**In the High Court of New Zealand**
**Auckland Registry**

**I Te Kōti Matua O Aotearoa**
**Tāmaki Makaurau Rohe** CIV-2019-404-2682

under the **Judicial Review Procedure Act 2016**

between

**Averil Rosemary Norman** and **Warwick Bruce Norman**

Applicants

and

**Tūpuna Maunga o Tāmaki Makaurau Authority**

First Respondent

and

**Auckland Council**

Second Respondent

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# AFFIDAVIT OF ANDREW FRANCIS BARRELL

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6 December 2019


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# AFFIDAVIT OF ANDREW FRANCIS BARRELL

I, Andrew Francis Barrell, arborist of Auckland, swear:

1. I have practised as an arborist in various capacities for the last 35 years. I am the director of Tree3 Limited, a company that provides consultancy and tree management services. Part of that involves providing tree management plans for both groups of trees and individual specimens.

2. I have read and am familiar with the Code of Conduct for Expert Witnesses in Schedule 4 of the High Court Rules and agree to be bound by it. All opinions expressed in this affidavit are based on my experience as an arborist and in the tree management and arboriculture industry and fall within my area of expertise.

3. I have been asked by the applicants in this proceeding to assist the Court by providing my opinion on:

    a. the industry standard in respect of management of urban forests and what good practice in this respect is;

    b. the extent to which the intended felling aligns with industry standards and good practice; and

    c. the effect on Mount Albert's treescape as a result of the intended felling.

2. I set out my experience, instructions and opinion below.

**Personal experience and qualifications**

3. I have around 35 years' experience as an arborist and in the tree management and arboriculture industry. I have always had a passion for working with trees and that is reflected in my career to date.

4. At the start of my career and in around 1984 I worked pruning trees in the United Kingdom. Part of that involved pruning the largest avenue of evergreen Oak trees in that country. That was one of my first experiences of the approach taken to the management of urban forests – learning how to manage a stand of trees to ensure health and safety concerns were addressed and adequate steps were taken to promote and protect the tree life, or, in other words, to extend the useful life expectancy of the trees. Those are two of the fundamental principles of managing trees within an urban forest environment, and I will address them in more detail below.

5. Before coming to New Zealand over 15 years ago I worked as an arborist in various places and locations around the world, including Britain, Europe, Australia, Africa and South East Asia. During that time I was also a Tree Officer for the North Dorset District Council (England), where I was

responsible for administering tree protection systems and providing advice to Council officers and the general public.

6. After moving to New Zealand, I worked for 2 years at North Shore City Council (as it was then) as an Environmental Services arborist. As part of that role I was responsible for assessing resource consent applications in respect of arboriculture considerations.

7. For the last 12 years I have been working in the private sector as a consultant arborist. My company, Tree3 Limited, provides consultancy services covering a wide range of tree-related matters. That includes management plans for general maintenance and management of trees, project-specific management plans, hazardous tree evaluation and management and other related services.

8. I have a number of formal qualifications, including a National Diploma In Arboriculture and a Bachelor of Science (Honours) in Environmental Protection. One component of that degree was study and training in ecological evaluation, which is a specialty that I incorporate in my work. I also have a Tree Risk Assessment Qualification from the International Society of Arboriculture and have completed training held by the UK Arboriculture Association on Risk Assessment for Commercial Arboriculture.

9. Ecological evaluation and consideration of ecological processes has become an integral component of the management of urban forests. That includes site evaluation and assessments for the presence of particular ecological components and the existing potential for further development or ongoing use by people. A subsequent management plan may then include provision for the appropriate management of the urban forest to best support and sustain that ecological potential. Usually that is for improving diversity value and sustainability value.

10. Throughout my career, I have developed management plans for trees in urban settings, including for parks, schools and golf courses.

**Basis of opinion**

11. In forming my opinion and preparing this affidavit, I have:

    a. consulted my own literature that I maintain on urban forest management;

    b. reviewed Auckland Council's "*Auckland's Urban Ngahere (Forest) Strategy*"; and

    c. reviewed the "*Owairaka/Te Ahi-ka-a-Rakataura Assessment of Ecological Effects*" produced by Te Ngahere Native Forest Management for the Tupuna Maunga Authority, final version dated 2 October 2018.

12. I have not seen any reports that may have been obtained by the Tupuna Maunga Authority or Auckland Council on the arboriculture effects of the intended felling. As I set out below, the Assessment of Ecological Effects report produced by Te Ngahere Native Forest Management does not appear to address non-native trees and specifically excludes arboriculture considerations.

13. By way of disclosure and for transparency, and as noted above, I have previously carried out and consulted to the Tupuna Maunga Authority on arboriculture matters for certain works on Mount Albert and Mount Richmond. That was discreet work based on specific instructions. I do not believe it impacts my objectivity in any way.

14. As I understand it, the Tupuna Maunga Authority and/or Auckland Council intend to fell around 345 mature, non-native trees in the space of the next 3 or 4 weeks on Mount Albert, being nearly half the trees on the reserve. Following that felling, some young, immature native trees will be planted together with a variety of other plants. I am not aware of the intended timing for that.

**Summary of opinion**

15. In my opinion, the felling of so many mature trees, in such a short space of time, is likely to have a dramatic, negative and possibly irreparable effect on the ecosystem of the reserve, including on many of the native trees on the mountain.

16. In fact, never in my 35 years' experience have I seen the manager of an urban forest propose to fell such a significant number of mature trees effectively at once. It is difficult to understand, from an arboriculture perspective, how that decision has come about and been made. If the goal is to replant the mountain exclusively with native trees, there would be both less damaging and more effective ways to achieve that.

17. The ideal when it comes to urban forest management is to let the forest follow its normal and natural life cycle, at least as far as that is consistent with other requirements like health and safety, risk management etc. The proposed felling is fundamentally inconsistent with that modern approach.

18. I understand the author Mike Wilcox, in his *book Auckland's Remarkable Urban Forest* describes Mount Albert on page 96 as "one of Auckland's best public tree spaces". I agree. I believe the proposed felling is far in excess of what is necessary for the effective management of that urban forest.

19. I include below a photograph I have taken of part of the mountain, which shows a mix of native and non-native mature trees growing together. Many of the larger trees in the picture below are non-native.

20. It is likely to be many decades before native trees planted in the place of the trees to be felled reach comparable height and stature. Some of the non-native trees on the mountain are likely to be over 100 years old.

**Proper management of urban forests**

21. An urban forest should always have a management plan if it is to survive and flourish. The basic objectives of that management plan will include risk management and, what I would more generally label, 'tree health'. Each management plan, and how those objectives are addressed, will vary depending on the particular environment.

*Management of health and safety risks*

22. I comment only briefly on health and safety because of my understanding that the decision to fell the non-native trees has not been made for health and safety reasons.

23. Trees can pose a risk to people or property – for example, branches can fall onto people. To remove the risk entirely would mean removing the tree. That is clearly not conducive to sustainable management. The preferable approach instead is to minimise any risk identified; to mitigate it; and, as a last resort, to remove it. That is consistent with my understanding of the RMA ("avoid, remedy, or mitigate") and the requirements applying to reserves.

*Ecological considerations and the importance of mature trees*

24. When considering 'tree health', the focus today is not just on how a tree is able to maintain itself but also on how it is able to contribute to its environment, the trees around it and growing near it, and more generally the complex interactions that occur between all living components of that environment.

25. The importance of that wider perspective when managing trees and forests in urban settings has increasingly become a part of modern practice. Past practices, in my experience at least, focused more on the aesthetics of individual tree shapes (for example removing dead or broken limbs and shape alteration to make the trees look nice), and management plans made accordingly. The current practice has moved away from that old-school approach.

26. Nowadays, for example, tree matter and debris are recognised as having significant ecological value while still in the tree or on the ground. Damaged and decomposing trees and tree matter provide an ecological niche for a whole variety of other forms of wildlife. This is why it is strongly preferable from an ecological perspective to let a tree die naturally, as opposed to cutting it down and removing it from its environment. This can translate as killing an undesirable tree and leaving it where it stands to decompose over time whilst still providing benefits to the surrounding ecosystem.

27. A sustainable forest will have – and should have - an uneven age-class; young, mature and dying/decaying trees. That uneven age-class is a key component of a sustainable urban forest.

28. Mature trees in particular have a significant role to play. They provide the most shade and shelter, preventing the ground being dried out by the sun and wind. They provide, amongst other things, significant ground protection by intercepting rainfall, protecting from erosion, consolidating soil with their root system and providing a buffer for stormwater surges. They also provide an ongoing source of nutrients (falling leaves, bark and wood) which are recycled into the soil and contribute to the overall ecological integrity of the environment. Obviously this is not so relevant to a tree in a planter pit in Queen Street but it does apply to trees in group situations (parks, reserves and other open spaces) where natural processes and interactions are better able to occur.

29. A tree's contribution to its environment (including the ecology and interactions with the surrounding ecosystem) increases exponentially with its maturity and growth. Mature trees contribute significantly more than their younger counterparts.

30. That has been recognised by Auckland Council. One of Auckland Council's current stated goals is to maintain and enhance the mature tree population in Auckland. A copy of Auckland Council's report "Auckland's Urban Ngahere (Forest) Strategy" is annexed to this affidavit and marked "A". That report notes the following benefits of larger trees, which I agree with:

    a. On page 28 and page 29:

        The 2013 LiDAR survey reveals that tall trees are rare in our urban ngahere; only six per cent of the urban ngahere is over 20 metres

in height, the majority, 64 per cent, is less than 10 metres (see Figure 5). This is partly due to the species that make up the urban ngahere and their height at maturity. In addition, trees over 20 metres in height need to be in the right place to allow for growth and are likely to be at least 60 years old. Historically, most mature trees were removed as land was cleared for agriculture and Auckland developed.

**When it comes to trees, size does matter!**

Benefits are disproportionally greater for larger trees. For example, big trees provide more shade because of their larger, wider canopy spread; their greater leaf areas and more extensive root systems intercept larger amounts of rainfall and stormwater; they absorb more gaseous pollutants, have higher carbon sequestration rates, and typically contribute more to calming and slowing traffic on local streets than small trees. Larger trees also usually have few or no low branches to interfere with activity at ground level, especially if pruned to provide higher canopy clearance over roads, public space and pedestrian footpaths.

b. On page 45:

**4. Protect mature, healthy trees**

The benefits provided by trees become exponentially greater as they mature. It's also more cost effective to care for mature trees, as this typically costs less than planting and caring for new trees. The only way to replace a 40-year-old tree is to spend 40 years caring for a new tree.

People often have strong emotional connections to landmark, mature trees in their neighbourhoods, and are more likely to mourn the loss of a large tree. Additionally, some native species, such as kākā, and bats, prefer taller trees and their presence can significantly improve the biodiversity value of an area.

c. On page 54:

Protecting our existing urban ngahere is crucial to realising the values and benefits of mature trees. Caring for new plantings and young trees is essential to ensure that older trees are replaced at the end of their life and our urban ngahere grows over time.

31. For an urban forest to be sustainable, diversity is also essential. Species diversity increases the ability of a tree population to survive the ongoing effects of climate change and any unexpected pest / disease outbreaks, a situation that is becoming ever more likely given the current abundance of opportunities for foreign pests to arrive in this country. Kauri dieback is one such problem, as is "myrtle rust". Both these diseases affect the most

iconic trees in New Zealand (kauri and pohutukawa). Diversity is the key to longevity in that respect.

32. Auckland Council's urban forest strategy also recognises the importance of forest diversity at page 45:

> **3. Ensure urban forest diversity**
>
> Planting a range of species increases the urban ngahere's resilience to the impacts of diseases, pests, and climate change. Planting a diverse range of species will ensure only a portion of the urban ngahere will be affected as diseases and pests tend to be limited to a certain tree species or genus.
>
> It is also important to maintain genetic diversity for each species to support better resilience, for example through our seed collection programme. Planting trees with varying lifespans helps to avoid a large-scale decline in numbers as trees with similar lifespans reach the end of their lives.

**Mount Albert**

33. I have first-hand knowledge of the mountain from my time spent on it and walking around it. For example, as mentioned above, I have previously consulted on the management of certain trees on Mount Albert.

34. I would describe Mount Albert as having a varied urban forest. There are areas with a large number of mature trees that are a mixture of native and non-native species.

35. I have considered the proposed felling plan in view of the principles regarding sustainable and effective management of urban forests I have set out in the section above.

36. First, I am not aware of there being any significant health and safety concerns from those trees that could not be addressed with a standard health and safety management plan and routine maintenance, as opposed to destruction.

37. Second, in my view, the intended felling of a significant of number of mature trees at once is likely to have a significant and negative impact on the reserve's ecosystem, including many of the remaining native trees. Trees are very adaptable organisms however their ability to adapt to significant changes directly correlates with how quickly those changes occur. They are much better able to adapt to changes that occur over longer time frames (years as opposed to days or months) than sudden changes, as would occur, for example, by immediate removal of around half the trees from a mature population as is proposed on the mountain.

