior to staged willow removal through appropriate Waikato Regional Council practice;
- Increase channel heterogeneity and provision of toe protection through introduction of sand/pebbles/cobbles to the channel bed in locations where existing erosion is <20% and bank stability is fair or poor;
- 3. Mitigation of fish barriers and consideration of upgrade or removal of culverts;
- Promote the reduction of stormwater flows through incorporation of on lot water quality detention devices and centralised sub-catchment devices prior to the consideration of mitigation measures;
- 5. During development, manage location and number of stormwater outlets to MZ 1 watercourses to allow for appropriate outlet structure design;
- 6. Promote the protection of upper bank and gully bank vegetation to reduce the likelihood of bank vegetation removal during construction and development applications in line with action 1.

#### 5.1.2 Management Zone 2 – Eastern Modified Tributaries

There is extensive modification of the watercourse in the eastern sub-catchment tributaries which include damming the watercourse to make a chain series of online ponds.

Online ponds and culvert damming cause surface water to pool and back up behind culverts. As a result, baseflows are often reduced especially during summer with impacts on water quality and freshwater ecology including increased temperatures and lowering of dissolved oxygen levels. Online ponds also present preferred habitat for exotic pest species such as mosquito fish.

Series of online aesthetic ponds are located in two discrete locations of the eastern sub-catchment in Mangakōtukutuku. These locations are: the midsection of Tributary 2 at 143 Hall Road (900 m of watercourse dammed to make a chain of eight ponds); and a section of the headwaters of catchment (300 m of watercourse dammed to make a chain of seven ponds) and the nearby tributary 10 (310 m of watercourse dammed to make a chain of 10 ponds).

The removal of online ponds in the catchment is generally recommended however the decision to remove, enhance or modify the ponds will depend on several constraints and opportunities including:

- 1. The cost of (and appetite for council to pay) for the naturalisation of the channel to return to natural state and the future ownership of the land (council vs privately owned);
- 2. The requirement/need for the ponds to become centralised sub-catchment stormwater management devices if the surrounding typography and location within the catchment is suitable;
- 3. The likelihood or authorisation of the dam/culverting works and structure to become consented under the RMA 1991;
- 4. The availability of upstream habitat for native fish species;
- The existing function of the pond to restrict flows and provide detention to reduce downstream erosion and scour.

#### 5.1.3 Management Zone 3 –Western and Central Tributaries – Erosion Remediation

The reaches under MZ3 include the tributaries to the main channel of the western and central sub-catchments. These areas generally require the most in stream works and should be prioritised as erosion mitigation projects. Refer to specific projects in section 5.2 and 5.3 for further details.

Several of the tributaries draining to the main sub-catchment channels have high erosion scarring with undercut banks. These reaches receive flows from the stormwater network via several outlet structures. Overhead cover is variable with good shading and riparian extent coinciding with reserves such as Te Anau Park, Fitzroy Park and Sandford Park.

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68



Final V4

There areas are considered to have good fish habitat and present an opportunity for increased ecological value with fish passage mitigation while maintaining aspects of existing channel morphology. The highest priority fish barrier mitigation in this management zone is the undercut culvert beneath a private drive crossing along MGK\_W\_Trib5\_1 (ID 027). It is recommended that council consider the following mitigation measures under this management zone:

- 1. Re-grading of banks to 3:1 (maximum) slope;
- Provide toe protection to reduce down-cutting in stream while increasing channel heterogeneity for fish habitat and introduction of woody debris, log overhangs and refuge tunnels;
- 3. Mitigation or removal of high priority fish barriers during works;
- 4. Weeding on immediate banks particularly tradescantia infestations and plant species with deep root mass along the banks;
- 5. Maintain overhead cover.

# 5.1.4 Management Zone 4 – Western and Central Main Channels – Biodiversity and Conveyance

Majority of the western and central main channels in the Mangakötukutuku catchment are stable, uniform channels with approximately 1 m wide wetted width and steep upper banks. These reaches have an important conveyance value to provide the pathway for stormwater in the catchment to the Waikato River.

These reaches generally have high watercourse shading and low bank erosion scarring. The vegetation along the reaches are predominantly exotic with significant infestations of tradescantia. Isolated sections have been planted and maintained by the Mangakōtukutuku Stream Care Group supported by Hamilton City Council and Waikato Regional Council.

It is recommended that HCC supports and contributes to community plantings organised by Mangakōtukutuku Stream Care Group in these areas and considers projects along the reaches to restore the riparian extent to native.

HCC must also recognise the importance of these reaches for stormwater conveyance and therefore maintenance of assets along these sections must be managed. Maintenance measures include:

- 1. Repair or replace bank lining assets identified to be in poor condition;
- 2. Mitigate existing erosion hotspots by regrading banks, providing toe protection, or consider artificial bank lining;
- 3. Repair or replace culverts identified to be in poor condition (e.g. condition rating of 4 or 5);
- 4. Mitigation or removal of fish barriers.

#### 5.1.5 Management Zone 5 – Western and Central Farm Drains

The headwaters of the western and central sub-catchments are agricultural farm drains. These reaches have been straightened and, in some cases, deepened to lower the water table and provide additional arable land. These areas are likely to have historically been part of a peatland wetland. It should be noted that both the western and central headwaters extend beyond the subject catchment and it is assumed that the drains are similar in morphology and the management can be applied to the entire drainage network.

A small proportion of these watercourses were accessible to stock, this is likely due to the fact that the Mangakōtukutuku Stream Care group and Waikato Regional Council have been active in planting and fencing especially in the western catchment. The farm drains are located on privately owned land.

Suggested actions and objectives specific to this Management Zone are to:

1. Support the Mangakōtukutuku Stream Care Group in the engagement with landowners to:

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69



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Final V4

- Plant all stream banks with native riparian vegetation to a width of 20 m on both banks where
  possible (with consideration of conveyance functions and flood flows);
- b. Promote stock exclusion via fencing to protect watercourses, natural wetlands and springs;
- 2. Investigate for possible mudfish habitat.

#### 5.1.6 Management Zone 6 – Eastern Tributaries and Wetlands

The headwaters of the tributaries and main reaches of the eastern sub-catchment in the Mangakōtukutuku catchment are low lying wide floodplain reaches or seepage wetlands often fed by springs. Majority of these areas have little overhead cover from vegetation, sparse understorey and are more than likely grazed by stock.

All of the watercourse in this management zone will be affected by Greenfield development. The reaches are expected to experience increased volumes and stormwater runoff, and if not attenuated, also increase peak flows. Currently erosion scaring is generally less than 20%. Following development, erosion is expected to increase with the stream channel becoming more defined, resulting in downcutting. It is anticipated that erosion remediation works may be required approximately 10 to 20 years following development.

The surrounding land is predominantly privately owned, however, as part of the Southern links designation, several properties corresponding with this management zone will be acquired by council. Council will also endeavour to acquire land that is deemed suitable for the Ecological Monitoring and Management Plan restoration locations during Greenfields development. Suggested actions and objectives specific to this Management Zone are to:

- 1. Plant native riverine wetland species along the floodplain floor and native riparian buffer while undertaking tradescantia, gorse and blackberry removal;
- 2. Identify set back of developable land based on the Waikato Riverbank and Gully Hazard Area and presence of seepage wetlands and springs;
- 3. Mitigation or removal of fish barriers;
- 4. Provide for recreational and amenity values through protection of watercourses;
- 5. Consider stormwater treatment and management devices in the headwaters of tributaries.

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#### 5.1.7 Management Zone Summary

	Table 13: Summary of Management Zones								
	Management Zone	Land Development type	Description	Main issues	Opportunities				
MZ1	Eastern main channel and wetlands	Greenfields	Non-developed, with steep upper banks and a wide floodplain gully floor forming riverine wetlands dominated by rushes and sedges.	<ul> <li>Potentially modified hydrographs due to increased impervious surfaces from development.</li> <li>Potential piping, diversions and/or reclamations of watercourses</li> <li>Potential exacerbation of existing erosion issues</li> </ul>	<ul> <li>Establish native riverine wetland plant communities along gully floor and native riparian buffer species on banks.</li> <li>Enhance existing native fish habitat and maintain fish passage by utilising best practice infrastructure design.</li> </ul>				
MZ2	Eastern modified tributaries	Greenfields	Extensive modification of the watercourses, including damming to create series of online ponds. Online ponds have caused changes in base flow, habitat type and availability and biochemical water quality conditions.	<ul> <li>Extensively modified watercourses, with culvert damming.</li> <li>Potential increased erosion downstream if these ponds are removed</li> </ul>	<ul> <li>Naturalisation of these ponds to increase watercourse connectivity and provide upstream fish habitat – needs to consider downstream impacts on erosion.</li> <li>Utilising existing ponds as part of stormwater. management devices if surrounding topography and location within catchment is suitable.</li> </ul>				
MZ3	Western and Central tributaries	Brownfield	Modified watercourses with several reaches showing severe erosion scarring and unstable undercut banks.	<ul> <li>Severe erosion noted in many reaches within the management zone</li> <li>Man-made fish barriers such as culverts</li> </ul>	<ul> <li>As part of development, opportunity to stabilise banks, create set-backs, and increase native vegetation. These actions will mitigate further erosion and enhance ecological values.</li> <li>Good fish habitat present throughout reaches, opportunities to increase ecological value, fish barrier mitigation.</li> </ul>				
MZ4	Western and Central Main Channel	Brownfield	Generally, have high watercourse shading and low bank erosion scarring. Vegetation along the reaches are predominately exotic with significant infestations of Tradescantia.	Isolated examples of stormwater infrastructure degradation	<ul> <li>Maintenance of assets; repair or replace bank lining assets identified to be in poor condition, mitigate existing erosion hotspots, repair or replace culverts identified to be in poor condition (rating of 4 or 5).</li> </ul>				
MZ5	Western and Central Farm drains	Brownfield	Agricultural farm drains, often straightened and deepened with evidence of stock damage.	<ul> <li>Agricultural streams, modified through straightening and deepening</li> <li>Stock damage is evident in these watercourses</li> </ul>	<ul> <li>Promote stock exclusion via fencing. This can be supported by statutory requirements such as the Proposed Healthy Waters Waikato Regional Plan Change 1. Schedule C – stock exclusion.</li> <li>Working with landowners to promote riparian planting.</li> </ul>				
MZ6	Eastern tributaries and wetlands	Greenfield	Headwaters and main reaches of the eastern tributaries are low- lying wide floodplain reaches or seepage wetlands often fed by springs. Little overhead cover from vegetation, sparse understory and modified by stock access.	Low-lying seepage wetlands modified by stock damage and pastoral land use	<ul> <li>As part of the NZTA Southern Links designation, several properties will be acquired by Council.</li> <li>Opportunity to implement effective stormwater design with positive ecological outcomes.</li> </ul>				

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#### 5.2 Erosion Mitigation Projects

The conversion of Greenfield and low density developed Brownfield areas to higher density urban areas will result in an increase in impervious surfaces, and associated changes in the hydrograph of receiving watercourses. These changes in the hydrograph often include 'flashy' hydrology with elevated flow depths and velocity, as well as lower base flows.

Mitigation of frequent flow changes is likely to be incorporated in development proposals, however there will be a residual potential that development will increase the erosion and channel instability downstream. Remediation of current instabilities is important to mitigate this further erosion risk in the sub-catchment resulting from the proposed development. Engineering approaches to remediate channel instabilities include reducing channel bank grade, placement of boulders for bank protection, and planting riparian vegetation buffers. The mitigation projects identified in this assessment arise from existing issues that have the potential to be exacerbated by changes in the contributing catchment, and areas within the Greenfields area which have the potential to be affected be erosion following development.

Where erosion hotspots, 'poor' Pfankuch stability scores, or reaches with erosion scarring > 60% were identified, engineering approaches to mitigate further erosion are recommended (EMP\_01 to EMP\_15) and are detailed in Table 14. Within the Greenfields area, an assessment was undertaken on the existing condition of the stream and the potential impact to stream erosion that could occur following development (EMP\_16 to EMP\_31) and are detailed in Table 15. Refer to Appendix 1 for a map showing the location of these projects within the catchment.

The erosion mitigation projects within the Greenfields areas is a high-level assessment based on current geomorphology and observed erosion within similar watercourses in Hamilton following development. The actual effects will be a function of the type of development and management of stormwater that occurs, and the natural factors of vegetation, topography and geology of the reaches. The projects shown should be treated as a guide for future planning, however, the actual scope and location of erosion mitigation projects will likely vary from those shown. Areas not currently designated as an EMP may also require future erosion mitigation projects if actual erosion effects are found to be worse than assumed.

It should be noted that the primary objective of these erosion mitigation projects is to manage existing erosion issues and mitigate residual future erosion effects only. The scope of these erosion mitigation projects does not provide mitigation solutions for agricultural best practices such as stock exclusion to waterways and have therefore not been costed for but have been noted where applicable. The projects do not directly seek but may have co-benefits to improve water quality, ecological enhancement, or amenity values. For enhancement opportunities, which aim to address factors such as ecological and amenity values within the Mangakōtukutuku catchment where erosion mitigation is not the primary driver, refer to in Section 5.3.

High-level costs for the proposed erosion mitigation measures using unit rates and costs applied to erosion mitigation works are derived from quotes and invoices from physical works in the last five years in the Auckland market. The rates are considered representative at the time of writing. The assumptions used to derive each unit cost is outlined in Appendix 2. It is recommended that the final costings presented in this report should be considered as indicative only with detailed options analysis and planning assessment is conducted to inform capital works at the detailed design stage. The sum of the 31 erosion mitigation costs (including physical works, project preparation and contingency) is \$ 12,532,000 (Table 16 & Table 17) with further project preparation and contingency costs breakdown in Appendix 3.

The cost estimates also exclude land acquisitions, excavation in solid rock, removal of contaminated material or asbestos, consent or development contributions, funding costs and legal fees, GST and unforeseen ground conditions. Detailed costing will be required at the detailed design stage. The purpose of the costs provided in this report is to indicate relative costings for the purpose of decision making.

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Hamilton City Council
Te kaunihera o Kirikirira

Mangakōtukutuku Catchment Watercourse Assessment Report Prepared for Hamilton City Council

Final V4

Project ID	Location in the catchment	Associated reach length	Issue	Proposed erosion mitigation works	High level costs for physical works
EMP_01	MGK_Main_2	328 m	Fluvial erosion resulting in highly incised, steep stream banks.  The subject reach receives discharge from the majority of the upstream contributing catchment.  Increases in impervious cover maybe influencing peak discharge which is resulting in channel forming flows, localised erosion and sediment mobilisation.	<ul> <li>Provide toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Replacement of weeds (tradescantia and Japanese walnut) with natives and consideration of staged willow removal</li> </ul>	\$ 737,000
EMP_02	MGK_E_Main_1	71 m	Fluvial erosion resulting in highly incised, steep stream banks. Constricted, narrow channel, toe erosion and degradation	Keystone boulders to provide toe protection	\$ 105,000
EMP_03	MGK_W_Fork1 MGK_W_Fork1_Trib1	499 m	The channel is narrow and incised with regular slumping, scour and undercut. The reaches are assessed as 40-60% bank erosion scarring or slumping and the bank stability is assessed as fair or good. There is a large erosion hotspot in the lower reach.  The upper portion of the subject reach has sparse overhead cover no pine canopy or understorey.	<ul> <li>Provide toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Replacement of weeds such as willows, tradescantia and Japanese walnut with natives</li> </ul>	\$ 394,000
EMP_04	MGK_C_Trib1_2 to 4	867 m	Much of the reach is classed as having 40-60% erosion along both banks with remaining reaches identified as having landslips and medium overall risk value erosion hotspots. Overall stability score of the upper banks is assessed as fair to poor. There is also significant sediment deposition along the banks.	<ul> <li>Provide toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Replacement of weeds such as willows, tradescantia and Japanese walnut with natives</li> <li>Mitigate fish barrier to climbing species at culvert outlet beneath path crossing MGk_C_Trib1_2 by installing a fish ladder or spat rope.</li> </ul>	\$ 703,000
EMP_05	MGK_W_Trib5_1 to 10	857 m	The reach has steep upper banks (10 m high) where residential houses are located. Tradescantia is the dominant ground cover across the floodplain and there are several weed infestations of blackberry and bind weed.  The upper reaches of the tributary (MGK_W_Trib5_7) is a concrete lined channel with concrete bank lining which has an impact on flow regimes, resulting in flashy flows and low base flows.	<ul> <li>Increased channel heterogeneity of cobbles and rocks to support fish habitat</li> <li>Significant weeding and replanting with natives</li> <li>Naturalisation/removal of the lined channel along MGK W Trib5 7</li> </ul>	\$ 428,000
EMP_06	MGK_W_Trib4_1 to 2	139 m	An incised watercourse with 15 m high steep upper banks. The outlet at Bruce Avenue has a dissipating structure of concrete blocks for a section of the downstream watercourse. There is considerable vegetation overgrowth preventing a full assessment of the asset however it is generally considered that this vegetation may pose a risk during high storm flows and should be cleared.	<ul> <li>Weeding and planting of natives 5m either side of reach to support the regraded banks</li> </ul>	\$ 52,000
EMP_07	MGK_C_Trib4_1	100 m	The reach consists of an incised channel with approximately 1 m high lower banks. The upper banks are approximately 8 m high. The reach has high bank erosion scarring (>60% reach length) and a poor overall upper bank stability score.  Down-cutting and channel widening is occurring along this reach which is likely a result of the piped discharge from the surrounding residential areas.	<ul> <li>Toe protection to banks and along channel while increasing channel heterogeneity of cobbles and rocks</li> <li>Bank regrading to 3:1 slope</li> <li>Planting of native understory along regraded banks</li> </ul>	\$ 242,000
EMP_08	MGK_W_Main_12	133 m	Ongoing erosion resulting in highly incised, steep stream banks.	<ul> <li>Toe protection to banks</li> <li>Regrading of banks</li> <li>Planting of native understory along regraded banks</li> </ul>	\$ 231,000
EMP_09	MGK_C_Fork1_1	35 m	The outlet of the triple culvert under state highway 3 has a concrete headwall with an informal timber lining above one of the culvert headwalls which extends along the upper true left bank for approximately 12 m.  The lining is assessed to have a high risk of collapsing and maintenance is required. Erosion is occurring at the outlet of these culverts.	<ul><li>Newbury Rock riffle</li><li>Keystone boulders</li><li>Grade control</li></ul>	\$ 113,000
EMP_10	MGK_E_Main_3 to 5 MGK_E_Trib2_1 to 3	160 m	Constricted, narrow channel with wide floodplains.  High sedimentation in the stream channel.  To increase the ecological and biodiversity value of the watercourse, tradescantia in the lower reach and that the riparian margins of the entire reach should planted with appropriate native flora.	<ul> <li>Weeding and planting of native understory along regraded banks</li> </ul>	\$ 56,000
EMP_11	MGK_Main_7 to 8, MGK_E_Trib3 MGK_Trib4_1	378 m	Fluvial erosion resulting in highly incised, steep stream banks.	<ul> <li>Toe protection along channel</li> <li>Weeding and planting of natives 5m either side of reach to support the regraded banks</li> </ul>	\$ 296,000

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73



Final V4

Project ID	Location in the catchment	Associated reach length	Issue	Proposed erosion mitigation works	High level costs for physical works
EMP_12	MGK_C_TRIB2_1	35 m	Incised lower banks, steep upper banks – 20 m high. High (> 60% of reach) erosion with loose sediment deposition with low flow, Woody debris creating pooling and localised flooding. Limited vegetation on floodplains.	<ul> <li>Bank batter to regrade banks to a 3:1 slope</li> <li>Erosion planting</li> <li>Retaining</li> <li>Toe protection</li> </ul>	\$ 112,000
EMP_13	MGK_C_MAIN_4	160 m	Unstable bank undercutting and slumping along reach. Poor water clarity. Timber lining extending approx. 30 m in the lower reaches.  Thick tradescantia weedy ground cover, with limited riparian vegetation.	<ul><li>Bank batter</li><li>Erosion planting</li><li>Toe protection</li></ul>	\$ 598,000
EMP_14	MGK_C_FORK1_2	290 m	Steep incised channel along lower reach.  Bank undercutting and slumping,  Debris including concrete blocks present in stream channel.	<ul><li>Bank batter</li><li>Erosion planting</li><li>Toe protection</li></ul>	\$ 587,000
EMP_15	MGK_E_TRIB3_1 MGK_W_TRIB3_1	24 m	Severe bank erosion, scouring and slumping along entire reach length. Unstable banks with limited vegetation. Large woody debris in stream channel has significantly altered the hydrology of the reach. Thick tradescantia ground cover.	<ul><li>Bank batter</li><li>Erosion planting</li></ul>	\$ 17,000
Total					\$ 4,671,000

			Table 15: Proposed Future Erosion Mitigation Works in the Mangakōtukı	ıtuku catchment	
Project ID	Location in the catchment	Associated reach length	Potential Issues Following Development	Proposed erosion mitigation works	High level costs for physical works
EMP_16	MGK_E_MAIN_2 to 4	854 m	Defined channel that may experience downcutting and widening with a change in stream hydrograph Stream banks will likely steepen and be susceptible to mass slumping. Fluvial erosion to stream banks is likely to increase, especially in areas of higher velocity flow, such as the outside of bends, constriction points, and at debris jams. Areas lacking in vegetation will likely experience increase erosion. Grade control may be required to maintain floodplain engagement.	<ul> <li>Erosion planting</li> <li>Bank regrading</li> <li>Toe protection</li> <li>Grade control structures</li> </ul>	\$788,000
EMP_17	MGK_E_Trib1_1 to 2	206 m	Defined channel within wetland area. May experience downcutting and removal of accumulated sediment. This will steepen bank grades, which can lead to bank slumping. Fluvial erosion is likely to increase, especially in areas of higher velocity flow such as the outside of bends, constriction points, and at debris jams. Grade control structures may be required to reduce flow velocity and to maintain engagement with the wetlands.	<ul><li>Bank batter</li><li>Toe protection</li><li>Grade control structures</li></ul>	\$175,000
EMP_18	MGK_E_Trib1_3 MGK_E_TRIB1a_1	278 m	Narrow channel that may experience downcutting and widening, and leading to steep bank grades, increase fluvial erosion and the potential for mass slumping. Lack of vegetation will increase soil susceptibility to erosion. Grade control structures may be required to reduce flow velocity due to the steep grade.	<ul> <li>Erosion planting</li> <li>Bank regrading</li> <li>Toe protection</li> <li>Grade control structures</li> </ul>	\$348,000
EMP_19	MGK_E_Trib1_4 to 5	218 m	The lack of vegetation will make the soils susceptible to fluvial erosion and potential downcutting.	Erosion planting	\$79,000
EMP_20	MGK_E_TRIB2_3 to 4	107 m	Currently a wetland area with sediment build up. Changes in the stream hydrograph may result in the sediment flushing out, which would lead to widening and downcutting of the stream. Grade control recommended to reduce flow velocity and minimise risk of loss of sediment.	<ul><li>Erosion Planting</li><li>Bank batter</li><li>Grade control</li></ul>	\$129,000
EMP_21	MGK_E_MAIN_7	178 m	Currently a wetland reach. Changes in the stream hydrograph may result in downcutting of the channel and increased fluvial erosion to the banks, particularly on the outside of bends, constriction points and at debris jams.	<ul><li>Bank batter</li><li>Toe protection</li></ul>	\$130,000
EMP_22	MGK_E_TRIB3_2 to 3	477 m	Currently a shallow channel that may begin to down cut following a change to stream hydrograph.  This may lead to mas slumping of banks and increase fluvial erosion and channel widening.	<ul><li>Erosion planting</li><li>Bank batter</li></ul>	\$195,000
EMP_23	MGK_E_TRIB4_1	204 m	Shallow, meandering channel. Increased fluvial erosion is expected to occur, especially in areas of higher velocity such as outside bends, constriction points and at debris jams.	<ul><li>Erosion planting</li><li>Bank Batter</li><li>Toe protection</li></ul>	\$145,000
EMP_24	MGK_E_MAIN_9	511 m	Defined channel that may experience downcutting and widening with a change in stream hydrograph. This may result in mass slumping of stream banks and an increase in fluvial erosion especially in areas of higher velocity flow, such as the outside of bends, constriction points, and at debris jams.	<ul><li>Bank batter</li><li>Toe protection</li></ul>	\$362,000

74

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Te kaunihera o Kirikiriroa

Mangakōtukutuku Catchment Watercourse Assessment Report Prepared for Hamilton City Council

Final V4

75

Project ID	Location in the catchment	Associated reach length	Potential Issues Following Development	Proposed erosion mitigation works	High level costs for physical works
EMP_25	MGK_E_TRIB6_2 to 3 MGK_E_TRIB6a_1	501 m	Incised channel that may experience downcutting and widening with a change in stream hydrograph. This may result in increased fluvial erosion and mass slumping of banks, particularly in areas of higher velocity such as the outside of bends and constriction points.	<ul><li>Erosion planting</li><li>Bank batter</li><li>Toe protection</li></ul>	\$269,000
EMP_26	MGK_E_TRIB6_4 to 5	358 m	Shallow channel that may experience downcutting and widening and removal of built up sediment with a change in stream hydrograph. This may result in increased fluvial erosion and mass slumping of banks, particularly in areas of higher velocity such as the outside of bends and constriction points.	<ul><li>Erosion planting</li><li>Bank batter</li></ul>	\$103,000
EMP_27	MGK_E_MAIN_11 to 12	576 m	Defined channel that may experience downcutting and widening with a change in stream hydrograph. This may result in increased fluvial erosion and mass slumping of banks, particularly in areas of higher velocity such as the outside of bends and constriction points and debris jams.	<ul><li>Bank batter</li><li>Toe protection</li></ul>	\$417,000
EMP_28	MGK_E_MAIN_13 t0 15	564 m	Wide flood plain with pools and sediment accumulation, and existing drainage ditch removing flow from the stream. A change in stream hydrograph will likely removal built up sediment and lead to additional fluvial erosion and downcutting, particularly in areas of higher velocity such as the outside of bends and constriction points and debris jams.	<ul><li>Erosion planting</li><li>Bank batter</li><li>Toe protection</li></ul>	\$443,000
EMP_29	MGK_E_TRIB8_1	211 m	Shallow, wetland area with a channel starting to become defined. A change in stream hydrograph is expected to increase fluvial erosion, leading to downcutting and widening.	<ul><li>Erosion planting</li><li>Bank batter</li></ul>	\$98,000
EMP_30	MGK_E_MAIN_16 to 17	154 m	An artificially straightened channel with sharp bends. Increased flow volumes and velocity expected to increase fluvial erosion, particularly in areas of higher velocity, such as the outside of bends and constriction points and debris jams. This could result in mass wasting of side slopes.	<ul><li>Erosion planting</li><li>Bank batter</li><li>Toe protection</li></ul>	\$72,000
EMP_31	MGK_E_TRIB7_2	75 m	Currently this is a wetland reach with a pond upstream. Flow volume and velocity is expected to increase following development, especially upstream where the pond may provide stormwater attenuation. Increased fluvial erosion and downcutting is expected to occur.	<ul><li>Erosion planting</li><li>Bank batter</li><li>Toe protection</li></ul>	\$63,000
Total					\$ 3,816,000

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12 August 2021



Mangakōtukutuku Catchment Watercourse Assessment Report Prepared for Hamilton City Council

Final V4

			Table 16	5: Proposed erosion mitiga	ition works costs (\$ round	ed to nearest \$000)			
Project ID	Bank Batter Excavation	Coir Matting	Planting	Keystone Boulders	Newbury Rock Riffle	Toe Protection	Physical Works Total*	Project Preparation**	Total including 20% Contingency
EMP_01	408,000	48,000	100,000			181,000	737,000	170,000	1,088,000
EMP_02				105,000			105,000	25,000	156,000
EMP_03	70,000	15,000	179,000			130,000	394,000	90,000	581,000
EMP_04	185,000	38,000	307,000			173,000	703,000	161,000	1,037,000
EMP_05	46,000	9,000	287,000			86,000	428,000	99,000	632,000
EMP_06			52,000				52,000	12,000	77,000
EMP_07	124,000	12,000	37,000			69,000	242,000	55,000	356,000
EMP_08	105,000	15,000	46,000			65,000	231,000	53,000	341,000
EMP_09			5,000	98,000	10,000		113,000	25,000	166,000
EMP_10			56,000				56,000	14,000	84,000
EMP_11	31,000	5,000	132,000			128,000	296,000	69,000	438,000
EMP_12	27,000	4,000	14,000	50,000		17,000	112,000	25,000	164,000
EMP_13	271,000	31,000	150,000			146,000	598,000	138,000	883,000
EMP_14	198,000	29,000	97,000			263,000	587,000	136,000	868,000
EMP_15	7,000	2,000	8,000				17,000	5,000	26,000
Total							\$ 4,671,000	\$ 1,077,000	\$ 6,897,000