38. As I mentioned above, trees in urban forests grow and mutually support and suppress each other. A group of trees should ideally be considered as

a single entity as opposed to a collection of individuals, at least if maximising ecological interactions and sustainability are part of the desired outcome. They develop collectively where they provide a mutual support from the strains of the environment (wind and exposure to direct sunlight being two major environmental influences), with particular trees therein adapting as necessary to cope with those strains. Where the trees have not had to adapt to those strains, any sudden and widespread loss of that supportive co-habitat can leave the remaining trees exposed and vulnerable.

39. The sudden felling of a significant number of mature trees is therefore likely to leave many of the remaining native trees on Mount Albert more susceptible to damage and degradation from the elements. For example, trees on the edge of a group will be more resistant to wind forces or sun scorch than those within the more sheltered internal areas. If these internal trees are suddenly exposed to wind or sun by removal of the edge trees, their health or stability is likely to be negatively affected.

40. It is possible that an urban forest may adapt over time to such disturbances, but it is very difficult to predict with certainty the scale of the impact that such intensive felling will have on the existing ecosystem. In my view, however, it is likely that the sudden loss of so many of the trees on the mountain – almost half of them – will have a major and negative impact, including on the adjacent native trees.

41. I have described in the section above how the presence of mature trees assists the establishment and growth of younger trees. They provide shade, space for birds (whose droppings provide nutrients and a viable seed source), and drop woody material (bark, twigs, wood and leaves), which contributes to improvements in soil condition. Many native trees in particular develop in shaded in environments, for example karaka, nikau, and cabbage trees. For these reasons, the removal of all non-native trees at the same time is likely to be a negative factor for the establishment of the natives to be planted also (as well as for existing younger native trees). That is at least the case in those clusters of trees on the reserve which are reasonably mixed or predominantly non-native.

42. What I might have expected to see would be a selective removal or partial removal of particular trees over a period of time. From an ecological and arboriculture perspective, that would be likely to significantly reduce the immediate shock to the overall system involved in removing many mature trees in one go.

43. That does not necessarily mean felling. There is incredible ecological value in standing dead trees and tree matter. A common approach to removing mature trees in similar circumstances would be 'ringbarking', where the tree is allowed to slowly die. That approach is often employed by Councils or the Department of Conversation. That ensures the tree still provides as much benefit to the ecosystem as possible, providing shade, debris for nutrient recycling, epiphyte habitat, allowing bird and other wildlife to nest and breed. Depending on the type of tree, the standing wood can survive

for a number of years. Another option is to "monolith" a large tree which means removing most branches to leave a single standing stem.

44. Obviously, any consideration of 'ringbarking' or the like would need to be carried out after a thorough assessment of the specific tree or trees involved. It would be inappropriate for trees that are more likely to decay and be unable to support themselves quickly. However, and by way of example, if it was *necessary* to remove the large oak on the mountain that is on the path down from the summit, that standing wood could possibly support itself for decades without posing any significant health and safety risk. The same applies for the large macrocarpa close to the oak – this could be "monolithed" so that only perhaps 5-10m of the main stem remains standing.

**Te Ngahere Native Forest Management Report**

45. I have reviewed the Te Ngahere Native Forest Management report that it produced for the Tupuna Maunga Authority on the ecological effects of the planned felling, obtained as part of the resource consent process. A copy of that report is annexed to this affidavit and marked "B".

46. The report does not appear to have considered any benefit coming from non-native trees, and so the loss of that benefit as a result of removing them. I am not sure if that is because of the instructions received as to the scope of the report but some of the qualifiers used throughout indicate that might be the case.

47. I say that because the report states that it does not cover arboriculture effects of exotic (non-native) tree removal. The scope of the report is then difficult to understand as ecology and arboriculture are intertwined in many ways. By ignoring the arboricultural aspects – i.e., the trees – the assessment of ecological effects is incomplete. As I have explained above, the loss of so many mature trees is likely have significant and negative ecological effects.

48. I have not seen or reviewed any other reports that might have been intended to accompany that report. Until I do I have not provided further comment. I do however make two further observations.

49. First, the report makes references to Auckland Council's Regional Pest Management Strategy and the "pest" classification of trees. The report does not appear to consider how to manage mature trees when they might have a particular classification. I am not aware of any requirement to remove mature trees that have less than desirable classifications. As a general observation, throughout the country there are a number of notable/heritage/scheduled trees (recorded in some cases on Council registers) that have 'surveillance' classifications according this Strategy, and which are either protected by Council rules or are considered to be specimens worthy of inclusion within the NZ tree register (see www.notabletrees.org.nz). The classification in and of itself is not determinative of how a tree is managed.

50. Second, the report recommends works be undertaken outside of the bird breeding season of August to January. My understanding is that the respondents intend to carry out the works right now, i.e., November/ December.

51. In summary, from an arboriculture perspective and based on my professional experience, I can see no rational basis for the intended felling to be carried out in the proposed manner. It is not necessary or appropriate for the effective management of an urban forest and is contrary to current thinking on the most effective way to sustainably and holistically manage urban tree populations. I believe there are much less damaging ways to achieve the objective of the TMA to eventually return the volcanic cones to native planting.

**Effect on the existing treescape**

52. Finally, I have been asked to comment on what the effect is likely to be on the current treescape of the reserve.

53. The mature non-native trees on the reserve include many old, large and tall trees, as can be seen in the picture above. The tallest tree in that grove is the macrocarpa, appearing to the left. The large, wide, round-looking tree in front of it is an evergreen oak.

54. I understand that the intention of the TMA is to plant native trees in the place of the non-natives that will be removed. My personal observations indicate that native trees can grow at about a metre a year once established. Growth may be less for those trees that are planted in elevated or exposed locations.

55. As noted in Auckland Council's Urban Ngahere (Forest) Strategy, referred to above, "[t]he only way to replace a 40-year-old tree is to spend 40 years caring for a new tree" (page 45). I believe that some of the non-native trees in the reserve are likely to be over 100 years old.

**SWORN** at **AUCKLAND** this 6th day of December 2019 before me:

Andrew Francis Barrell

Barrister/Solicitor of the High Court of New Zealand

Ana Lenard
Barrister

"A"

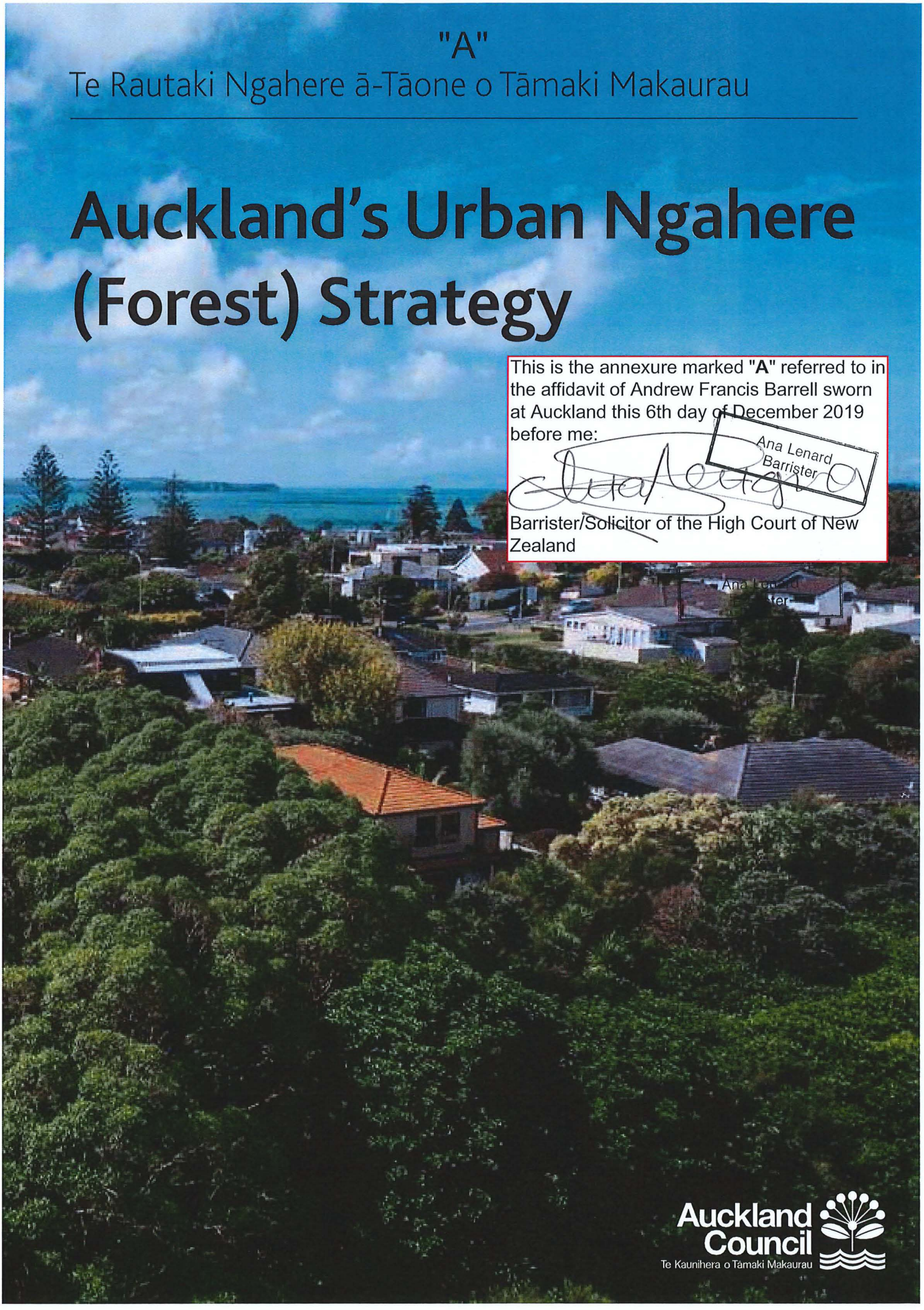
Te Rautaki Ngahere ā-Tāone o Tāmaki Makaurau

# Auckland's Urban Ngahere (Forest) Strategy

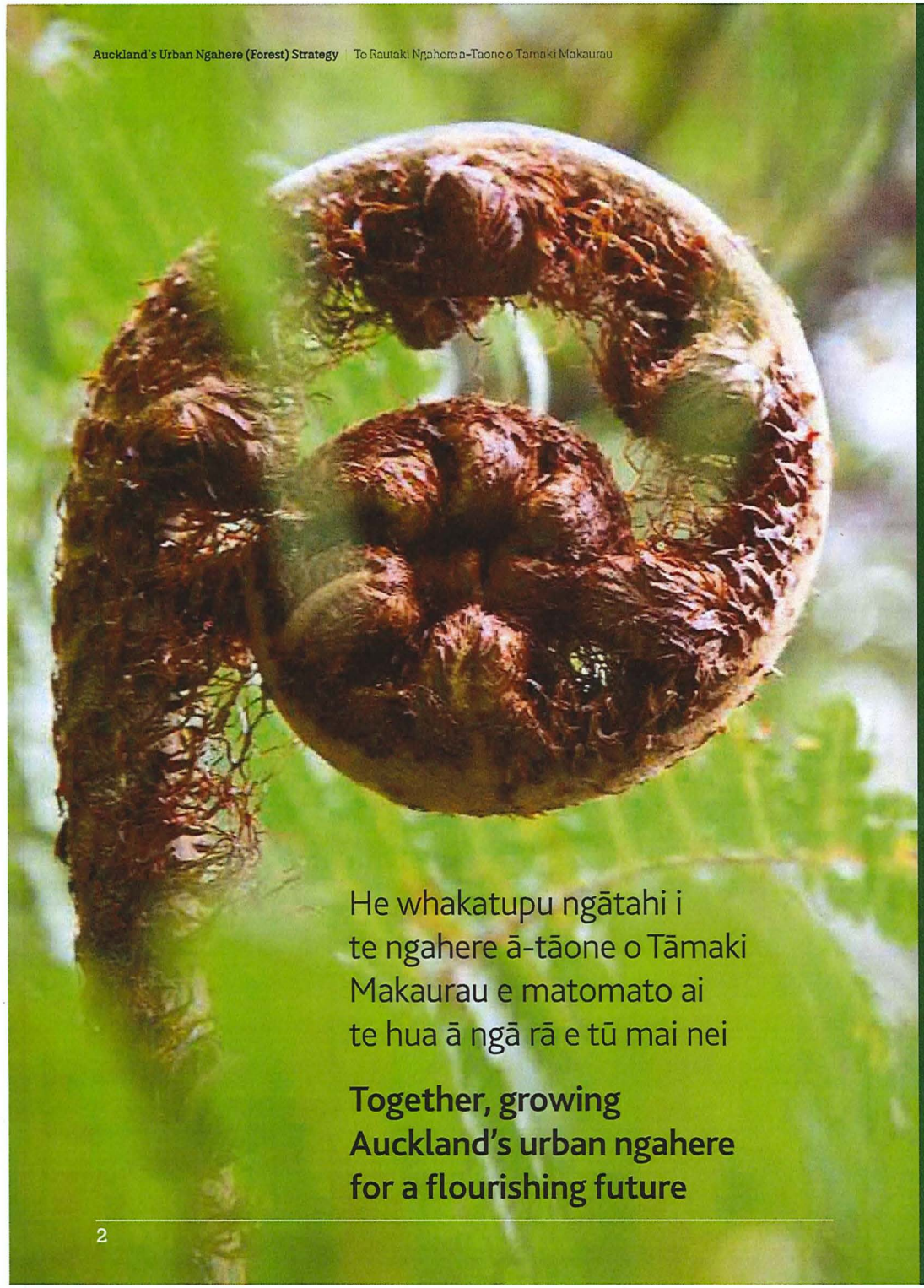
This is the annexure marked "**A**" referred to in the affidavit of Andrew Francis Barrell sworn at Auckland this 6th day of December 2019 before me:

Ana Lenard
Barrister

Barrister/Solicitor of the High Court of New Zealand



Auckland Council
Te Kaunihera o Tāmaki Makaurau



He whakatupu ngātahi i
te ngahere ā-tāone o Tāmaki
Makaurau e matomato ai
te hua ā ngā rā e tū mai nei

**Together, growing
Auckland's urban ngahere
for a flourishing future**



Auckland's Urban Ngahere (Forest) Strategy | Te Rautaki Ngāhere a-Tāone o Tāmaki Makaurau

# He Mihi

Nau mai e te hā o Tāne,
Whakatau mai e te oranga o Tāne.