<sup>\*</sup> Unit rates used to calculate costs are in Appendix 2

<sup>\*\*</sup> Resource consent, design, feasibility, and Liability costs breakdown in Appendix 3

Table 17: Proposed future erosion mitigation works costs (\$ rounded to nearest \$000)										
Project ID	Bank Batter Excavation	Coir Matting	Planting	Keystone Boulders	Newbury Rock Riffle	Toe Protection	Physical Works Total*	Project Preparation**	Total including 20% Contingency	
EMP_16	200,000	30,000	61,000		97,000	400,000	788,000	182,000	1,164,000	
EMP_17	24,000	5,000			84,000	62,000	175,000	41,000	259,000	
EMP_18	18,000	4,000	100,000		176,000	50,000	348,000	80,000	514,000	
EMP_19			79,000				79,000	18,000	116,000	
EMP_20	6,000	1,000	20,000		102,000		129,000	30,000	191,000	
EMP_21	43,000	6,000				81,000	130,000	30,000	192,000	
EMP_22	21,000	5,000	169,000				195,000	46,000	289,000	
EMP_23	23,000	5,000	55,000			62,000	145,000	34,000	215,000	
EMP_24	120,000	11,000				231,000	362,000	83,000	534,000	

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76

Hamilton City Council
Te kaunihera o Kirikiriroa

Mangakōtukutuku Catchment Watercourse Assessment Report
Prepared for Hamilton City Council

Final V4

Total					\$ 3,816,000	\$ 880,000	\$ 5,635,000
EMP_31	9,000	2,000	29,000	23,000	63,000	14,000	92,000
EMP_30	9,000	2,000	42,000	19,000	72,000	16,000	106,000
EMP_29	16,000	5,000	77,000		98,000	23,000	145,000
EMP_28	129,000	19,000	40,000	255,000	443,000	101,000	653,000
EMP_27	137,000	19,000		261,000	417,000	97,000	617,000
EMP_26	27,000	12,000	64,000		103,000	23,000	151,000
EMP_25	46,000	11,000	136,000	76,000	269,000	62,000	397,000
EMD 25	46 000	11,000	126,000	76,000	269 000	62 000	397 000

<sup>\*</sup> Unit rates used to calculate costs are in Appendix 2

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<sup>\*\*</sup> Resource consent, design, feasibility, and Liability costs breakdown in Appendix 3

Hamilton City Council
Te kaunihera o Kirikiriroa

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Final V4

#### 5.3 Enhancement Opportunities

A total of 19 enhancement opportunities have been identified in the Mangakōtukutuku catchment. Some enhancement projects are intended to work in tandem with the proposed erosion mitigation works to improve management outcomes. Other enhancement projects highlight opportunities to utilise best practice green infrastructure design to minimise adverse impacts on watercourses, particularly in areas of Greenfield development. Enhancement opportunities are intended to increase the amenity and ecological value of the watercourses, while improving flow conveyance and improving resistance to further changes to surrounding land use.

The enhancement projects identified in this assessment represent opportunities only. The enhancement information has value as it can inform a range of parties (e.g. HCC, WDC, WRC, landowners) who may be considering or undertaking other works in the vicinity. Parties will be able use this information to, if they choose, influence project scoping to deliver or maximise environmental benefits, perhaps with no significant additional investment required. Identifying these opportunities also provides an information base for not-for-profit or environmentally focused delivery agencies looking for opportunities to invest in environmental improvement works (e.g. Streamcare groups such as Mangakōtukutuku Stream Care Group, Mangakōtukutuku Puna Koiora Trust, WRC, WRA).

The enhancement opportunities are located on both public (i.e. Council-owned) and private land. For some of these enhancement opportunities to be realised, co-operation with landowners will be required and, in some cases, easements developed for maintenance of these areas. In the prioritisation of enhancement opportunities, projects located on private land have been scored as lower priority. The prioritisation scores and description of these enhancement projects is presented in Table 18.

The majority of these enhancement opportunity projects focus on ecological planting along riparian corridors of streams. Riparian planting along these corridors would enhance potential inanga spawning habitat and ecological connectivity in the catchment. The estimated cost of the enhancement opportunity is approximated at \$35,282,000. This cost does not include pricing for proposed enhancement projects EO18 and EO19. For EO18 and EO19 it is recommended that an engineering evaluation is undertaken at the site to understand the impacts of the construction of multiple large offline and online ponds using concrete dams on the property. The two main enhancement opportunities for EO18 and EO19 include;

- 1. Re-instating a natural watercourse including removal of dams and culverts, increased riparian planting and naturalisation; or,
- Naturalisation of the terraced ponds/ wetlands. This option would include the removal of the large informal dam structures and adaption of best practice design for inlet and outlet points.

It is recommended that HCC work closely with the landowners to ensure that these ponds, which appear to be non-consented receive consent approval or are remediated. The remediation would enhance the watercourses by re-introducing natural hydrology consisting of riffle/run sequences, and removal of fish barriers.

As per the REM methodology (HCC, 2015), each enhancement opportunity is assigned a high-level prioritisation score based on the potential benefits to the public and local amenity values, ecological values such as biodiversity and habitat improvements, and flow conveyance. Prioritisation scores range from 1 – 4, with 4 indicating that the potential project will significantly improve the environment. The individual values for amenity, ecological and conveyance values were summed, and an overall priority was calculated.

In addition, high-level costs for the proposed works within each project are presented in Table 19. These costs are calculated using the same unit rates used for the erosion mitigation projects. The assumptions

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78



Final V4

used to derive each unit cost is outlined in Appendix 2. The unit rates and costs applied to enhancement opportunity projects are derived from quotes and invoices from physical works in the last five years in the Auckland market. The rates are considered representative at the time of writing. The assumptions used to derive each unit cost is outlined in Appendix 2. The final costings presented in this report should be considered as indicative only with further refinement required at the detailed design stage.

The cost estimates also exclude land acquisitions, excavation in solid rock, removal of contaminated material or asbestos, consent or development contributions, funding costs and legal fees, GST and unforeseen ground conditions. Detailed costing will be required at the detailed design stage. The purpose of the costs provided in this report is to indicate relative costings for the purpose of decision making.

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79

Final V4

roject	oject Location in the Land Overall Prioritisation High level costs								
)	catchment	Ownership	Description	Amenity	Ecology	Conveyance	Score	Score	High level costs
<b>)</b> 1	Main	Public	Potential good spawning habitat, dense weed cover dominated by willow, privet and Tradescantia weed.	3	3	2	8	4 – High	\$ 191,000
O 2	Main	Public	Narrow channel showing some signs of erosion susceptibility, with protective measures such as coir matting.	2	2	3	7	3 – Moderate	\$ 54,000
O 3	Central Sub- catchment	Public	Potential good habitat for native Kokopu. Extensive sediment deposition and signs of erosion susceptibility. removal of culvert would enhance fish passage.	2	4	2	8	4 – High	\$ 240,000
O 4	Central Sub- catchment	Private	Straightened and potentially deepened channel. Grasses and weeds prevalent along reach, pastoral land use. Naturalisation of the channel, weed control and erosion protection would enhance this section of the catchment.	2	3	2	7	3 – Moderate	\$ 364,000
O 5	Eastern Sub- catchment	Private	Some good macroinvertebrate taxa present, potential good in-stream habitat. Riparian planting, particularly along TRB, would enhance stream conditions.	2	4	2	8	4 – High	\$ 1,153,000
06	Eastern Sub- catchment	Mixed	Incised watercourse with 15 m high steep upper banks. Overhead shading of the watercourse is good (> 70%). Significant tradescantia cover along banks and riparian extent. There are several locations of illegal litter dumping and the weedy vegetation may present a risk to asset.	3	3	3	9	4 – High	\$ 4,326,000
<b>0</b> 7	Eastern Sub- catchment	Mixed	Upstream sections owned by private landowners, need to consider engagement with HCC to work collaboratively. The project is located in close proximity to the central interchange of the Southern Links roading project at 112 Peacockes Lane. The reaches are small, incised watercourses.	1	3	2	6	3 – Moderate	\$ 2,876,000
8 8	Eastern Sub- catchment	Mixed	Reaches characterised as defined gully banks (>20 m), wide wetland floodplains and meandering channel along the gully floor. The upper reach if a culverted farm pond. The vegetation along this section includes an understorey of willow, weed infestations (including blackberry, tradescantia, and gorse) carex grasses or rush wetlands with pine canopy along the upper banks near the central channel.	1	3	1	5	3 – Moderate	\$ 3,754,000
O 9	Eastern Sub- catchment	Private	Reaches are defined as gully systems with high, steep banks (> 10 m height), wide wetland floodplains and meandering channels. The vegetation is predominately exotic willow with weed infestations including blackberry, tradescantia, and gorse. Weed control and planting riparian vegetation to enhance the existing ecological values.	1	3	1	5	3 – Moderate	\$ 1,747,000
) 10	Eastern Sub- catchment	Private	Reaches are defined as gully systems with high, steep banks (> 10 m height), wide wetland floodplains and meandering channels. The vegetation is predominately exotic willow with weed infestations including blackberry, tradescantia, and gorse. Weed control and planting riparian vegetation to enhance the existing ecological values.	1	3	1	5	3 – Moderate	\$ 554,000
) 11	Eastern Sub- catchment	Private	Reaches are defined as gully systems with high, steep banks (> 10 m height), wide wetland floodplains and meandering channels. The vegetation is predominately exotic willow with weed infestations including blackberry, tradescantia, and gorse. Weed control and planting riparian vegetation to enhance the existing ecological values.	1	3	1	5	3 – Moderate	\$ 455,000
) 12	Eastern Sub- catchment	Private	Reaches are defined as gully systems with high, steep banks (> 10 m height), wide wetland floodplains and meandering channels. The vegetation is predominately exotic willow with weed infestations including blackberry, tradescantia, and gorse. Weed control and planting riparian vegetation to enhance the existing ecological values.	1	3	1	5	3 – Moderate	\$ 1,134,000
O 13	Eastern Sub- catchment	Private	The watercourse is incised with wide floodplains with numerous wetland seeps and springs along the floodplains and dense macrophyte cover. Deep sedimentation and the lower reaches are impacted by stock damage. Enhancement through maximising riparian buffer width.	1	3	1	5	3 – Moderate	\$ 5,200,000
) 14	Eastern Sub- catchment	Private	The watercourse has wide floodplains with areas of defined channel and the banks have a gradual slope. The watercourse shows signs of stock damage, exclusion fencing, and riparian planting would improve the ecological condition of the reach.	1	2	1	4	2 – Low	\$ 1,414,,000
) 15	Eastern Sub- catchment	Private	Extensive stock damage has caused deterioration of the stream channel morphology. No defined channels and hydrologically functions as a wetland.	1	2	1	4	2 – Low	\$ 1,668,000
O 16	Eastern Sub- catchment	Private	The reach includes exotic weed species. The section could be enhanced through weed control and planting, fencing and stock exclusion. There are opportunities to work with the land owners to enhance the riparian habitat and promote connectivity in the catchment.	1	2	2	5	3 – Moderate	\$ 592,000

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80

Item 12

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Final V4

Project ID	Location in the catchment	Land Ownership	Description	Amenity	Ecology	Conveyance	Overall Score	Prioritisation Score	High level costs
EO 17	Eastern Sub- catchment	Private	Series of online and offline ponds dominated by aquatic weeds and stagnant flows. Multiple fish barriers present for upstream populations. Re-instating watercourse or wetland from culverted ponds or consider as treatment device locations.	2	3	3	8	4 – High	\$ 1,951,000
EO 18	Eastern Sub- catchment	Private	Series of four online ponds (totalling 3.6 Ha) and multiple offline ponds dominated by aquatic weeds and stagnant flows. Multiple fish barriers present for upstream populations due to the construction of informal concrete and earth dams. Four dams up to 6 m width (parallel to flow) and 2 5m length (perpendicular to flow) have created ponds with significant drops (2 – 4 m) reducing connectivity in the watercourse.  Enhancement opportunity options may include: Re-instating a natural watercourse including removal of dams and culverts, increased riparian planting and naturalisation; or, Naturalisation of the terraced ponds/wetlands. This enhancement option would include removal of the four informal large dam structures.	3	4	3	10	4 – High	A full cost estimate for EO18 has not been provided due to the scale of the proposed works. It is recommended that an options assessment and landowner liaison be undertaken prior to cost estimates being undertaken.
EO 19	Eastern Sub- catchment	Private	Series of online and offline ponds dominated by aquatic weeds and stagnant flows. Multiple fish barriers present for upstream populations. Re-instating watercourse or wetland from culverted ponds or consider as treatment device locations.	2	3	3	8	4 – High	A full cost estimate for EO19 has not been provided due to the scale of the proposed works. It is recommended that an options assessment and landowner liaison be undertaken prior to cost estimates being undertaken.

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81

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Final V4

Table 19: Summary of enhancement opportunity costs (rounded to nearest \$000)						
Enhancement Opportunity	Planting	Pond Naturalisation	Contingency (20%)	Total		
EO 1	\$ 191,000		\$ 38,000	\$ 229,000		
EO 2	\$ 54,000		\$ 11,000	\$ 65,000		
EO 3	\$ 240,000		\$ 48,000	\$ 288,000		
EO 4	\$ 364,000		\$ 73,000	\$ 437,000		
EO 5	\$ 1,153,000		\$ 231,000	\$ 1,384,000		
EO 6	\$ 4,326,000		\$ 865,000	\$ 5,191,000		
EO 7	\$ 2,876,000		\$ 575,000	\$ 3,451,000		
EO 8	\$ 3,754,000		\$ 751,000	\$ 4,505,000		
EO 9	\$ 1,747,000		\$ 349,000	\$ 2,096,000		
EO 10	\$ 554,000		\$ 111,000	\$ 665,000		
EO 11	\$ 455,000		\$ 91,000	\$ 546,000		
EO 12	\$ 1,134,000		\$ 227,000	\$ 1,361,000		
EO 13	\$ 5,200,000		\$ 1,040,000	\$ 6,240,000		
EO 14	\$ 1,414,000		\$ 283,000	\$ 1,697,000		
EO 15	\$ 1,668,000		\$ 334,000	\$ 2,002,000		
EO 16	\$ 592,000		\$ 118,000	\$ 710,000		
EO 17	\$ 1,821,000	\$ 130,000	\$ 390,000	\$ 2,341,000 <sup>1</sup>		
EO 18	\$ 1,229,000	Refer to notes <sup>2</sup>	\$ 246,000	Refer to notes <sup>2</sup>		
EO 19	\$ 499,000	Refer to notes <sup>3</sup>	\$ 100,000	Refer to notes <sup>3</sup>		
Total (excluding Pond naturalisation of EO18 and EO19) \$ 35,282,000						

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 $<sup>^{1}</sup>$  Excavation: 1000 m3; Rock lining at \$600, 150 m3; Reintroduction of 11 riffles at 6 m2 = 66 m2 to connect the isolated farm ponds; Rock riffle at average depth of 0.5 m3, at 70 m3.

 $<sup>^{2}</sup>$  A full cost estimate for EO18 has not been provided due to the scale of the proposed works. It is recommended that an options assessment and landowner liaison be undertaken prior to cost estimates being undertaken.

 $<sup>^{3}</sup>$  A full cost estimate for EO19 has not been provided due to the scale of the proposed works. It is recommended that an options assessment and landowner liaison be undertaken prior to cost estimates being undertaken.



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### 6.0 Issues and Opportunities Prioritisation.

The information collected through this project has been incorporated into the Stormwater Master Plan version 2 [SMPv2] as both tabulated and spatial information. The below information was incorporated into the Issues and Opportunities [I&O] Register and ranked in accordance with the related criteria:

- All ecolines with the associated erosion classification
- Hot spots with overall risk score
- Fish barriers

All projects described in this report, including their costings, have been recorded in the SMPv2 Projects Database. Where applicable the I&O Register ranking has been associated with each individual project. The SMPv2 Receiving Environment Projects Database collates and prioritises watercourse protection and restoration at a citywide level.

Due to the tabulated and spatial format of the SMPv2 data, the Mangakōtukutuku Receiving Environment I&O Register and Project Database have not been appendices to this report but have been supplied as a separate resource for the ICMP.

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## 7.0 Cost allocation of Erosion Mitigation Projects

Hamilton City Council has the ability to request financial contribution towards watercourse protection and restoration. As per the HCC erosion cost allocation method the following costs have been calculated for Greenfield contribution proportion (Table 20).

Table 20: Erosion cost allocation for Mangakotukutuku					
\$12,532,000					
573 ha					
500 ha					
36%					
64% (23% Infill growth, 41% Greenfield growth)					
\$ 5,170,800					
\$ 10,333 per ha					

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84



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#### 8.0 Conclusions

Impacts on the freshwater ecosystems through future land use change in the Eastern sub-catchment are a key issue for the Mangakötukutuku catchment. The Greenfield development process must consider the future pressures and potential impacts on watercourses and the receiving environment. These pressures include:

- Change in land use and the associated contaminants of concern;
- Increased imperviousness and associated changes in hydrograph and impacts on watercourses, including increased potential for channel erosion and reduced base flows; and,
- Further potential barriers to fish passage with the development of more roads and associated culvert structures.

Six management zones were identified based on common pressures and impacts on watercourses which collectively include:

- Increased imperviousness and associated changes in hydrograph and impacts on watercourses, including increased potential for channel erosion and reduced base flows; and,
- Existing fish passage barriers and potential barriers to fish passage with the development of more roads and associated culvert structures.
- Change in land use and the associated contaminants of concern.
- · Loss of riparian margin vegetation.
- Stock access to waterways.
- Drainage and piping of freshwater systems.
- · Online farm ponds.

The erosion mitigation projects highlight areas of immediate concern and provide remediation options to address localised issues, as well as looking at future erosion issues from Greenfields development. The 31 erosion mitigation projects have been developed at a high level and consist of remediation types such as grade control, erosion planting, bank regrading and toe protection. Generally, the projects that identified areas of existing erosion (EMP\_1 to EMP\_15) are located along the main channels of the central and western Mangakōtukutuku sub-catchments within the Brownfields area, with the exception of projects EMP\_10 and EMP\_11. These areas were identified as the most prone to erosion during the watercourse assessment with several reaches showing high erosion scarring and unstable undercut banks. These reaches currently receive flows from the stormwater network via several outlet structures, with inputs expected to increase with development in the area. It is recommended that erosion mitigation projects in these areas are prioritised.

Erosion mitigation projects have also been designated within the Greenfields area (EMP\_16 to EMP\_31) and are based on the predicted erosion effects from increased flow volumes and velocity within the streams. Any increase in erosion will only be observed in the years following development. The design of the stormwater network, including flow attenuation devices and outfall structures will be an important factor in managing the effects of development on stream erosion.

The total estimated costs including contingency of the physical works for the proposed erosion mitigation projects (current erosion projects and future projects) is approximately \$ 12,532,000.

A total of 19 enhancement opportunities have been proposed within the Mangakotukutuku catchment. These projects highlight enhancement opportunities for the developer, private landowners and Council to increase the ecological and amenity values of the watercourse, whilst enhancing flow conveyance and improving resilience against further changes to surrounding land use. The estimated cost of the

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enhancement projects (excluding EO18 and EO19) is approximately \$ 35,282,000. The final costings presented in this report should be considered as indicative only with further refinement required at the detailed design stage. The purpose of the costs provided in this report is to indicate relative costings for decision making.

The enhancement opportunities focus primarily on enhancement planting along stream corridors. Most of the enhancement opportunities emphasising ecological planting in the Eastern sub-catchment can be incorporated into the Southern Links implementation works. This will be part of implementing an Ecological Monitoring and Management (EMMP) as required by the conditions of the Southern Links designation (which requires at least 11.8 ha of restoration).

#### 8.1 Recommendations for the ICMP

Through the development of this Watercourse Assessment Report, the requirements for additional investigations and considerations have been identified to inform the wider ICMP. These include:

- Hydrogeology investigation in the eastern Peacocke sub-catchment to understand groundwater processes of springs and seepages with objectives to maintain baseflows for ecological outcomes and inform geotechnical risk.
- Further investigation into the interaction between increased volumes and the erosion risk in the eastern Peacocke sub-catchment.
- Flood storage within the gully and impact on road crossings including investigating issues such as inadvertent dam failure risk under flood conditions.
- Top of gully bank management including possible set back of development for geotechnical risk and management of stormwater for overland flow.
- Management and control of stormwater discharge within the gully including outfall erosion protection.

It is therefore recommended that detailed design of watercourse works and detailed pricing is undertaken as a future action. This would include using existing information on these reaches collected as part of this watercourse assessment together with specific technical investigation undertaken as part of the ICMP. These investigations include:

- Flood modelling outputs (estimated increases in flow and volumes along the network for post development).
- Stormwater management toolbox (development of appropriate works including extended detention),
- Geotechnical and hydrogeology reviews (information of gully form, groundwater interaction and bank crest stability).
- Following this exercise, detailed design and revised costs can be identified for the Peacockes subcatchment gully network for specific projects.

The Mangakōtukutuku Watercourse Assessment and this report provides Hamilton City Council with valuable knowledge and understanding of the existing state of the Mangakōtukutuku watercourse.

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#### 9.0 References

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12

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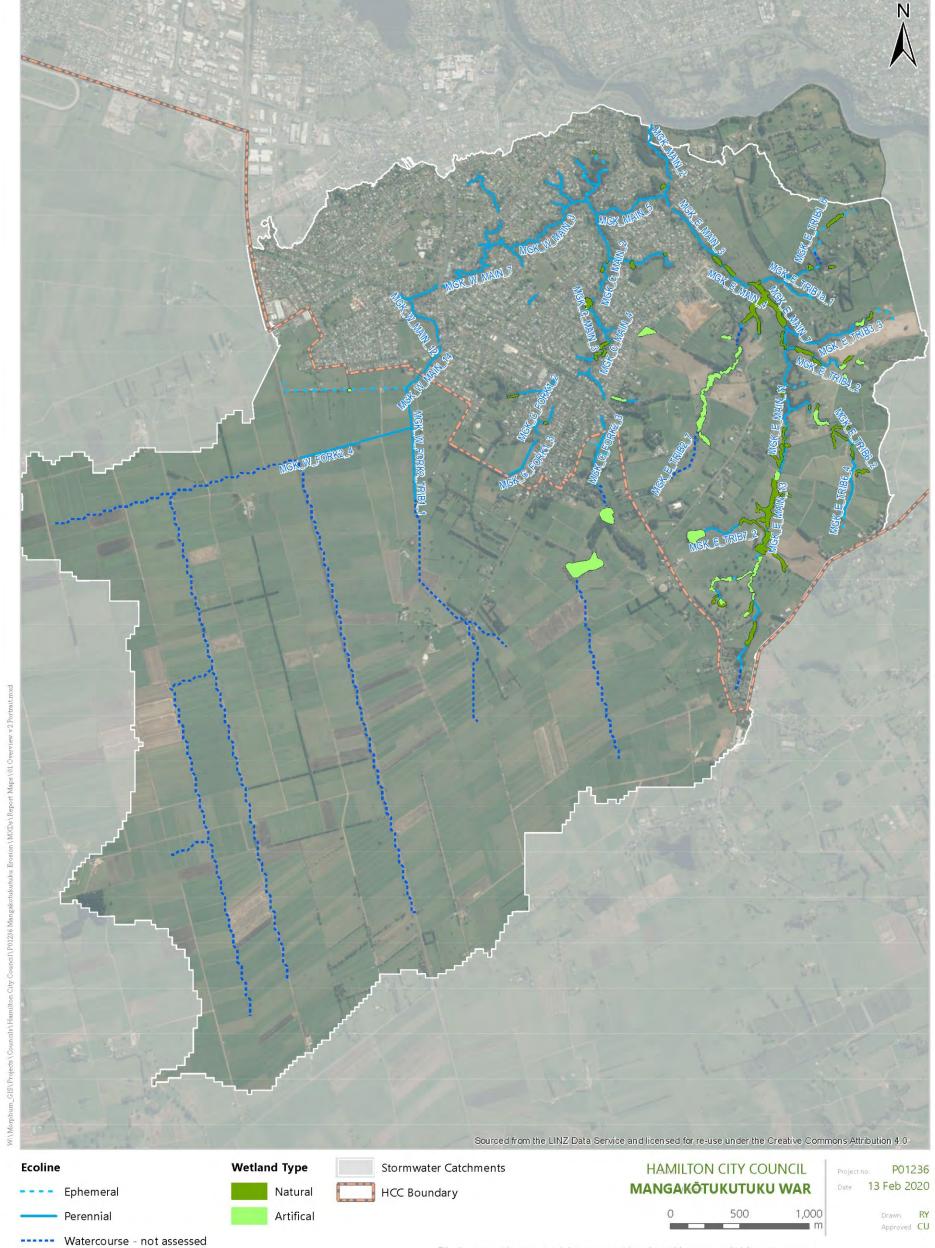
## Appendix 1 Maps

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88

MAP 1 - CATCHMENT OVERVIEW





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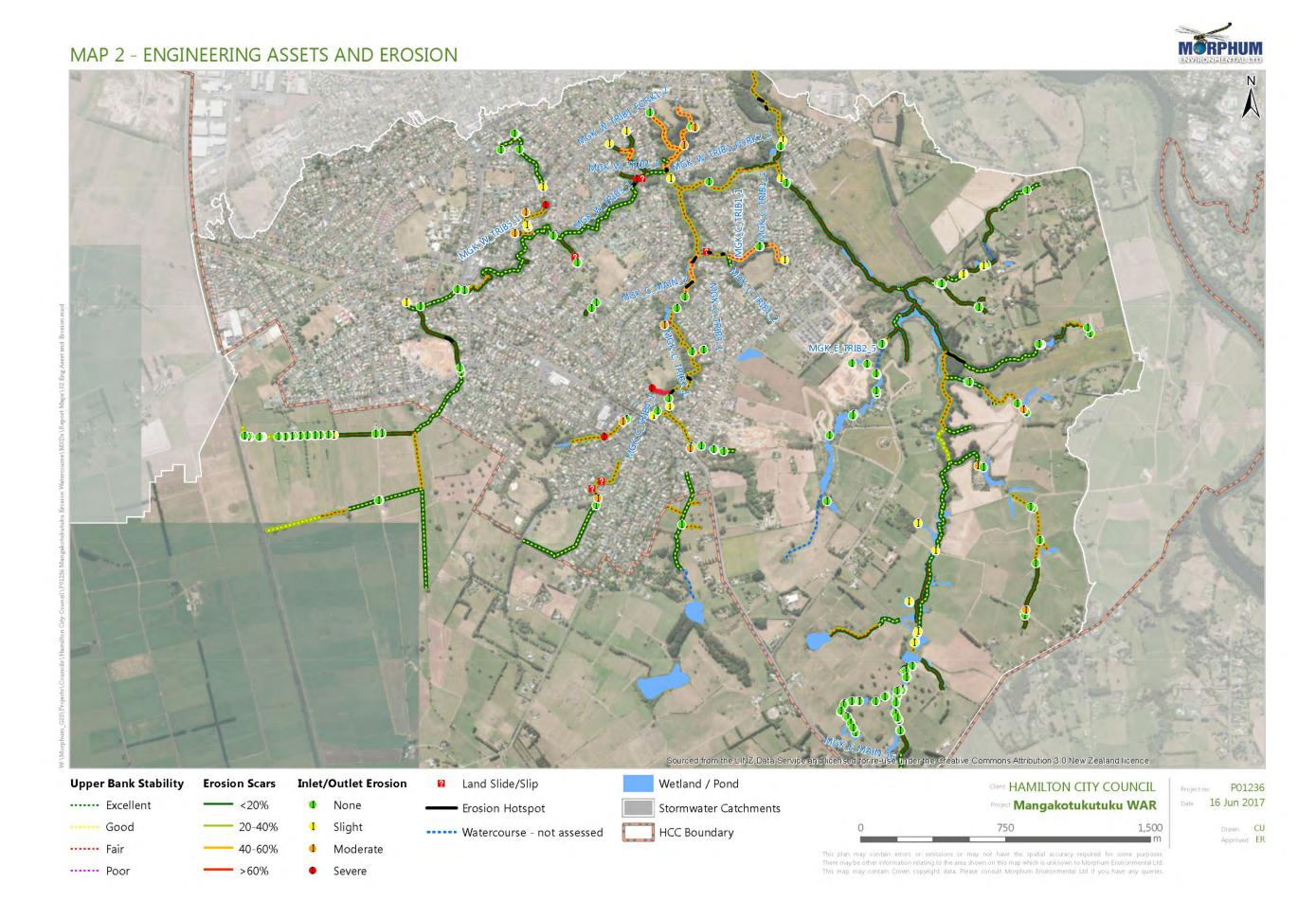
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Map 2 – Engineering Assets and Erosion