Tīkina mai te ate rahirahi
o te Tāone nui o Tāmaki Makaurau
hei whakaniko anō ai i te whenua tapu;
ko tō whaea, ko Papatūānuku.

Kia toro ake ōna hua me ōna pai
kia tauawhia e tō matua
e Rangi-nui e tū iho nei,
kia rongohia anō te tīhau a ngā manu,
me te kētete a ngā pēpeke.

Kia wawara anō te reo o ngā rākau
kua roa e ngū ana
ki te wao kōhatu e tāwharau nei
i ngā maunga tapu o tō whenua taketake.

Tane-o-te-waiora,

Tāne-whakapiripiri,

Tāne-nui-a-rangi,
tukua mai anō tō ihi,
tukua mai anō tō mana.

Māu e kitea anō ai
he awa para-kore e rere ana,
he hau mā e kōrewarewa ana,
he taiao hauora e takoto ana.

Kia hipokina anō e tō korowai kākāriki te tāone nui
kia whiwhi ko mātou,
kia whiwhi te ao katoa.

Tāne let your breath pervade all,
may your life-essence be ever-present.

Reclaim the very heart
of Auckland city
and adorn once again the hallowed ground;
that is your mother, Papatūānuku.

May all that is fruitful and good
reach skyward to the embrace of your father
Rangi-nui on high
so the chorus of birds may be heard again,
and the splendid symphony of insects in response.

Bring with you the sounds of rustling trees
that have long stood silent
to this concrete jungle that bounds
the sacred mountains of your primal domain.

Tāne-purveyor of life,

Tāne-provider-of-shelter,

Tāne-source-of-all-knowledge,
bestow us again with your wonder,
and grace us with your prestige.

By you, we will again realise
fresh waterways,
pure air,
and a healthier environment.

Garb the city with your verdant cloak
that we, your heirs might benefit,
and so too, the whole world.

*Te Pumanawa Square, Westgate.*





# Kupu whakataki
# Foreword

A healthy urban ngahere (forest) enriches our communities, our local economies and our natural environment. Auckland cannot become a world-class city without one.

Whether you are from Takanini or Takapuna, Herne Bay or Henderson, trees and vegetation are valuable to all of us. They clean our air and stormwater, cool and beautify our urban spaces and bring nature to our doorsteps. Developed in partnership with tangata whenua, the strategy gives voice to an important role trees play in the mauri of the land. They provide a wide range of measurable benefits that make our lives healthier, happier and more gratifying.

How can we protect what we value in the face of a growing and urbanising population, rising inequality, and the major impacts of invasive pests and climate change? How do we maintain and enhance the richness that our urban ngahere provides? How do we align our efforts?

This is precisely why we have developed a strategy for Auckland's urban ngahere. It delivers on the vision for our future Auckland, ensuring each one of us – and future Aucklanders – have access to the tangible benefits provided by a vibrant, green city.

The strategy ensures that when Auckland Council, corporate partners, community groups and each one of us plants or maintains a tree, our collective efforts truly add up to something – contributing towards increasing our average canopy cover from 18 to 30 per cent. Likewise, the strategy helps target our efforts to grow the urban ngahere where it's scarce – as in parts of South Auckland – so that all local board areas have at least 15 per cent canopy cover.

This strategy provides an overarching vision and 18 high level actions under three main themes, Knowing, Growing and Protecting but doesn't provide all the answers or deliver the vision. We will need to work with each of you and across all local boards to tailor specific and unique approaches to implementation that respond to the local context, harnessing and building local talents, partnerships and resources along the way.

I invite you to join me. Let's work together to grow, protect and maintain our valuable urban ngahere for a greener and greater Auckland for all of us.

**Councillor Penny Hulse**
Chair, Environment and Community Committee

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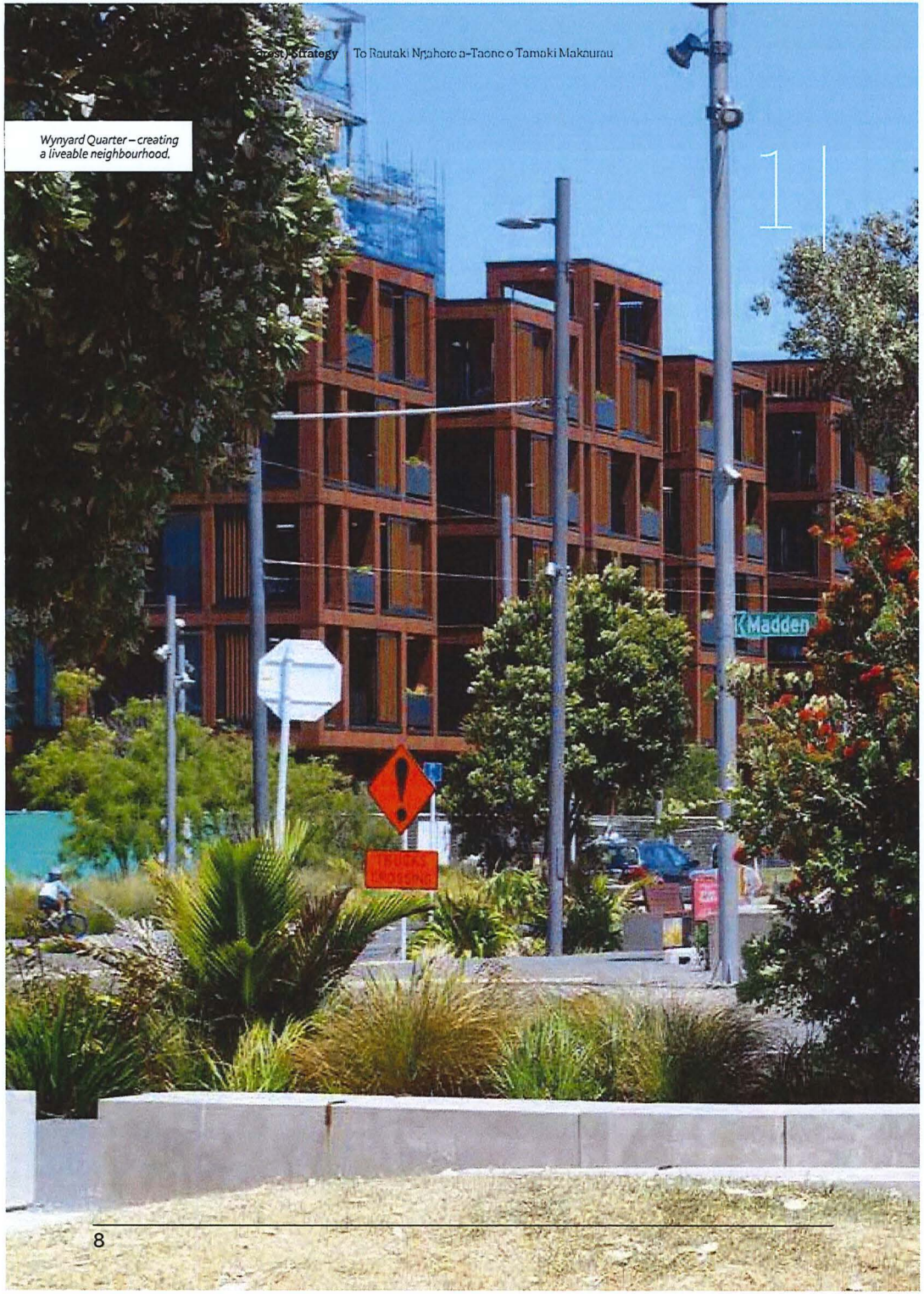
*Tagata Way, Māngere.*




*Wynyard Quarter – creating a liveable neighbourhood.*



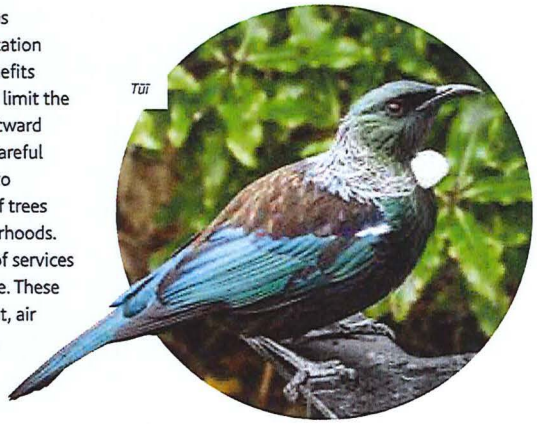
# He mahere rautaki mō te ngahere ā-tāone o Tāmaki Makaurau
# A strategic plan for Auckland's urban ngahere (forest)

When Tāne went to the heavens – so the story goes – he was enraptured by the tūī that lived in his brother Rehua's hair. Tāne desperately wanted to bring the tūī back to earth but he was told he must first plant trees to provide food. So Tāne introduced trees to our world and, three years later when the kahikatea blossomed, Tāne's wish came true. The tūī came to live with him.

When it comes to trees, the message is much the same. If we plant trees now, in time, we create value for our communities. We might even hear the dawn chorus – e kō i te ata – once again within urban Auckland.

Auckland is growing and changing rapidly. To accommodate this, Auckland Council has committed to a strategy of urban intensification to increase housing density, deliver the benefits associated with a compact urban form and limit the negative impacts linked with continued outward growth. Successful development requires careful planning; intensification and growth need to complement the protection and planting of trees and vegetation to create liveable neighbourhoods. Trees and vegetation also provide a range of services required for Auckland to function and thrive. These include enhanced stormwater management, air pollution removal, improved water quality, cooling to reduce the urban heat island effect, and ecological corridors to connect habitats and improve biodiversity.

Our urban ngahere faces a number of pressures. Alongside the need for urban development, amendments to the Resource Management Act (RMA) came into effect in 2015, lifting blanket tree protection in urban areas. As a result, the vast majority of trees on private urban properties are no longer protected. Threats from pests and diseases, as well as the impacts of climate change are further challenges. If we want to continue to benefit from the services provided by our urban ngahere it is essential that we better understand its status and value and plan to protect and grow it. Our urban ngahere has the mauri (life force) to care for us but needs our help to be sustainable and healthy.



*Tūī*

## 1.1 | He aha te ngahere ā-tāone o Tāmaki Mākaurau? What is Auckland's urban ngahere?

Auckland's urban ngahere is the realm of Te Waonui o Tāne (the forest domain of Tāne Mahuta) and consists of the network of all trees, other vegetation and green roofs – both native and introduced – in existing and future urban areas.

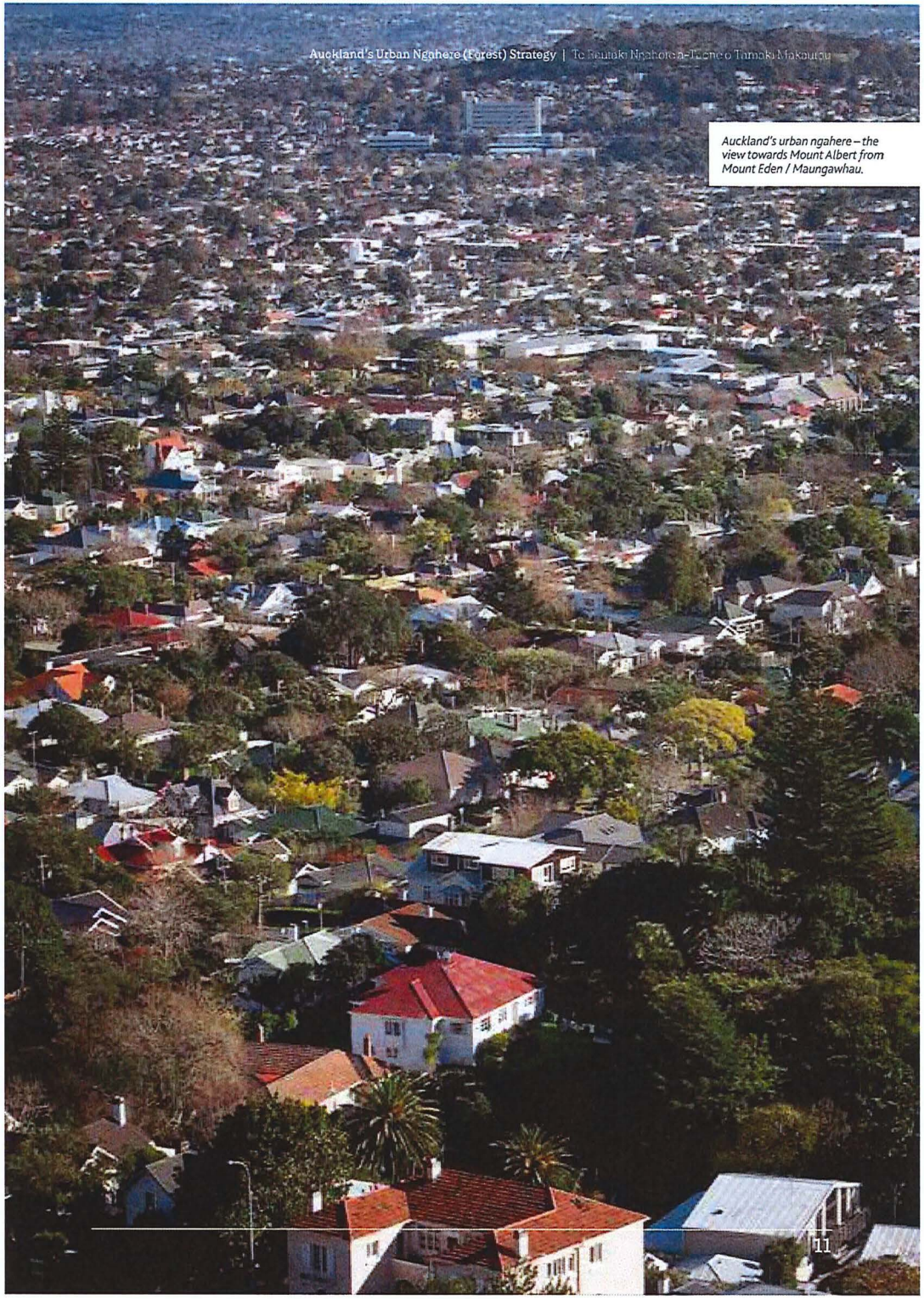
It's important to recognise the urban ngahere as more than just trees and vegetation. Urban ngahere captures the interconnected whakapapa (genealogy) of all living things to the wider ecosystem. It consists of a complex network weaving through public and private land, and includes the water, soil, air and sunlight that support it. It also involves people, wildlife and the built environment – all of which impact upon, or are impacted by, the urban ngahere. The urban ngahere has its own mauri (life force) but also depends upon a range of conditions and relationships to support its health, growth and survival.

Auckland's urban ngahere is diverse; it includes trees and vegetation in road corridors, parks and open spaces, natural stormwater assets, community gardens, living walls, green roofs and trees and vegetation in the gardens of private properties. The urban ngahere, like the pōhutukawa fringing Auckland's coastline, is an important part of Auckland's identity and natural heritage and shapes the fabric of the landscape. Trees also help distinguish our heritage places and areas, such as Albert, Western and Myers Parks, early cemeteries, for example, Symonds Street and Waikumete, and the settings of properties, including Monte Cecilia and Alberton. In addition, Auckland's scheduled character areas often feature memorial plantings and early street plantings.

*Manukau Square*



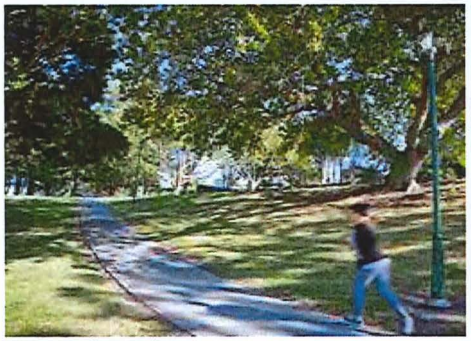




*Auckland's urban ngahere – the view towards Mount Albert from Mount Eden / Maungawhau.*

Examples of Auckland's urban ngahere:

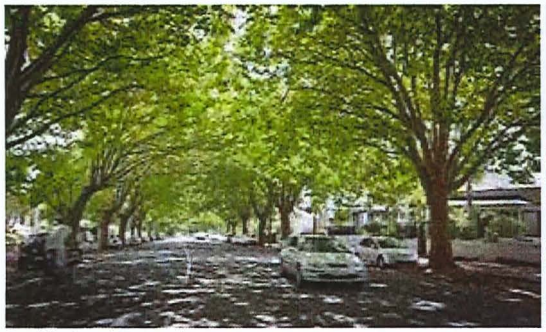
## Parks and open space



Potters Park, Mt Eden

Orewa Beach

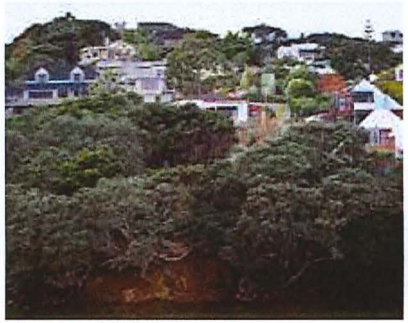
## Street trees and road corridors



Franklin Road, Ponsonby

Federal Street shared space

## Private gardens



Island Bay, Birkdale

Blockhouse Bay



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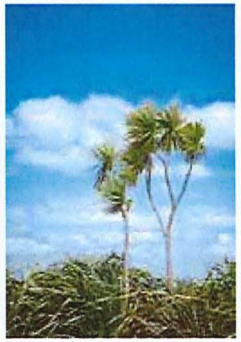
## Native forest

Native forest



Tī Kōuka / Cabbage tree

Kererū / New Zealand pigeon

## Natural stormwater assets

Te Auaunga Awa / Oakley Creek

Rain garden, Wynyard Quarter

## Green roofs and living walls

The University of Auckland green roof

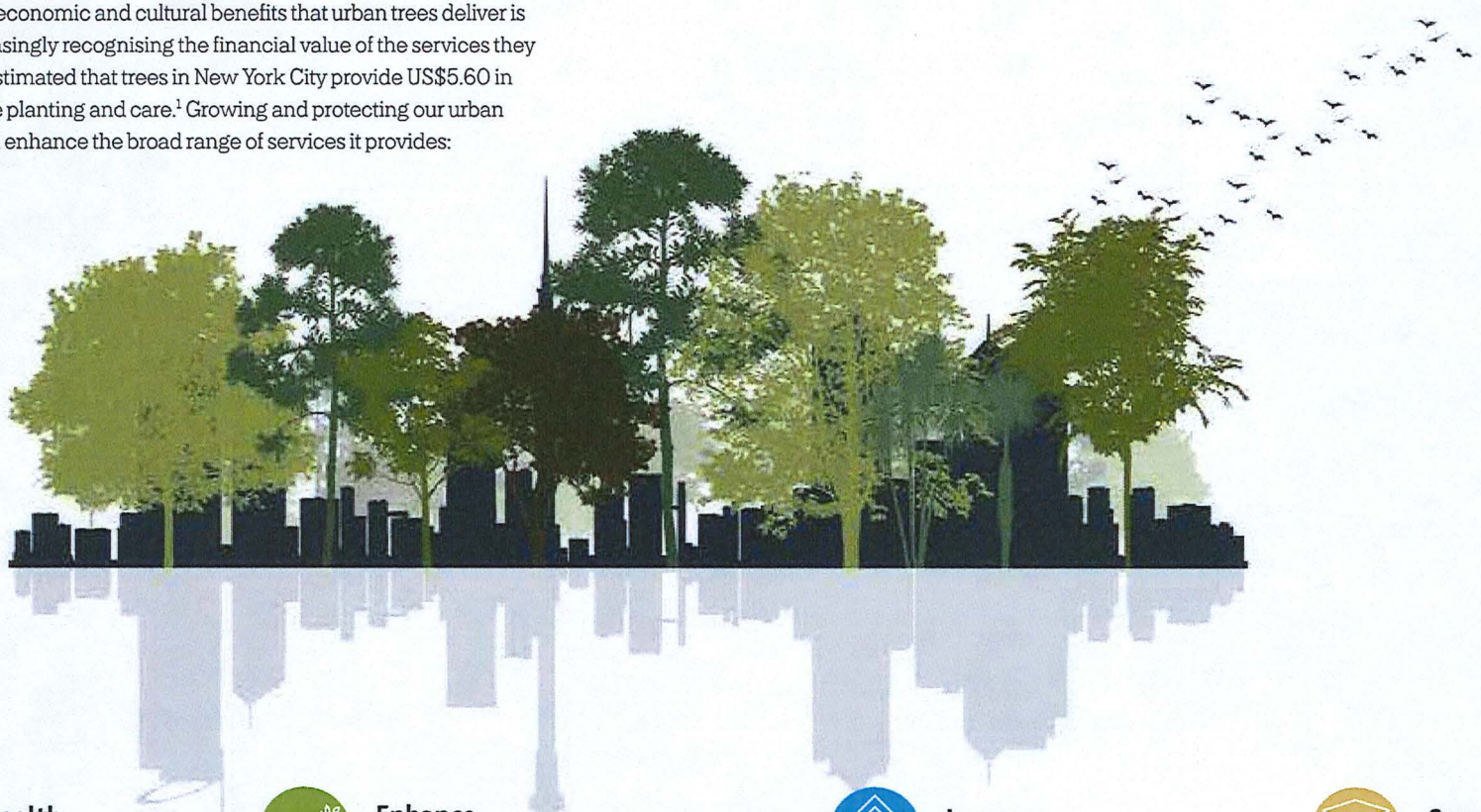
*Green roof images sourced from:*
*Zoë Avery from Living Roofs Aotearoa, www.livingroofs.org.nz*

Private residential green roof

Auckland's Urban Ngahere (Forest) Strategy | Te Rautaki Ngahere a-Taone o Tamaki Makaurau

## 1.2 | Ngā painga o te ngahere ā-tāone o Tāmaki Makaurau
## Benefits of Auckland's urban ngahere

The range of social, environmental, economic and cultural benefits that urban trees deliver is well-documented, with cities increasingly recognising the financial value of the services they provide. The USDA Forest Service estimated that trees in New York City provide US$5.60 in benefits for every US$1 spent on tree planting and care.[1] Growing and protecting our urban ngahere is essential to maintain and enhance the broad range of services it provides:



**Social**

- Improve health and wellbeing
- Reduce the urban heat island effect
- Provide shade
- Enhance visual amenity

**Environmental**

- Enhance biodiversity
- Improve air quality
- Carbon sequestration
- Improve water quality

**Economic**

- Increase property values
- Reduce flood risk
- Reduce energy costs
- Reduce healthcare costs

**Cultural**

- Support education
- Local food growing
- Sustain and enhance mauri
- Cultural heritage

# Social

## Improve health and wellbeing

Research has shown that access to trees and nature can reduce stress, improve mental health and promote wellbeing[2] whilst tree lined streets have been shown to encourage walking.

## Reduce the urban heat island effect

The cooling effect of trees, as a result of evapotranspiration, reduces the urban heat island effect[3] and enhances Auckland's resilience to an increasing number of hot days (>25°C), one of the projected impacts of climate change.

## Provide shade

Trees shading school grounds, playgrounds, public spaces, and cycling and walking routes provide relief from the sun and protect people from harmful ultraviolet (UV) radiation, in turn reducing the risk of heat stroke, sunburn and melanoma.

## Enhance visual amenity

Trees can visually enhance a street, the character of an area and foster neighbourhood pride. They add beauty, soften harsh urban environments and screen unsightly views.

# Environmental

## Enhance biodiversity

A healthy urban ngahere enriches biodiversity and provides opportunities for connected habitats that support wildlife.

## Improve water quality

Trees intercept rainwater and reduce the amount of pollutants being washed from hard surfaces into the stormwater system and watercourses. Increasing canopy cover will also contribute towards fewer storm water overflows from our combined sewer/stormwater systems and therefore lower levels of water pollution in our harbours and streams.

## Carbon sequestration

Trees reduce carbon dioxide ($CO_2$) in the atmosphere through sequestering carbon in new growth. One tonne of carbon stored in wood is equivalent to removing 3.67 tonnes of $CO_2$ from the atmosphere.

## Improve air quality

Trees improve air quality by removing air pollutants, such as particulate matter, and absorb gases harmful to human health. A 2006 study estimated that Auckland's urban trees remove 1320 tonnes of particulates, 1230 tonnes of nitrogen dioxide and 1990 tonnes of ozone.[4]



**Auckland's Urban Ngahere (Forest) Strategy** | Te Rautaki Ngāhere a-Tāone o Tāmaki Makaurau

# Economic

## Reduce healthcare costs

Improving air quality and enhancing health and wellbeing will reduce the need for healthcare and associated costs.

## Reduce flood risk

An increase in canopy cover would intercept an increased volume of rainwater; reducing and slowing urban runoff and placing less pressure on stormwater systems. International studies show that trees intercept 15 to 27 per cent of the annual rainfall that falls upon their canopy, depending on a tree's species and architecture.[5]

## Increase property values

Studies have shown that mature street trees increase residential property values and attract buyers and tenants.

## Reduce energy costs

Well-positioned trees provide shade and reduce cooling requirements and associated energy costs in buildings.