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89







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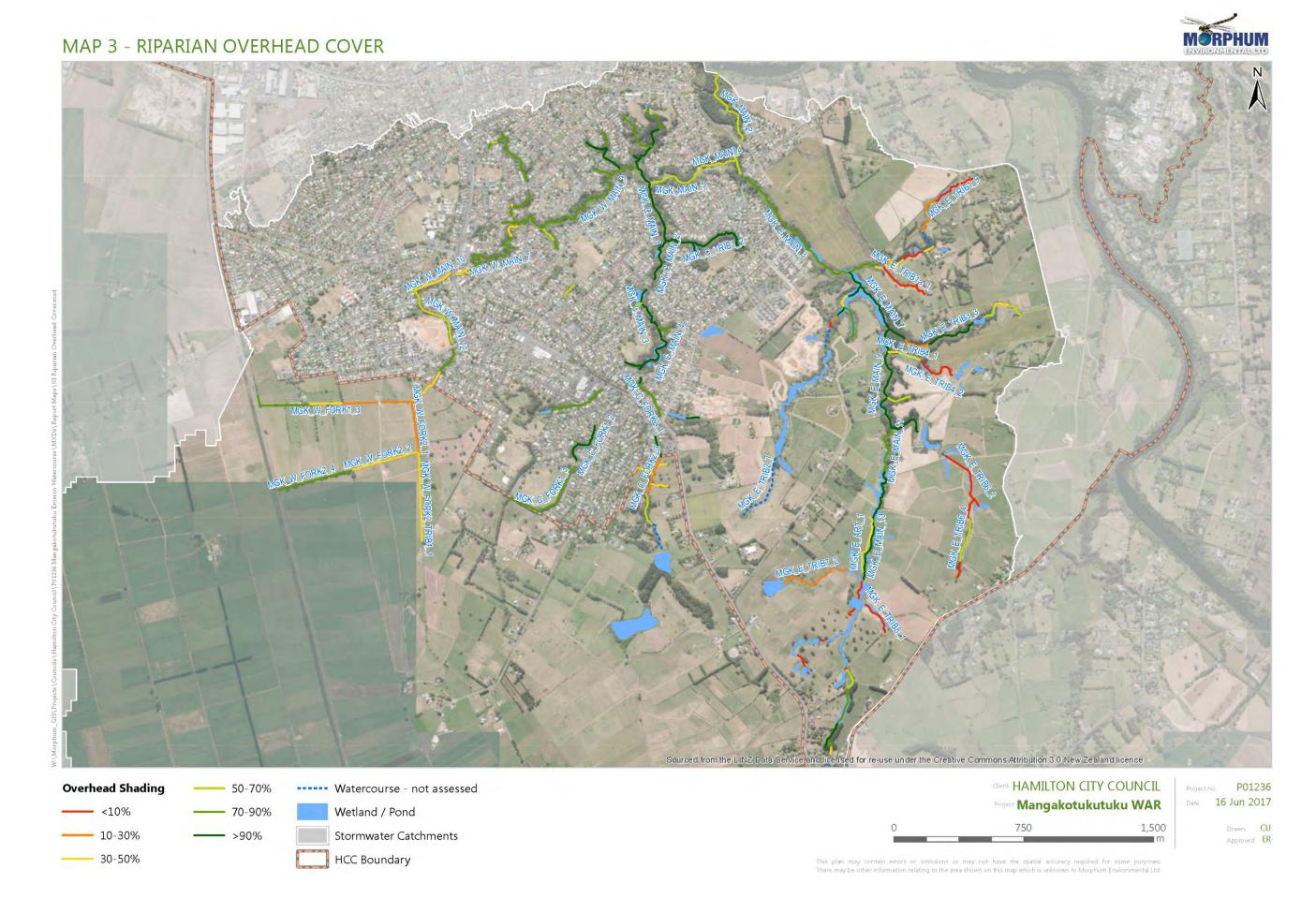
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Map 3 – Riparian Overhead Cover

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90





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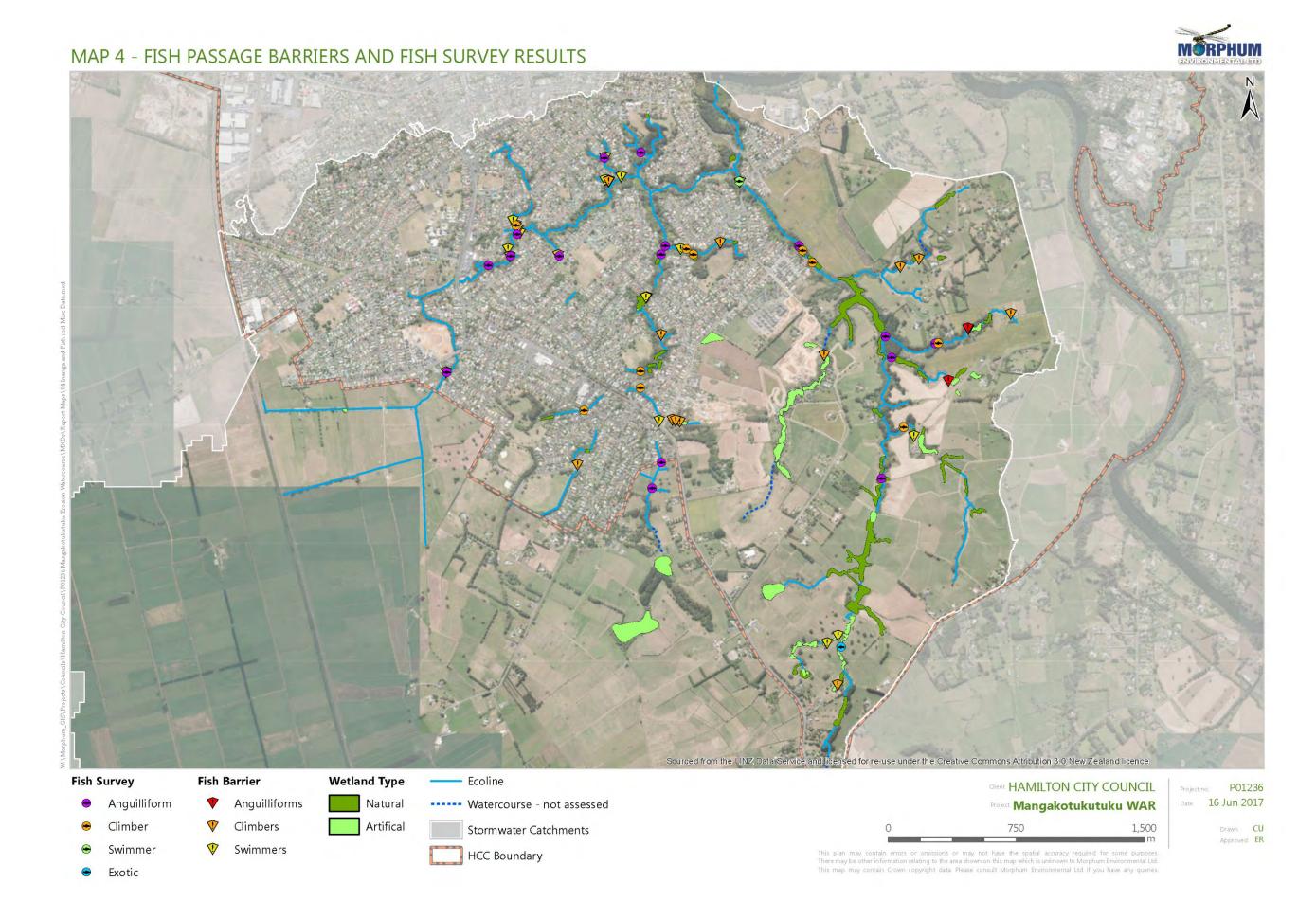
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Map 4 – Fish Barriers and Fish Survey

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91





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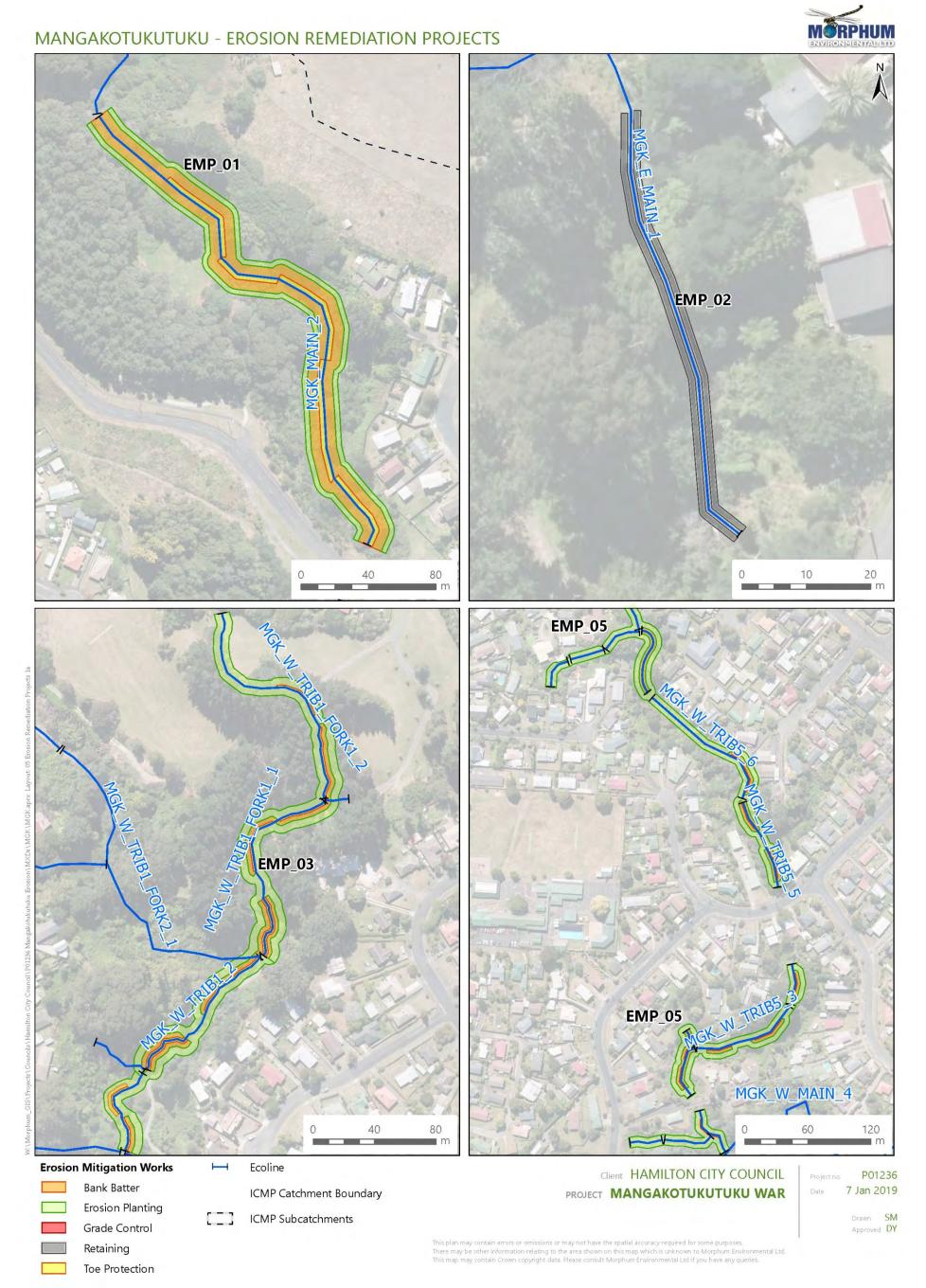
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Map 5 – Erosion Mitigation Projects