# Cultural

## Support education

Tree nurseries and planting projects promote environmental awareness and provide opportunities to encourage and facilitate learning.

## Cultural heritage

The cultural benefits of Auckland's urban ngahere are diverse and priceless. Native forest is important to mātauranga Māori (knowledge and understanding), and trees create a cultural connection to place and history.

## Sustain and enhance mauri

Mauri is a life force derived from whakapapa (genealogical connections and links to ecosystems), an essential element sustaining all forms of life. Mauri provides life and energy to all living things, including our urban ngahere, and is the binding force that links the physical to the spiritual worlds.[6] Mauri can be harmed if the life-supporting capacity and ecosystem health of our urban ngahere is diminished. Protecting and growing our urban ngahere will sustain and enhance its mauri.

## Local food growing

Planting fruit trees and establishing community orchards provides people with access to fresh fruit. Maintaining and harvesting fruit trees can connect and strengthen communities.

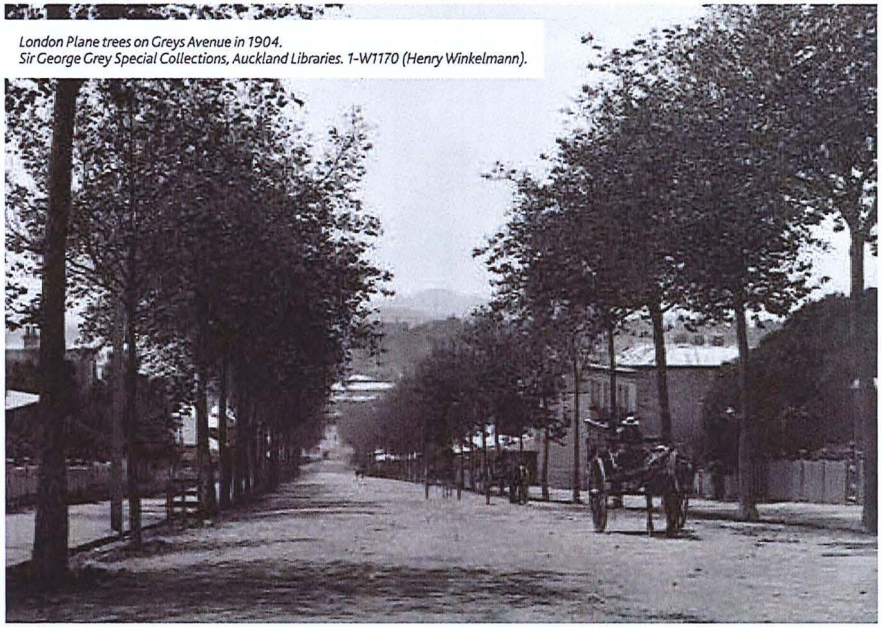
Native forest

## The cultural significance of Auckland's urban ngahere

The urban ngahere is an important part of Tāmaki Makaurau / Auckland's cultural heritage. Remnants of native forest represent traditional supermarkets (kai o te ngahere), learning centres (wānanga o te ngahere), the medicine cabinet (kapata rongoā), schools (kura o te ngahere) and spiritual domain (wairua o te ngahere).[7] Trees also represent landing places of waka (canoe) and birth whenua (to Māori, it is customary to bury the whenua or placenta in the earth, returning it to the land).

Many of Auckland's trees provide a visible reference to the city's history and development. European settlers planted London plane trees along streets in the 1860s which have now grown to create grand tree-lined avenues in the city centre and the adjoining suburbs of Ponsonby, Freemans Bay and Grey Lynn. Bishop Selwyn, New Zealand's first Anglican Bishop, is reported to have brought hundreds of Norfolk Island pine seedlings to Auckland in 1858-60. Many of the mature Norfolk Island pines now in Auckland, such as those at Mission Bay, are likely to have been grown from these seedlings.[8]





*London Plane trees on Greys Avenue in 1904.*
*Sir George Grey Special Collections, Auckland Libraries. 1-W1170 (Henry Winkelmann).*

*Greys Avenue 2017*

## 1.3 Te horopaki ā-kaupapa here mō ā tātou ngahere ā-tāone ināia tonu nei
## Current policy context for our urban ngahere

Auckland's plans and polices recognise and reference the value of trees and vegetation to varying degrees but do not provide a clear framework for the management of Auckland's urban ngahere. A range of plans and polices influence our urban ngahere (Figure 1) – explicitly and implicitly – yet urban ngahere objectives are only incidental to other considerations, such as green growth, climate change, indigenous biodiversity, and encouraging sport and recreation. In the past, this contributed to a situation in which Auckland's urban ngahere was managed and maintained through piecemeal initiatives rather than in a strategic and holistic way. This strategy consolidates and builds upon existing directives that support our urban ngahere and sets out a clear framework to protect and grow Auckland's urban ngahere for a flourishing future.

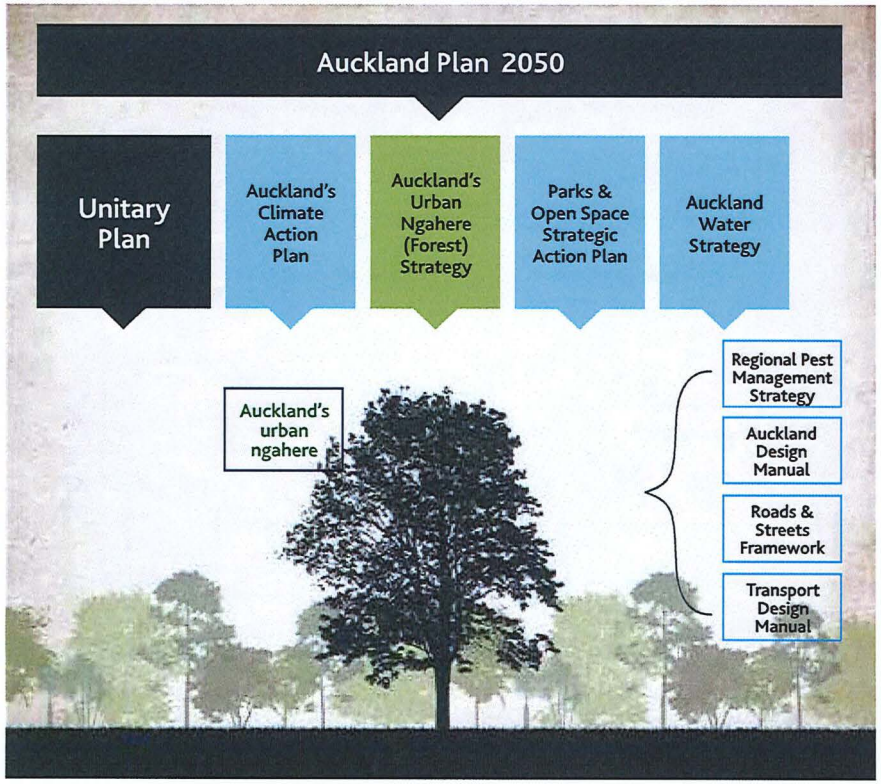



*Figure 1 – Key plans, strategies and guidance documents that influence Auckland's urban ngahere*





*The central city from above - London plane trees on Greys Avenue and Vincent Street (bottom left) and trees in Myers Park (bottom right) and Albert Park (top right).*

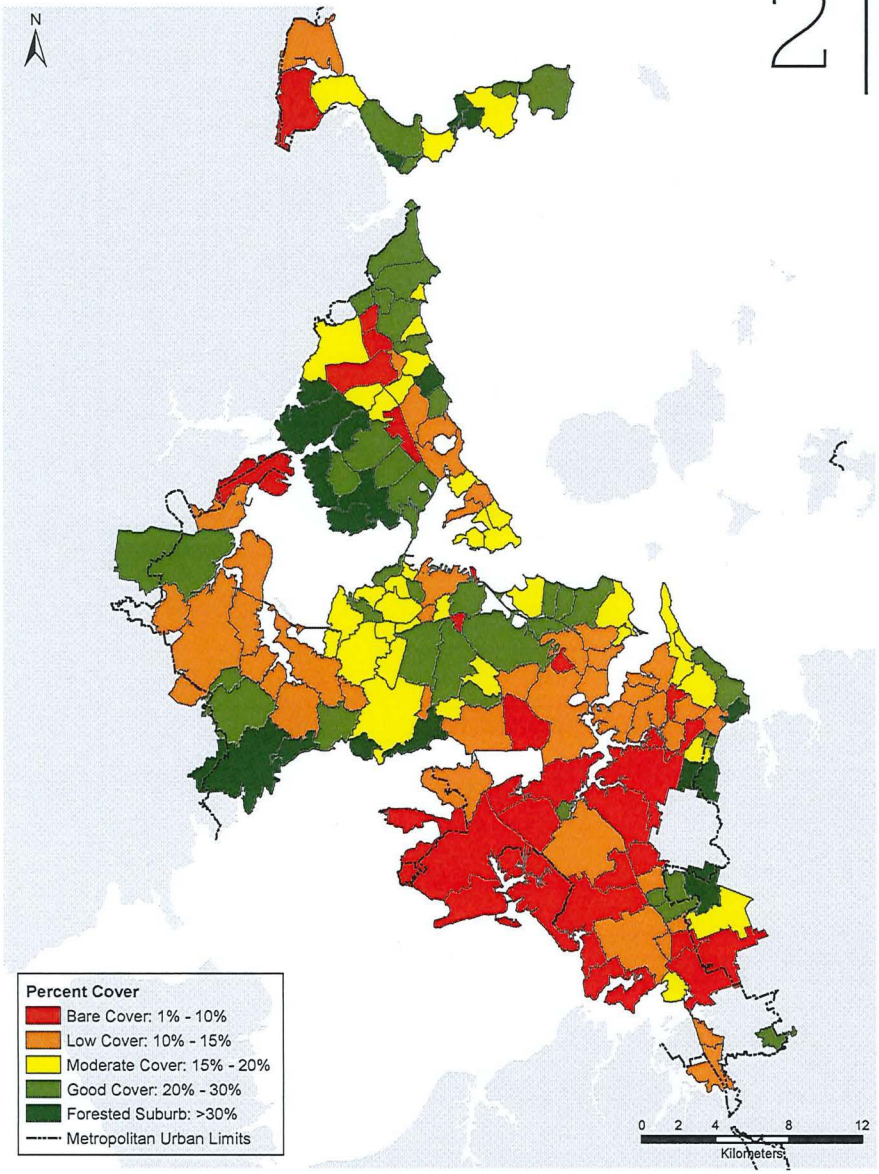



*Figure 2 – Average percentage canopy cover of urban ngahere (3m+ height) in Auckland suburbs – based on analysis of the 2013 LiDAR survey.*





# 2 | Te tūranga a ō tātou ngahere ā-tāone ināia tonu nei
# Current status of our urban ngahere

## 2.1 | Te hora o te uhinga rākau
## Distribution of canopy cover

Analysis of data from the 2013 LiDAR survey found that Auckland's urban area has just over 18 per cent canopy cover, with 10,130 hectares of canopy cover belonging to trees over three metres tall. This varied across different land types, with urban ngahere on 11 per cent of Auckland's road area, 24 per cent of public land, and 18 per cent of private land.

Figure 2 illustrates that Auckland's urban ngahere is distributed unequally throughout the city, with lower levels of canopy cover in southern suburbs, and relatively high canopy cover in northern and western parts of the city. Auckland's three leafiest suburbs are Titirangi, which adjoins the Waitakere Ranges (68 per cent canopy cover), Wade Heads (57 per cent) and Chatswood (55 per cent), where historically the landform was unsuitable for development. Unequal canopy cover distribution is particularly apparent at a local board area level (see Figure 3). The local boards with the lowest canopy cover are Māngere-Ōtāhuhu (eight per cent) and Ōtara-Papatoetoe (nine per cent). The local board with the highest canopy cover is Kaipātiki with 30 per cent canopy cover, two-thirds of which is in public open spaces.

The majority of Auckland's urban ngahere – 61 per cent – is located on privately-owned land. The remaining 39 per cent is on public land, with seven per cent on Auckland Council parkland, nine per cent on road corridors, and 23 per cent on other public land, such as schools (see Figure 4).

### What is LiDAR?

LiDAR (Light Detection and Ranging) is used to examine the surface of the Earth through collecting data from a survey aircraft. It measures scattered light to find a range and other information on a distant target. The range to the target is measured using the time delay between transmission of a pulse and detection of a reflected signal. This technology allows for the direct measurement of three-dimensional features and structures and the underlying terrain. The ability to measure the height of features on the ground or above the ground is the principle advantage over conventional optical remote sensing technologies such as aerial imagery.

LiDAR data itself does not provide information on the status of Auckland's urban ngahere, further analysis of the data is required to create a tree canopy layer and quantify the distribution and height of the urban ngahere.