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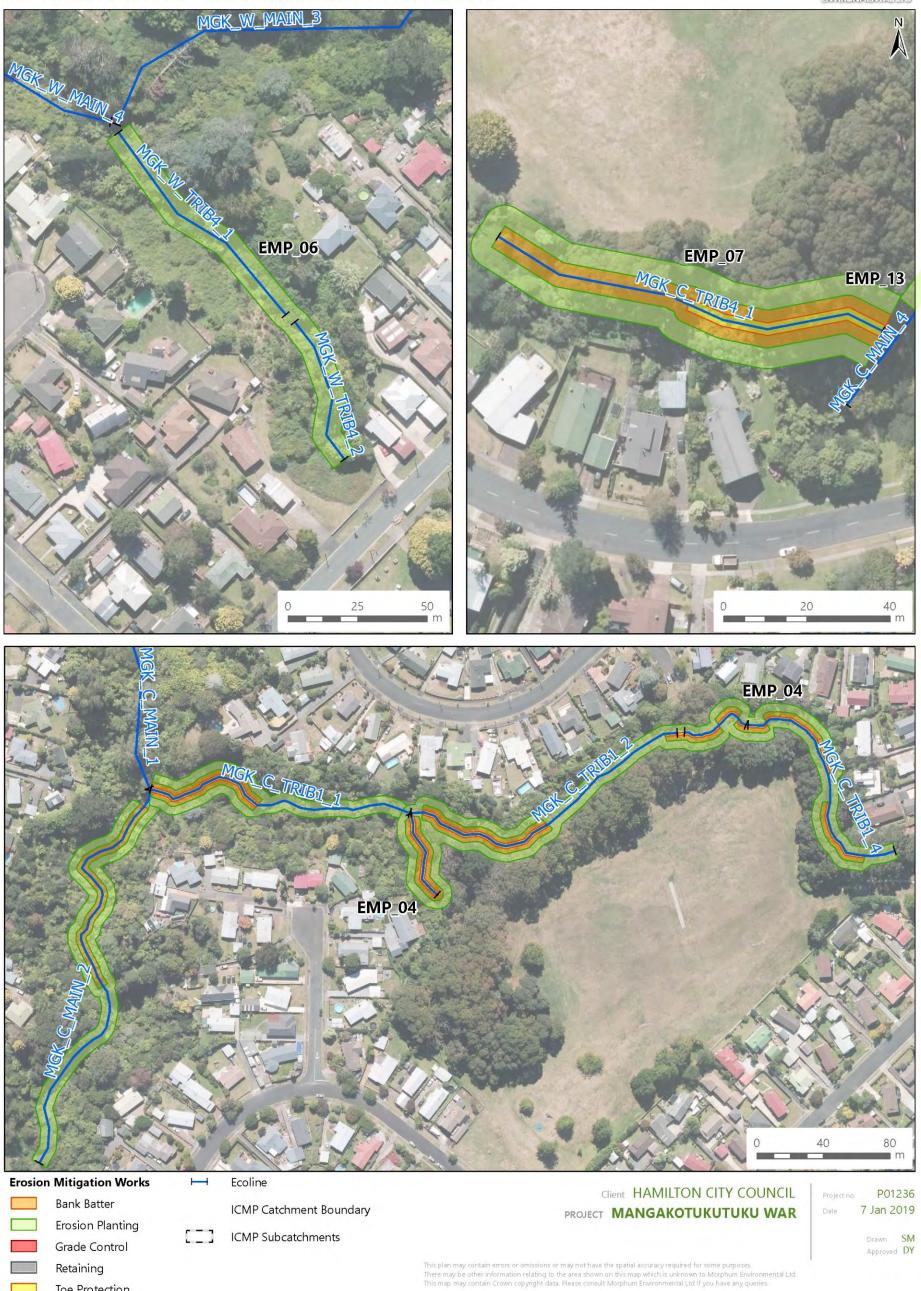
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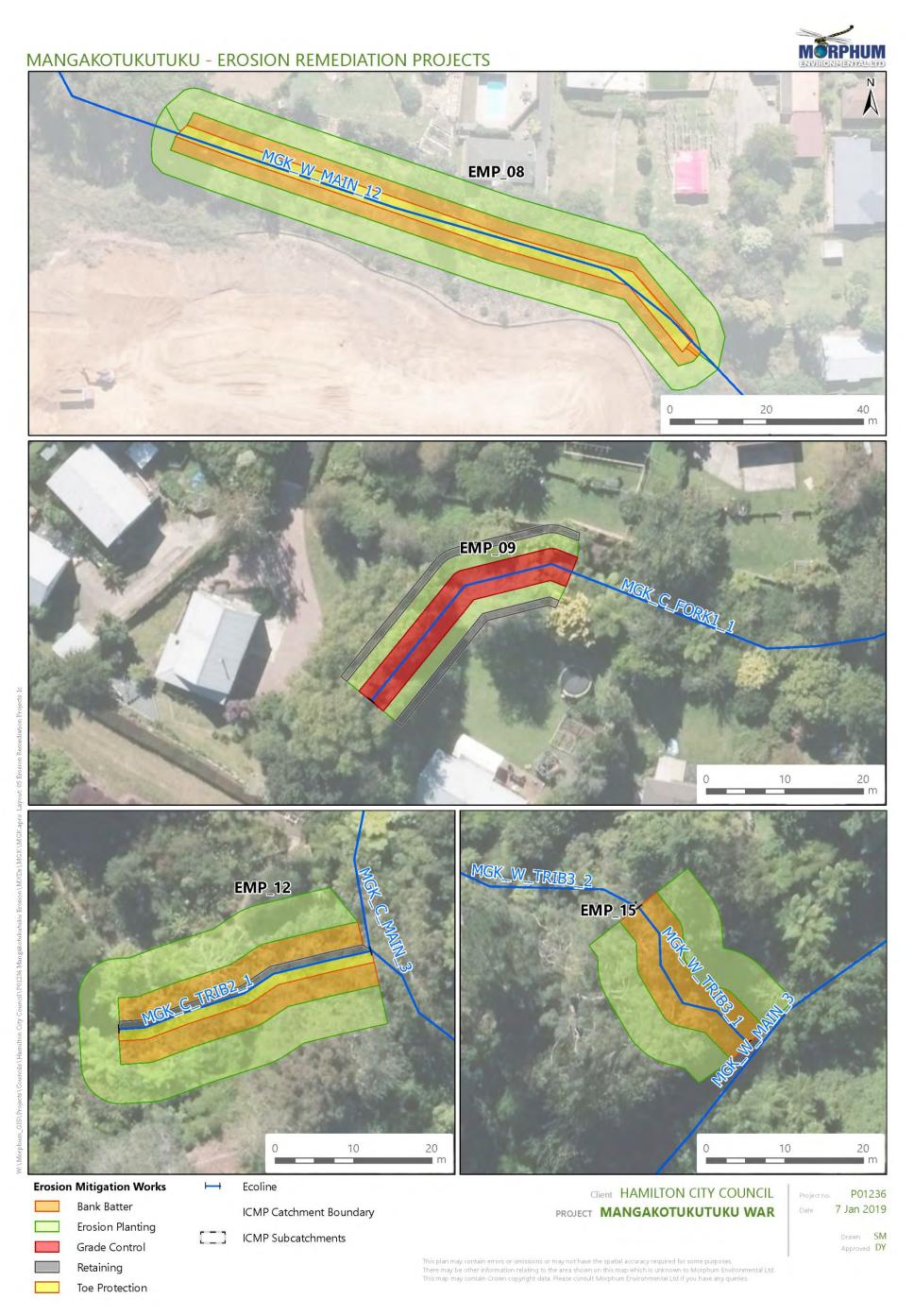


#### MANGAKOTUKUTUKU - EROSION REMEDIATION PROJECTS





Toe Protection





#### MANGAKOTUKUTUKU - EROSION REMEDIATION PROJECTS







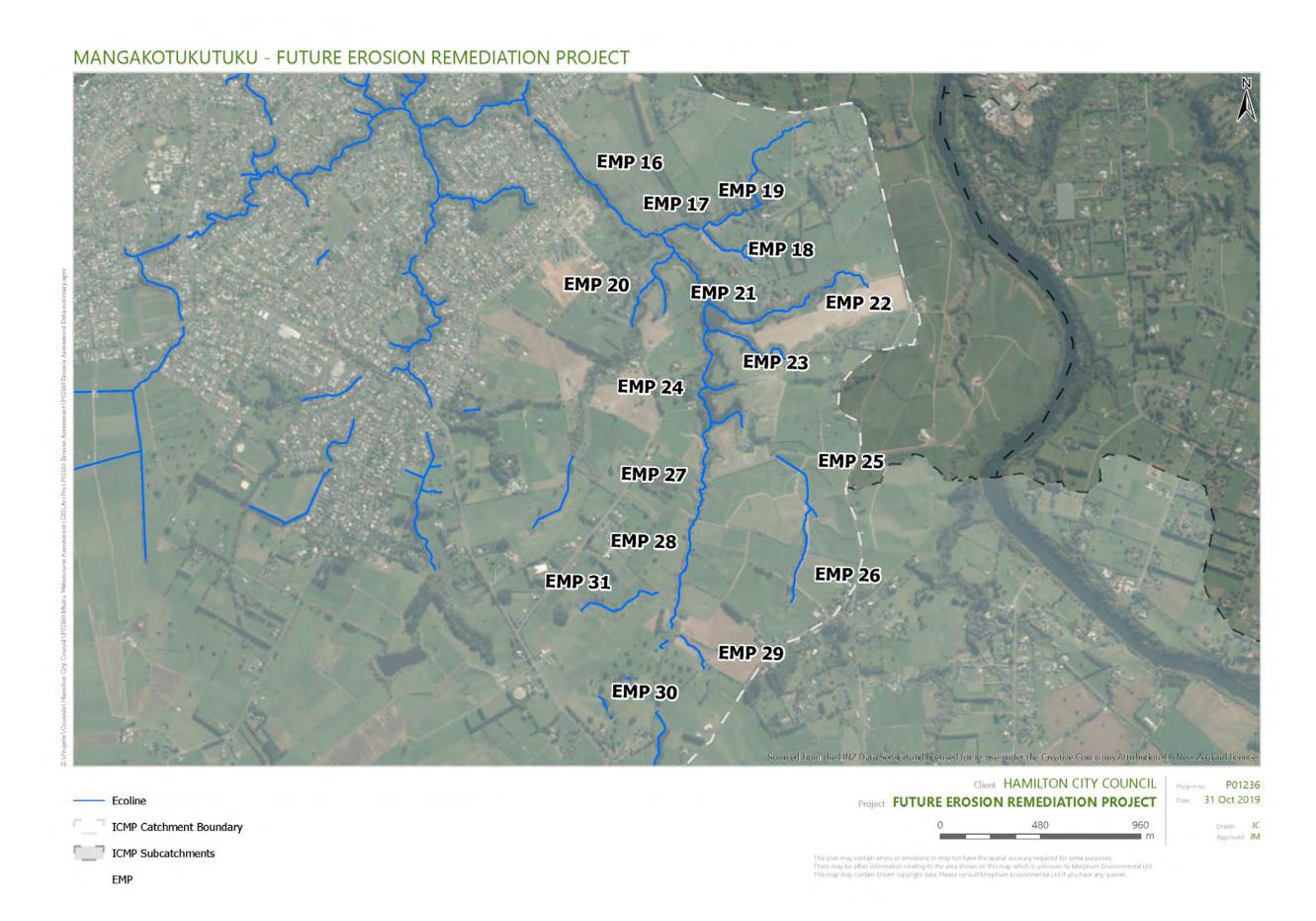




### MANGAKOTUKUTUKU - EROSION REMEDIATION PROJECT OVERVIEW EMP 01 **EMP 03** - EMP\_05 EMP 14 **EMP 04** EMP\_06 EMP 11 EMP\_12 EMP\_13 **EMP 08** EMP\_07 EMP\_10 EMP 09 EMP\_14 sti, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the 61S Use Ecoline Client HAMILTON CITY COUNCIL P01236 ICMP Catchment Boundary 7 Jan 2019 PROJECT MANGAKOTUKUTUKU WAR [ ] ICMP Subcatchments

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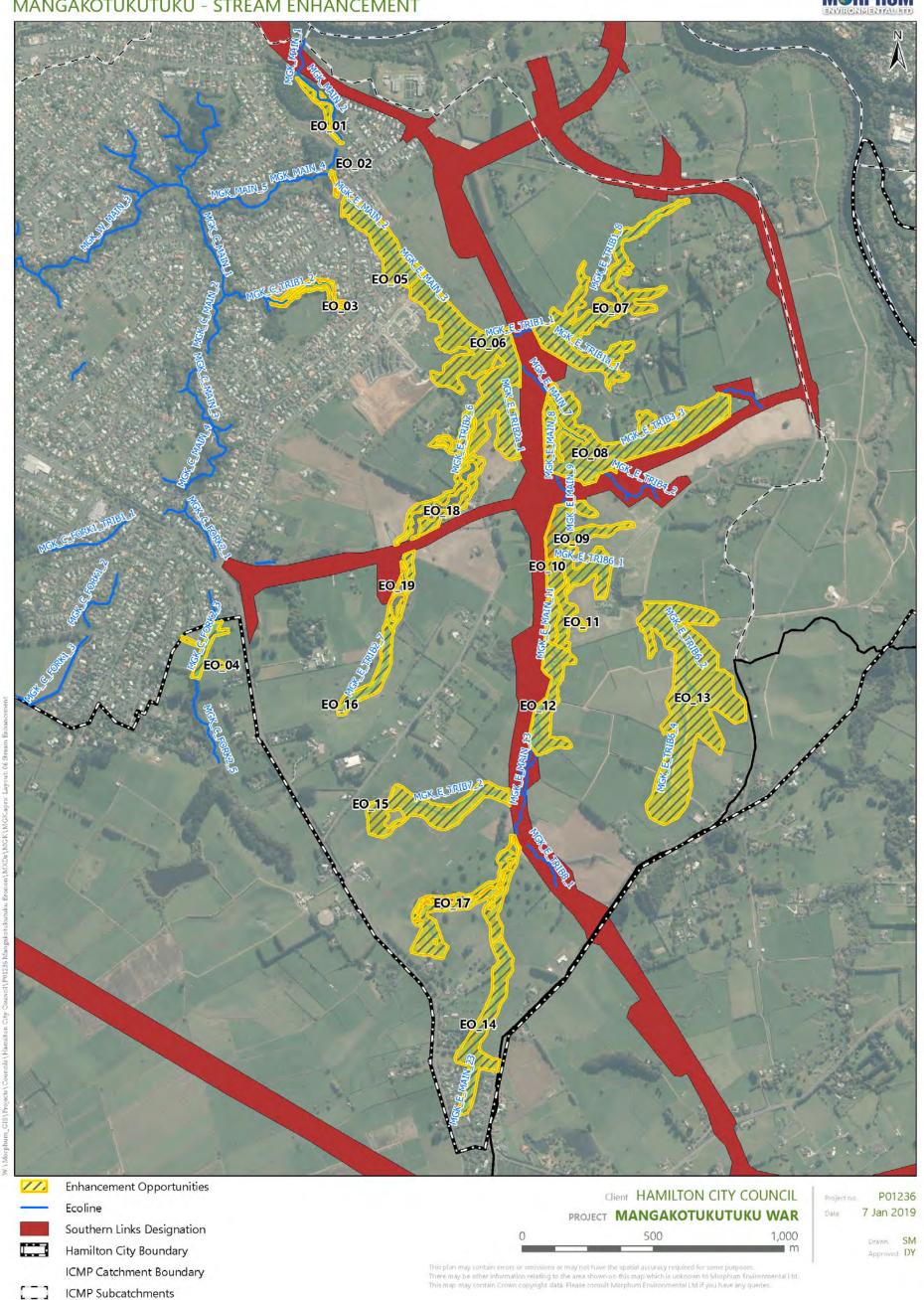
Map 6 – Enhancement Opportunity Projects