## An aerial view of unequal canopy cover

Māngere, 2017

Mount Eden, 2017





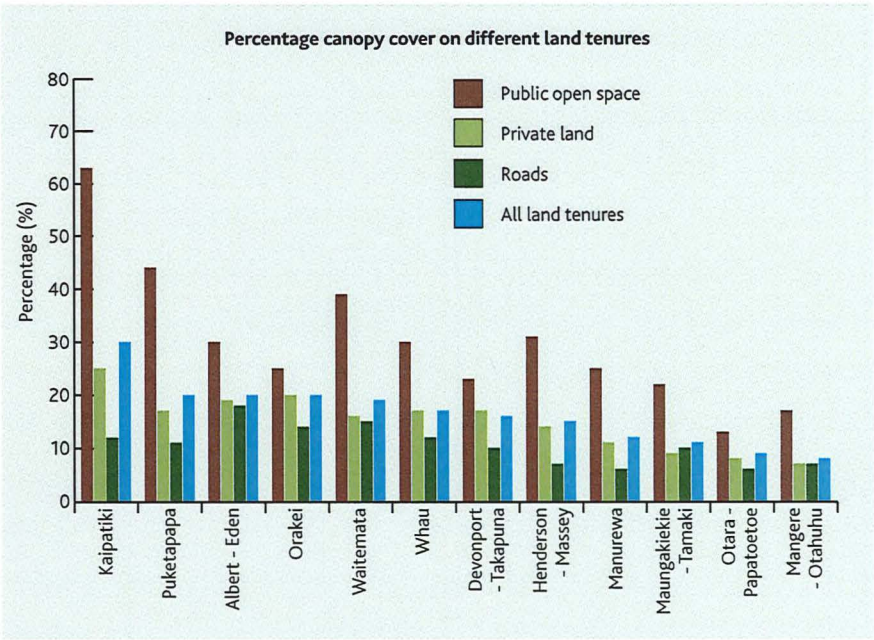



*Figure 3 - canopy cover on different land tenures by local board area.*

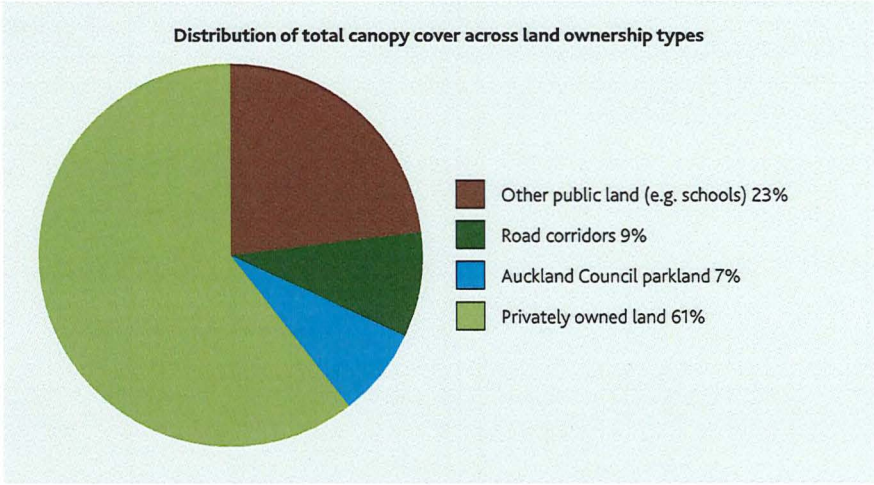
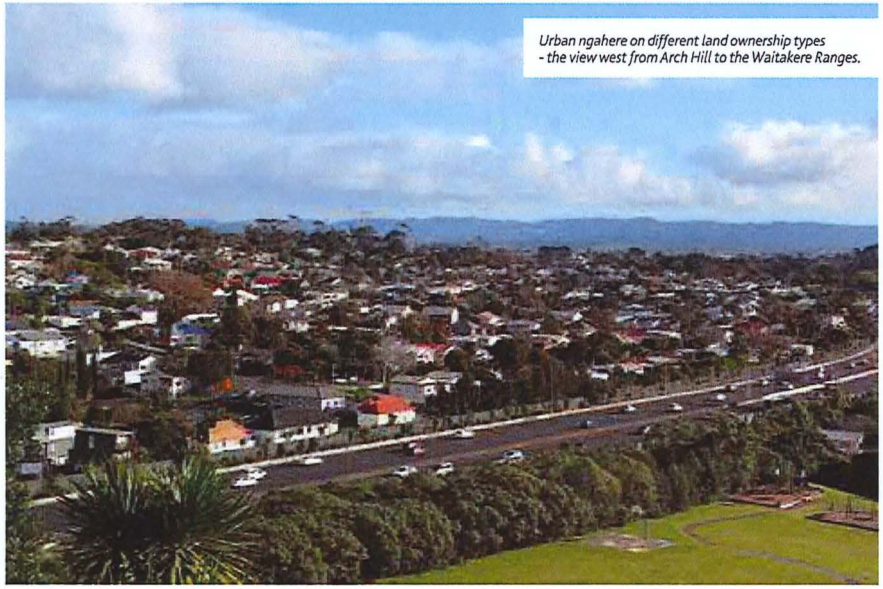



*Figure 4 – proportion of canopy cover on different land ownership types (2013 LiDAR survey).*



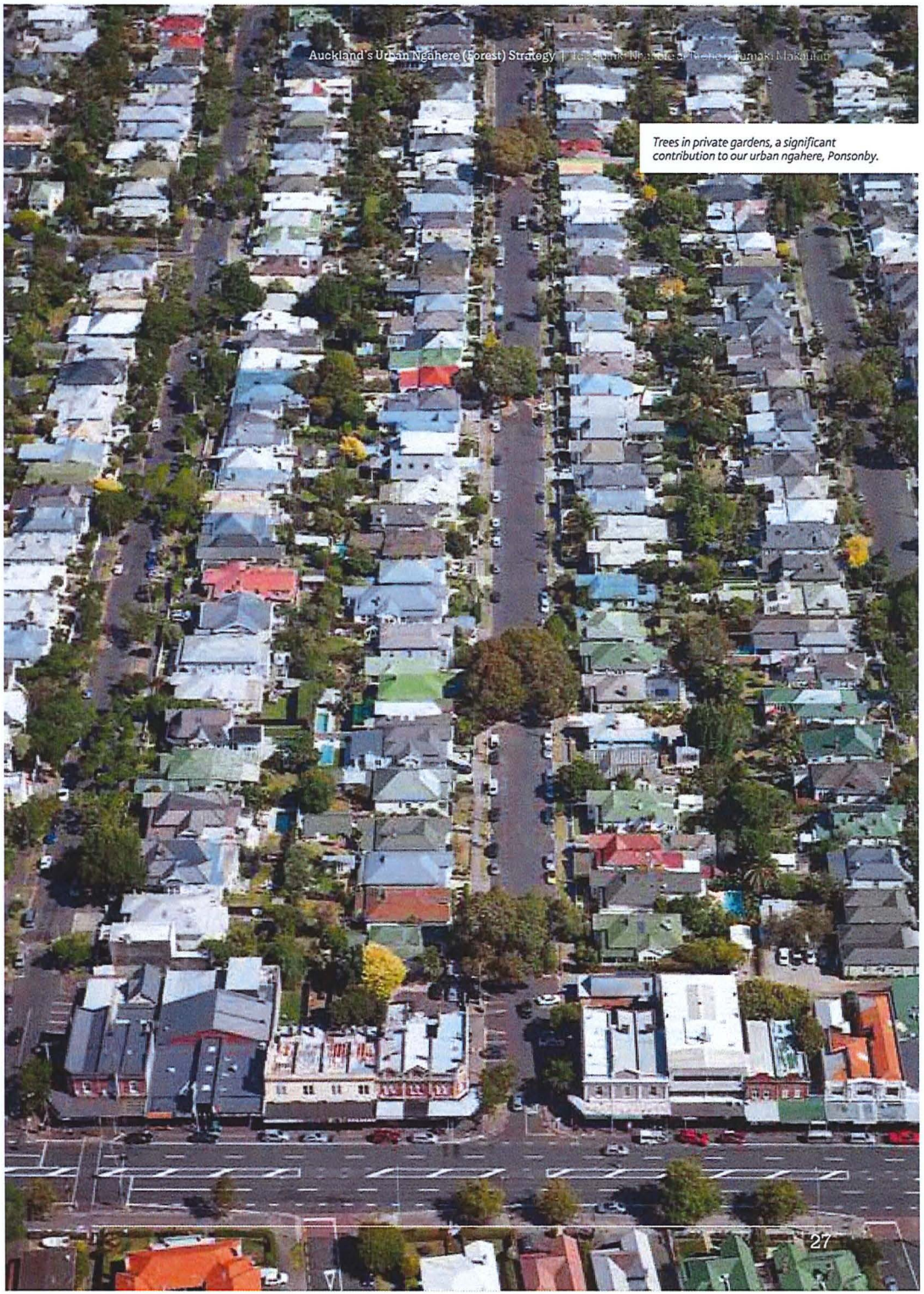
*Urban ngahere on different land ownership types - the view west from Arch Hill to the Waitakere Ranges.*

## Why the unequal distribution?

There are a number of reasons for the difference in tree cover across the region, including land ownership (public/private), land use (urban/industrial/agricultural), geography and legal protections (eg Significant Ecological Areas and notable trees). Historically, the type of development and street layout also influenced the funding and space available for tree planting. For example, in areas developed for social housing, there was typically a low level of investment in tree planting, resulting in relatively few street trees. The age of a suburb can also be a factor, for example trees planted close to the city centre in the early days of Auckland's development have now matured (eg in Ponsonby). More recently, prior to the amalgamation of the region's councils into Auckland Council, some legacy council areas had active tree planting programmes.







*Trees in private gardens, a significant contribution to our urban ngahere, Ponsonby.*

## 2.2 | Te hora tū teitei
## Height distribution

The 2013 LiDAR survey reveals that tall trees are rare in our urban ngahere; only six per cent of the urban ngahere is over 20 metres in height, the majority, 64 per cent, is less than 10 metres (see Figure 5). This is partly due to the species that make up the urban ngahere and their height at maturity. In addition, trees over 20 metres in height need to be in the right place to allow for growth and are likely to be at least 60 years old. Historically, most mature trees were removed as land was cleared for agriculture and Auckland developed.

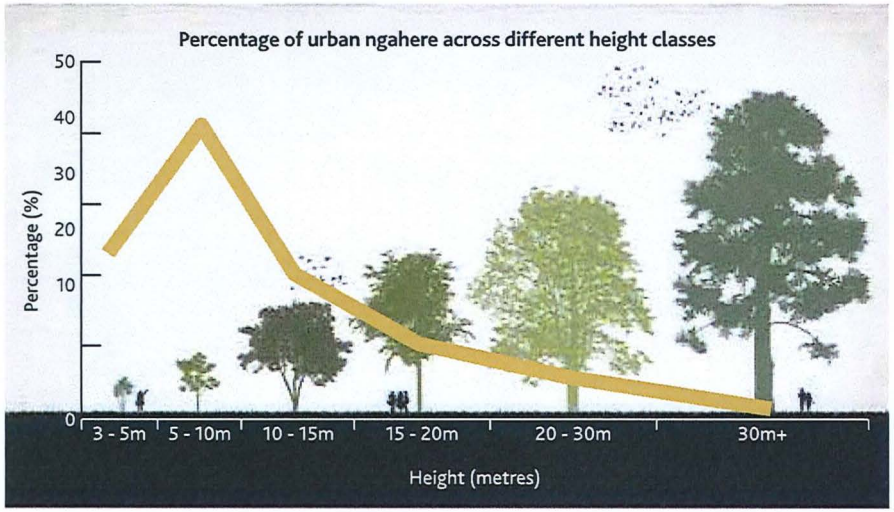



*Figure 5 – Percentage of urban ngahere across different height classes.*



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### When it comes to trees, size does matter!

Benefits are disproportionally greater for larger trees. For example, big trees provide more shade because of their larger, wider canopy spread; their greater leaf areas and more extensive root systems intercept larger amounts of rainfall and stormwater; they absorb more gaseous pollutants, have higher carbon sequestration rates, and typically contribute more to calming and slowing traffic on local streets than small trees. Larger trees also usually have few or no low branches to interfere with activity at ground level, especially if pruned to provide higher canopy clearance over roads, public space and pedestrian footpaths.

## 2.3 | Te paerewa āraitanga Level of protection

Just 50 per cent of Auckland's urban ngahere has some degree of statutory protection. A high level of protection applies to urban ngahere in Significant Ecological Areas (SEAs) which account for 62 per cent of all protected forest (although SEAs capture only about one-third of Auckland's total urban ngahere). A moderate level of protection is provided to urban ngahere in outstanding natural features or landscapes, open space conservation zones, coastal yards, riparian yards and lake protection zones. Some protection is provided to urban ngahere in coastal natural character areas or open space informal recreation zones. A low level of protection is given to urban ngahere in open space active recreation zones and road corridors.

The Notable Trees Schedule in the Unitary Plan is another form of protection. This schedule contains nearly 3000 items (representing some 6000 trees and groups of trees), the majority of which were 'rolled over' from legacy council schedules as part of the Unitary Plan process.

The proportion of protected urban ngahere varies widely from suburb to suburb, much like the level of urban ngahere canopy cover:

- Suburbs with large patches of indigenous ngahere that have been designated as Significant Ecological Areas (SEAs) tend to have a high level of urban ngahere canopy cover and a high level of protection (eg Chatswood, Birkenhead and Titirangi).
- Leafy suburbs where the urban ngahere is dominated by exotic and native trees in private backyards (eg Remuera, Epsom and Mt Eden) have moderate to high canopy cover but a low level of protection.
- Some suburbs have a low level of urban ngahere canopy cover, but a relatively high proportion of the canopy cover has some form of protection (eg Māngere, Wiri and Manukau).
- A number of suburbs that have experienced recent urban growth currently have a low level of urban ngahere canopy cover and protection (eg Northpark, Golflands, Howick, New Lynn and New Windsor).