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98

#### MANGAKOTUKUTUKU - STREAM ENHANCEMENT





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#### Appendix 2 Cost and Unit Rates for Mitigation Options

Mitigation	Unit	Cost	Assumptions and exclusions
			Includes boom spray of glyphosate single application;
Planting of			Planting at up to 4 plants per m2, Carex, Juncus, toetoe, flax and cabbage tree;
Banks and	m <sup>2</sup>	\$35	Plant grade PB3s;
Floodplains			Assumes team of 6 planting 350 plants each per day;
			Cost includes vegetation removal, planting, weeding and maintenance for 5 years.
Newbury Rock Riffles as Grade Control	m²	\$950	Import and place rock riffles. Weirs to be 400-500 mm boulders, riffles to be $D_{50}$ =300 mm well graded angular rip rap in combination with 5-50mm railway ballast, approximately $20m^3$ of rip rap per riffle. 50mm bedding layer of GAP30 installed over existing ground surface. Crushed aggregate $D_{50}$ =50 mm to be installed to fill gaps around rip rap.
			\$50/m³ for excavation;
			\$20/m³ for haulage away from site and disposal to clean fill;
			Does not include setting up diversions/erosion and sediment control;
Bank batter	m <sup>z</sup>	\$70	Assumes 45° banks from toe of existing bank, does not include the excavation required to install the rip rap. The rip rap volume may need to be excavated also for installation of the rip rap. This could be avoided by placing the rip rap directly on the cut bank.
			Rip rap may not be required at all sites of bank batter but has been used here to allow for the cost of stabilisation. Determination of the best stabilisation material will be decided during concept design or detailed design.
			Note: Any topsoil removed as part of the excavation will be re-spread No importation of topsoil has been allowed for due to potentially changing the planting environment
		****	D <sub>50</sub> = 300mm
Control of the Contro	m³	\$600	Lso = Southin
banks	m³ m²	\$10	Uso = Southin
Rip rap for banks Coir matting Keystone Boulders			600 mm boulders placed within a 400 mm deep trench

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Attachments Page 1901



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#### Appendix 3 Erosion Mitigation Projects Preparation and Planning Breakdown Cost

Planning and preparation costs breakdown (\$ rounded to nearest \$000)

Project ID	Physical Works	Design and Feasibility	Resource Consent	Defects and Liability	Sub-Total	Total including Contingency
Total		(10%)	(3%)	(10%)		(20%)
EMP_01	737,000	74,000	22,000	74,000	907,000	1,088,000
EMP_02	105,000	11,000	3,000	11,000	130,000	156,000
EMP_03	394,000	39,000	12,000	39,000	484,000	581,000
EMP_04	703,000	70,000	21,000	70,000	864,000	1,037,000
EMP_05	428,000	43,000	13,000	43,000	527,000	632,000
EMP_06	52,000	5,000	2,000	5,000	64,000	77,000
EMP_07	242,000	24,000	7,000	24,000	297,000	356,000
EMP_08	231,000	23,000	7,000	23,000	284,000	341,000
EMP_09	113,000	11,000	3,000	11,000	138,000	166,000
EMP_10	56,000	6,000	2,000	6,000	70,000	84,000
EMP_11	296,000	30,000	9,000	30,000	365,000	438,000
EMP_12	112,000	11,000	3,000	11,000	137,000	164,000
EMP_13	598,000	60,000	18,000	60,000	736,000	883,000
EMP 14	587,000	59,000	18,000	59,000	723,000	868,000
EMP_15	17,000	2,000	1,000	2,000	22,000	26,000

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100



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Sub Total	\$ 4,671,000					\$ 6,897,000
EMP_16	788,000	970,000	1,164,000	1,164,000	3,377,000	3,377,000
EMP_17	175,000	216,000	259,000	259,000	752,000	752,000
EMP_18	348,000	428,000	514,000	514,000	1,491,000	1,491,000
EMP_19	79,000	97,000	116,000	116,000	337,000	337,000
EMP_20	129,000	159,000	191,000	191,000	554,000	554,000
EMP_21	130,000	160,000	192,000	192,000	557,000	557,000
EMP_22	195,000	241,000	289,000	289,000	839,000	839,000
EMP_23	145,000	179,000	215,000	215,000	624,000	624,000
EMP_24	362,000	445,000	534,000	534,000	1,549,000	1,549,000
EMP_25	269,000	331,000	397,000	397,000	1,152,000	1,152,000
EMP_26	103,000	126,000	151,000	151,000	438,000	438,000
EMP_27	417,000	514,000	617,000	617,000	1,790,000	1,790,000
EMP_28	443,000	544,000	653,000	653,000	1,894,000	1,894,000
EMP_29	98,000	121,000	145,000	145,000	421,000	421,000
EMP_30	72,000	88,000	106,000	106,000	307,000	307,000
EMP_31	63,000	77,000	92,000	92,000	267,000	267,000
Subtotal	\$ 3,816,000					\$ 5,635,000
Total	\$ 8,487,000					\$ 12,532,000

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101

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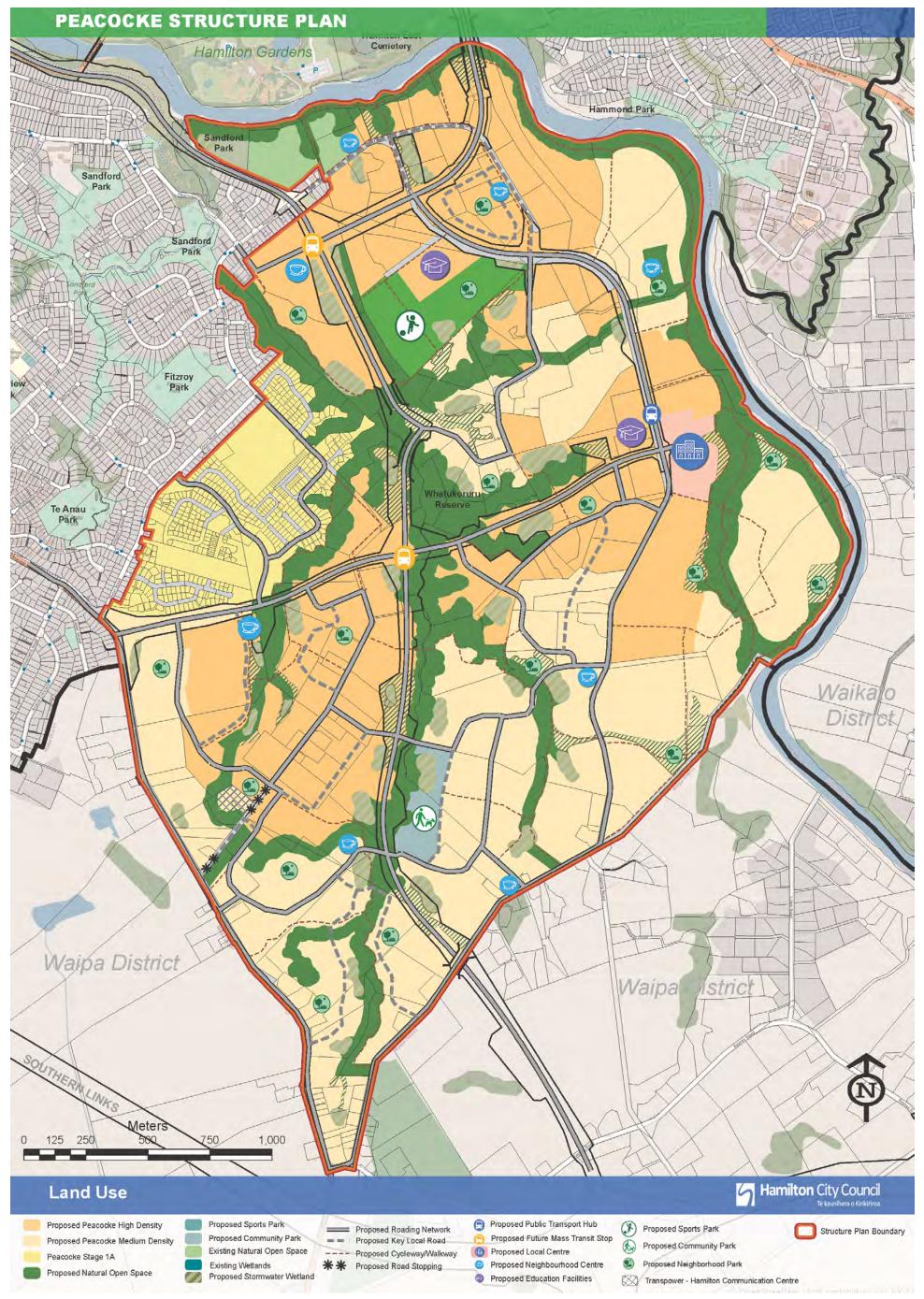
### **APPENDIX AA**