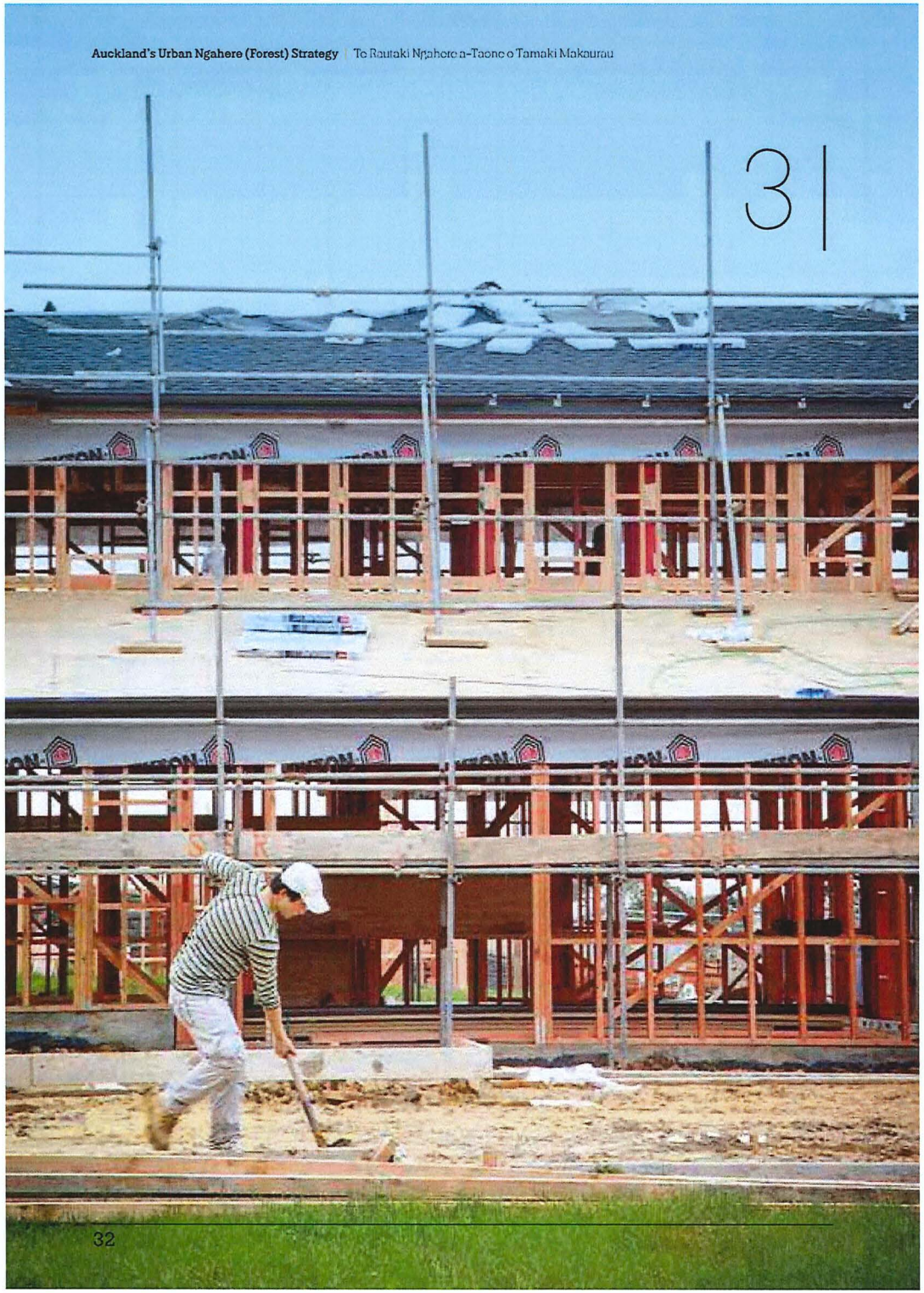
*Birkdale*






*A Pin Oak being lowered into position by a mobile crane and planted at Britomart Place in approximately the 1950's. Credit: Robert Hepple*

*The Pin Oak pictured above in 2018 – now protected and on the Notable Trees Schedule. This tree is the central feature of a busy intersection, visually contributing to the local streetscape and visible from Quay Street, Beach Road, Anzac Avenue and Fort Street. It is also notable as a solitary specimen of a species that is not well represented in the locality.*



# 3 | Ngā pēhitanga o ināianei, anga atu anō hoki Current and future pressures

## 3.1 | Te tupu haere o te tātai tāngata me ngā whakakīkītanga āhua tāone A growing population and urban intensification

Auckland is experiencing unprecedented growth and is projected to grow substantially into the future. Around 1.66 million people currently live in Auckland; over the next 30 years this number could grow by another 720,000 people to reach 2.4 million. Auckland will need many more dwellings, possibly another 313,000, in addition to new infrastructure and community facilities. Development will be focused within existing and future urban areas within the urban boundary (see Figure 6) and this will put significant pressure on the urban ngahere. Much of this growth will occur in existing urban areas through intensification; as land is redeveloped, unprotected trees are at risk of being removed to maximise the developable area of a site.

*Development as an opportunity to create new green urban environments: Medium density housing with street tree planting, Addison Development, Takanini.*

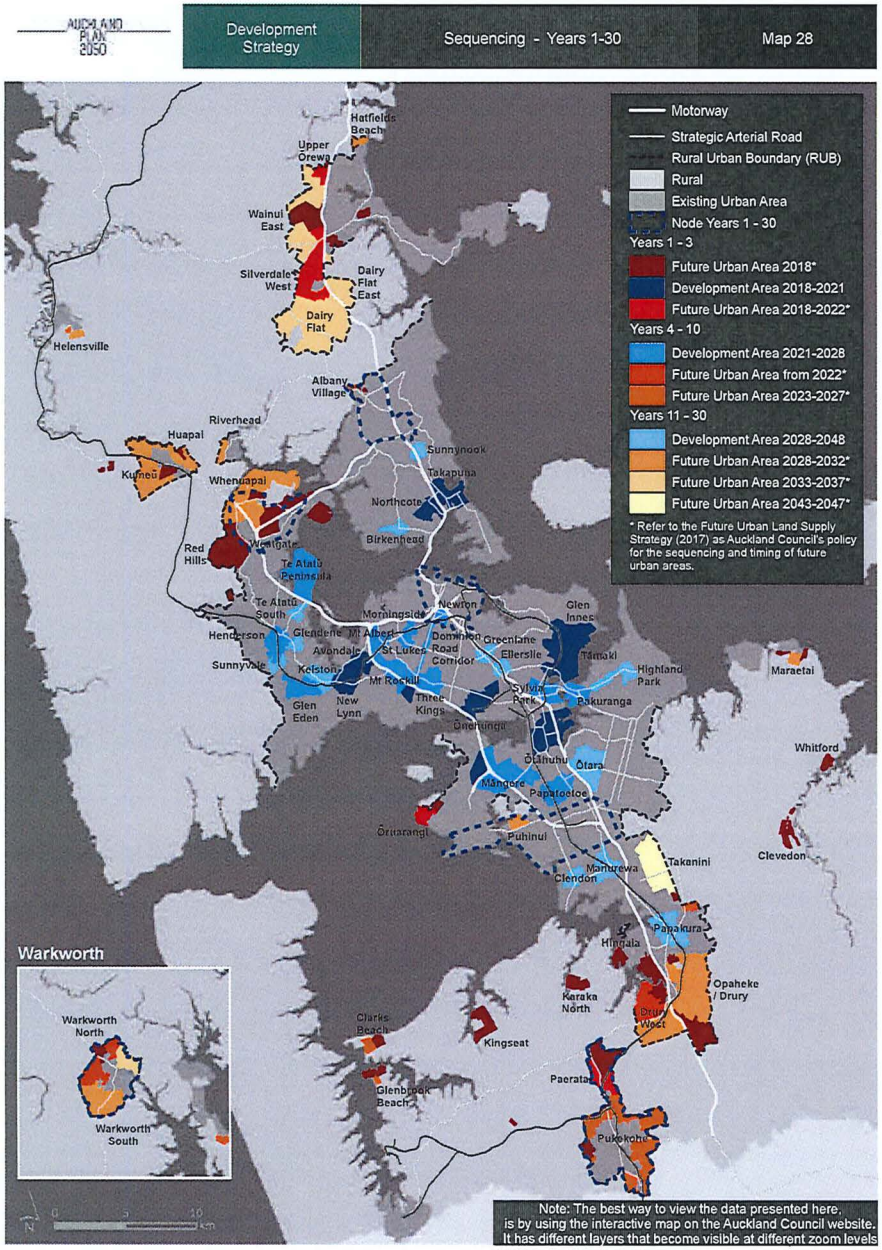
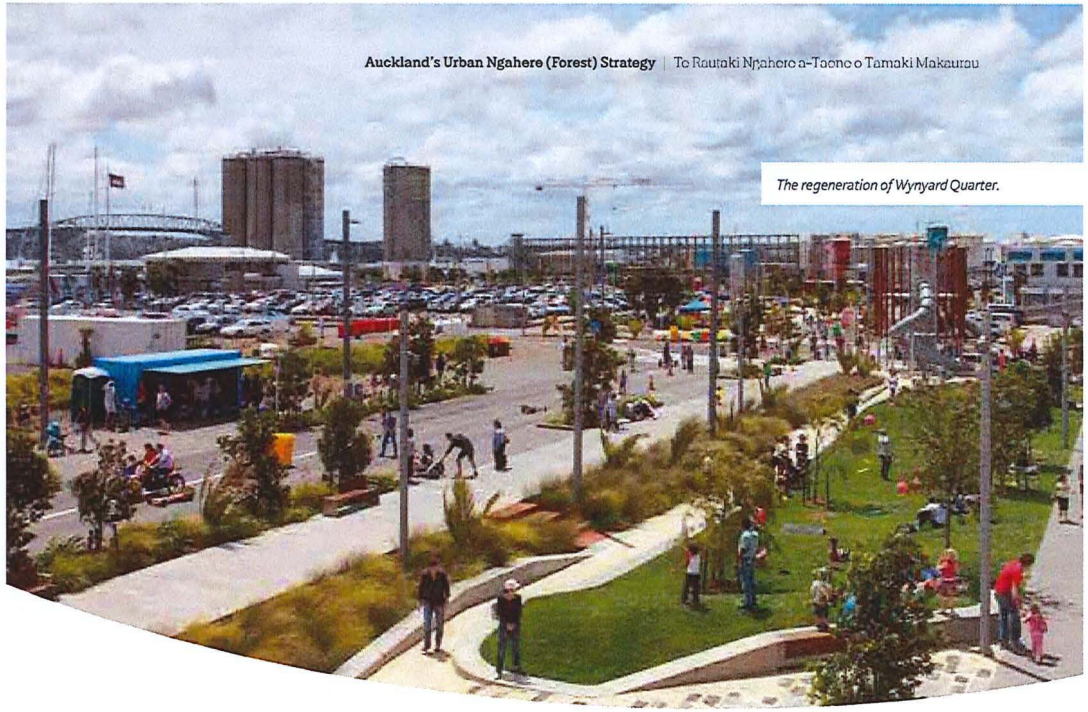



*Figure 6 – Anticipated development in existing and future urban areas as outlined in the Development Strategy (2018).*







*The regeneration of Wynyard Quarter.*

Without properly recognising the value of trees and understanding the benefits they provide; urban growth is likely to occur at the expense of the urban ngahere. However, urban development and intensification also present opportunities to green our city – to plant and grow our urban ngahere and create new green urban environments in areas set to be urbanised over the next 30 years. Future urban areas are outlined in Auckland's Future Urban Land Supply Strategy (2017) and the Development Strategy (2018). These areas cover around 15,000 hectares, with the potential to accommodate approximately 137,000 dwellings and 1400 hectares of new business land.

Urban regeneration within the existing city limits, such as the implementation of the City Centre Waterfront Refresh Plan and redevelopment plans for suburbs, presents an opportunity to retrofit green spaces and replace lost trees. The benefits of keeping established trees and the opportunities for these to complement and add value to new developments needs to be recognised. Where development occurs around trees, implementing a best practice approach to tree protection significantly increases their survival rate.

## 3.2 | Te takahurihanga o te huarere
## Climate change

Climate change threatens our urban ngahere through changing seasonal rainfall patterns, more severe weather events, and increased susceptibility to pests and diseases. Auckland is projected to experience increased occurrence of drought and reduced soil moisture. This requires us to better understand the threats to our urban ngahere and what can be done to protect it.

## 3.3 | Ngā taimahatanga kei runga i ngā whakahaere ā-wai
## Pressure on water infrastructure

Auckland's water infrastructure is vital to ensure that Aucklanders have clean water to drink and use, that wastewater is disposed of safely, homes, businesses and infrastructure are protected from flooding, and waterways and harbours are healthy. Population growth is putting all components of Auckland's water infrastructure under pressure. At the same time, this infrastructure is ageing and needs to be managed to ensure its continued performance. Climate change will place additional pressure on water infrastructure as the frequency and intensity of storm events is predicted to increase.