### PEACOCKE PLAN CHANGE 5

PROPOSED MAPS AND PLANS

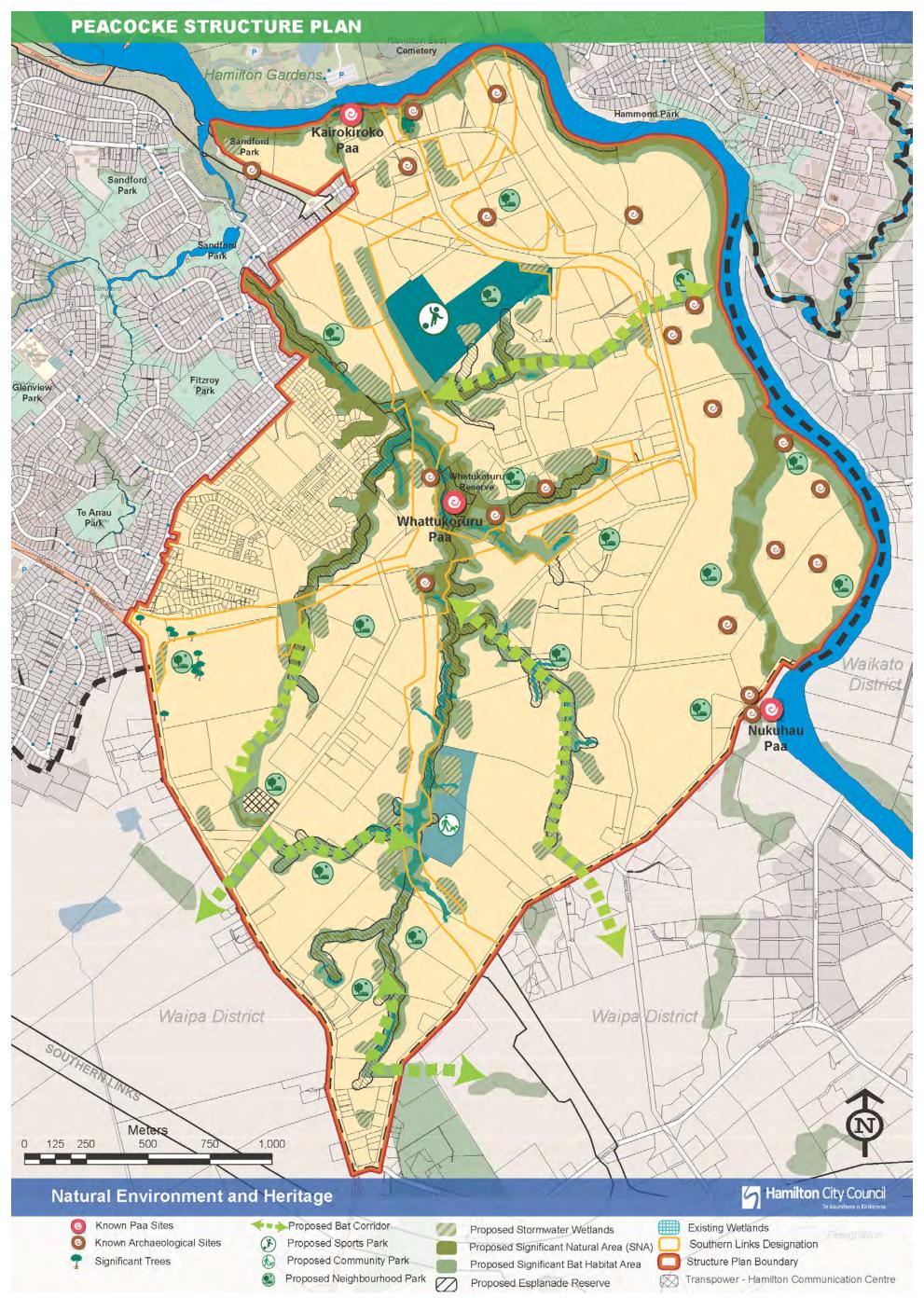


## PROPOSED LAND USE PLAN





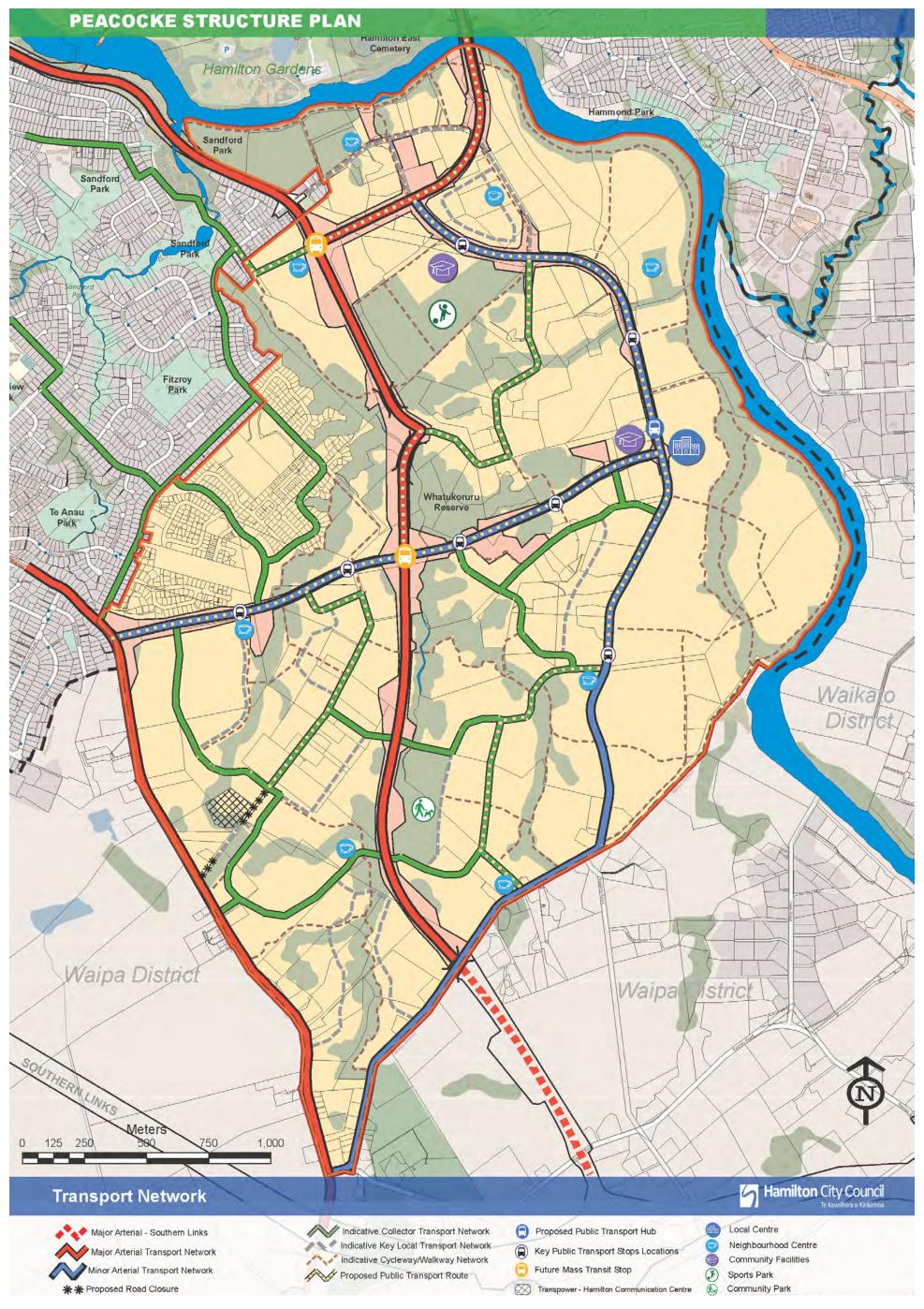
# PROPOSED NATURAL ENVIRONMENT AND HERIATGE PLAN





# PROPOSED TRANSPORT NETWORK PLANS

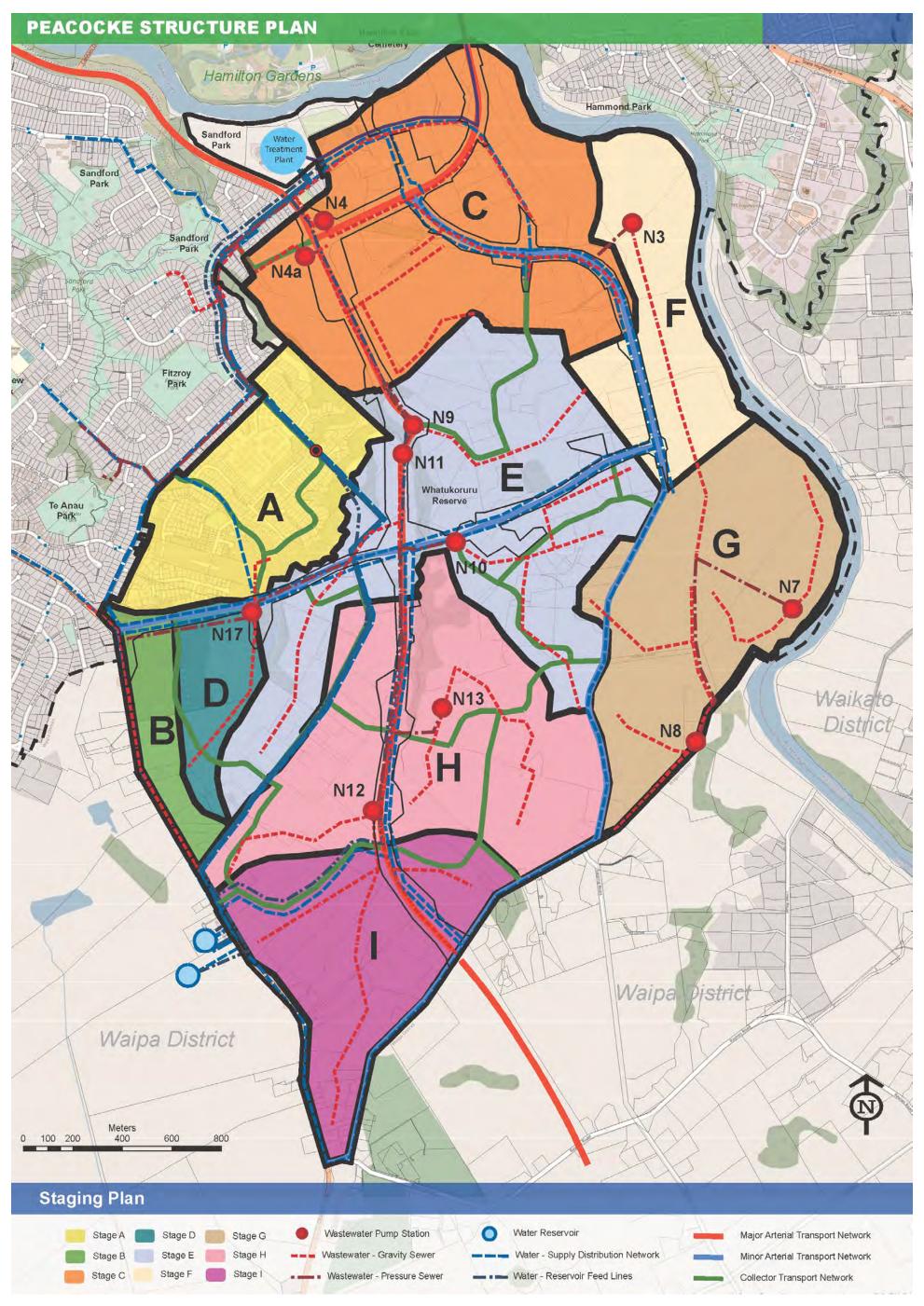
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## PROPOSED STAGING PLANS





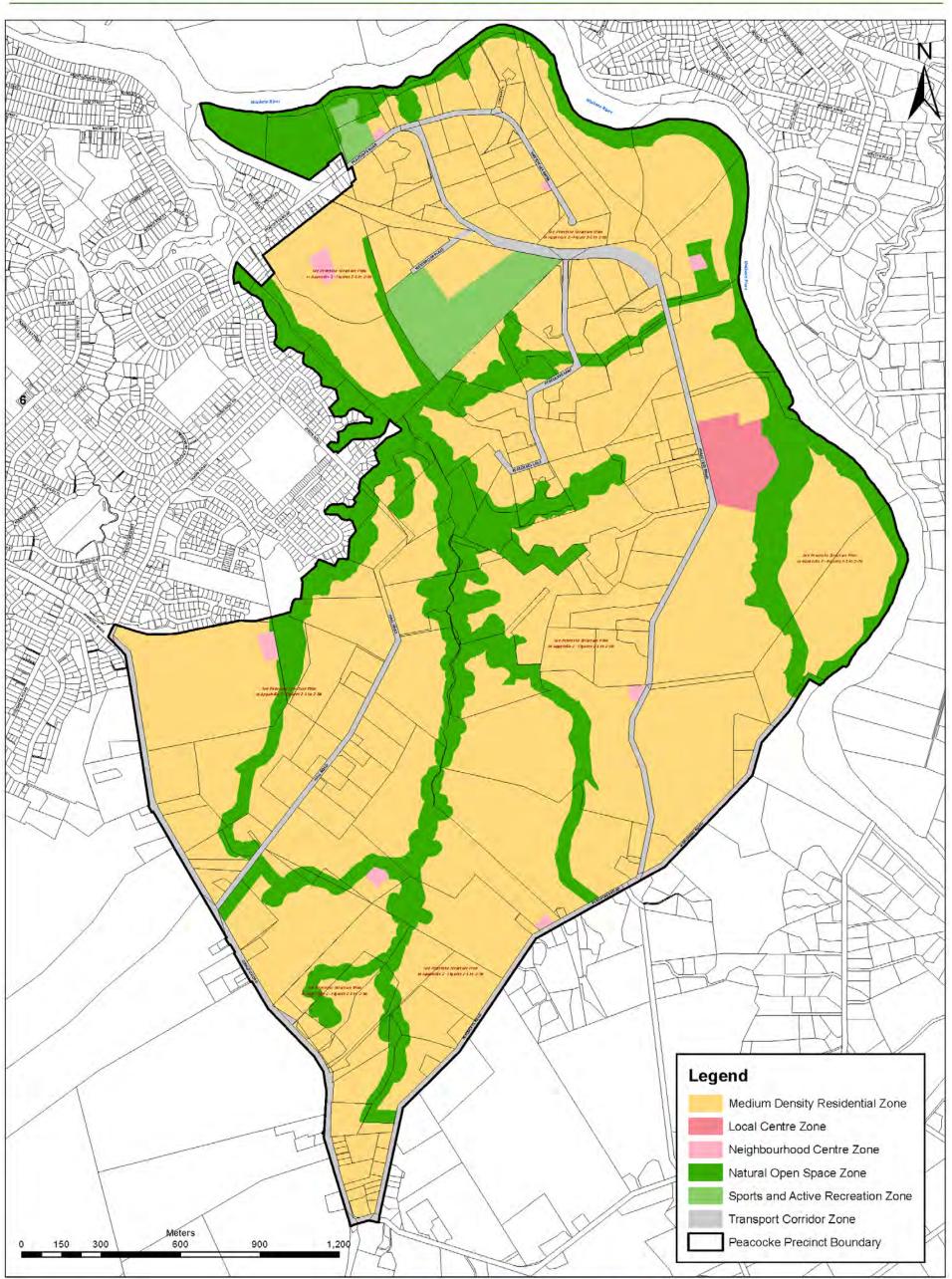


## PROPOSED ZONING MAP



Plan Change 5 Operative District Plan





Volume 2

Peacocke Precinct - Zoning Map



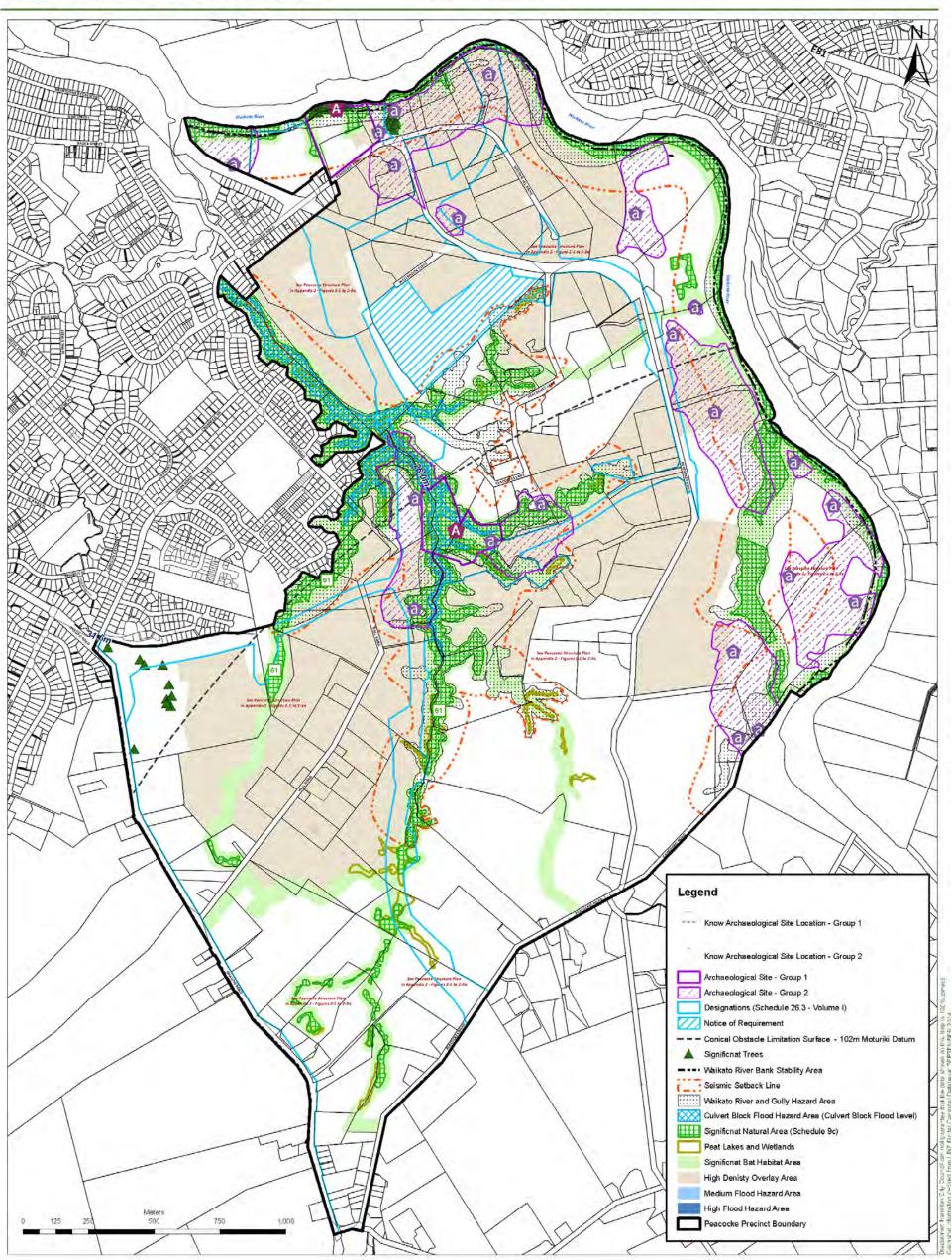
### PROPOSED FEATURES MAP





Plan Change 5 Operative District Plan





Volume 2

Peacocke Precinct - Features Map