The Auckland Plan 2050 sets a clear direction to use Auckland's growth and development to protect and enhance the environment.[9] This includes a focus on using green infrastructure to deliver greater resilience, long-term cost savings and quality environmental outcomes.[10] The Auckland Unitary Plan emphasises the use and enhancement of natural hydrological systems and green infrastructure during development to address pressures on stormwater infrastructure.[11] This strategic direction and focus on using green infrastructure provides an opportunity to grow Auckland's urban ngahere.

### What is green infrastructure?

Green infrastructure is a strategically planned network of natural and semi-natural areas designed and managed to deliver multi-functional benefits such as stormwater management, water purification, filtration of airborne pollutants, space for recreation and climate mitigation and adaptation. Auckland's urban ngahere is an integral part of our green infrastructure network.

*Green infrastructure - Te Auaunga Awa / Oakley Creek*



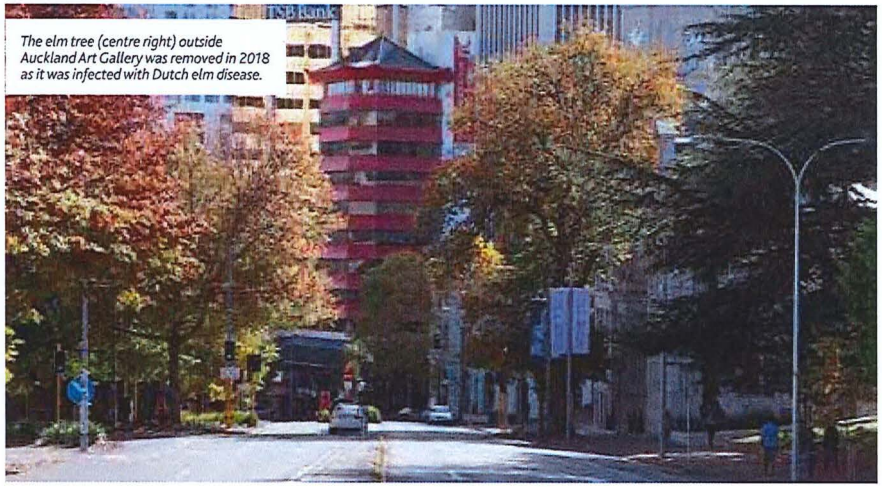
Auckland's Urban Ngahere (Forest) Strategy | Te Rautaki Ngāhere a-Taone o Tamaki Makaurau

## 3.4 | Ngā mate orotā me ngā mate urutā
## Pests and diseases

Animal pests and weeds threaten the urban ngahere, including the precious native forest remnants that are found in pockets on public and private land. Possums eat leaves, buds, flowers and young shoots, while weeds like climbing asparagus and monkey apple, smother or out-compete valued species.

*Myrtle rust*

Plant diseases are a serious threat to the future of our urban ngahere. Kauri dieback is causing localised extinctions, Dutch elm disease has been in Auckland for many years now, myrtle rust has also reached Auckland and is a risk to pōhutukawa, bottlebrush, eucalyptus, and willow myrtle, all common street trees in central Auckland. Climate change is expected to create more favourable conditions for plant diseases to establish and spread. Successfully managing the urban ngahere means these threats must be understood and addressed, if we do not take sufficient action to address these threats, we place our urban ngahere at greater risk. Actions include pest and disease control, using a mix of species and, where possible, disease resistant variants of susceptible species in new plantings, and by responding quickly and effectively to new and emerging threats. To better understand and address kauri dieback and myrtle rust, Auckland Council is working with central government agencies, Crown Research Institutes and academia.



*The elm tree (centre right) outside Auckland Art Gallery was removed in 2018 as it was infected with Dutch elm disease.*

*Kauri Park, Birkenhead – at risk from kauri dieback.*

# 4 | Te tarāwaho rautaki Strategic framework

The strategic framework consists of a vision, three main objectives (Knowing, Growing and Protecting), two key mechanisms for delivering these objectives (Engage and Manage), and a set of nine supporting principles (Figure 7).

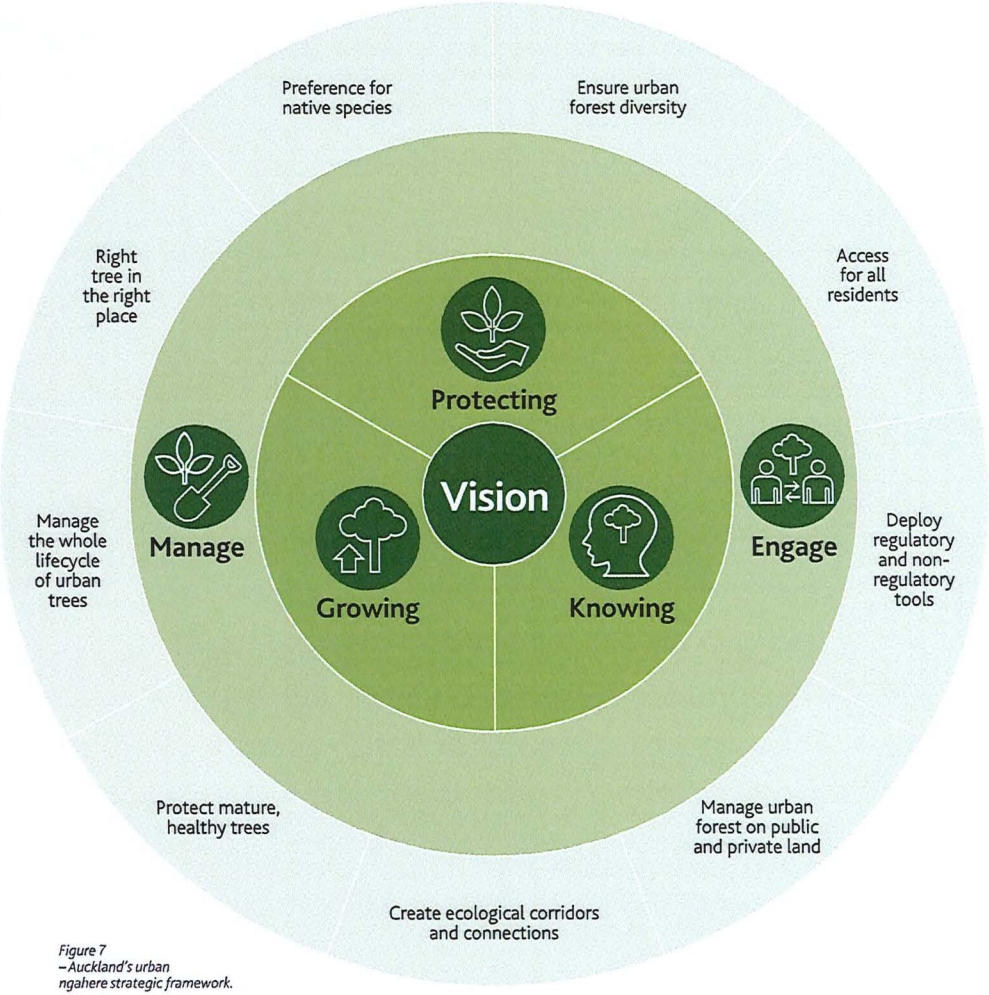
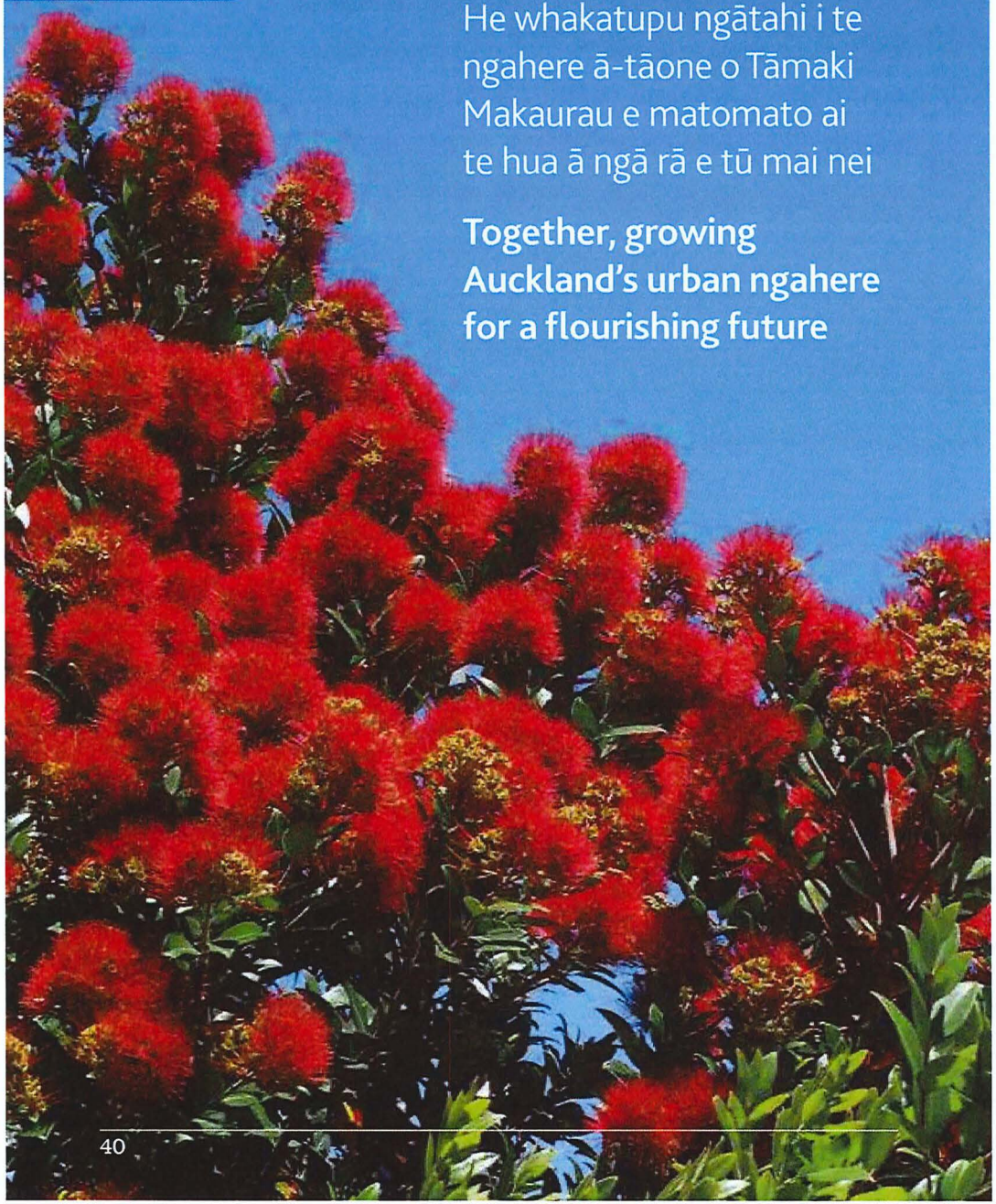



*Figure 7 – Auckland's urban ngahere strategic framework.*

*A flowering pōhutukawa variety.*



He whakatupu ngātahi i te ngahere ā-tāone o Tāmaki Makaurau e matomato ai te hua ā ngā rā e tū mai nei

**Together, growing Auckland's urban ngahere for a flourishing future**



Auckland's Urban Ngahere (Forest) Strategy | Te Rautaki Ngāhere a-Tāone o Tāmaki Makaurau

## 4.1 | Te tirohanga whānui Vision

Our vision is that Aucklanders are proud of their urban ngahere, that Auckland has a healthy and diverse network of green infrastructure, that it is flourishing across the region and is celebrated, protected, and cared for by all. The urban ngahere is equally distributed across our communities and brings significant benefits to the city. It contributes to our resilience, enhances stormwater management, delivers energy savings, supports biodiversity, and improves health outcomes and quality of life for all Aucklanders. Expanding and improving the urban ngahere is enabled through strong, collaborative partnerships across Auckland. Communities, government, businesses and citizens work together to make our urban ngahere flourish.

We will know we have been successful when we have:

- increased canopy cover across Auckland's urban area
- enhanced the associated social, environmental, economic and cultural benefits
- addressed unequal distribution of canopy cover through increasing canopy cover in neighbourhoods with previously low levels of cover
- increased the network of green infrastructure on public land
- improved linkages between green spaces by establishing ecological corridors
- effectively engaged with private landowners to support a thriving urban ngahere on private land
- planted diverse tree and plant species on public land
- shared knowledge of our urban ngahere
- instilled a sense of pride in Aucklanders for their urban ngahere.

## 4.2 | Ngā whāinga Objectives

| | |
|---|---|
| **Knowing** | Auckland needs to know the status of its urban ngahere, the extent, number and distribution of trees, as well as their size, health and condition. Understanding the social, environmental, economic and cultural value of Auckland's ngahere and quantifying the benefits it provides will support better informed, strategic decision-making about its management and growth. |
| **Growing** | Auckland needs to grow its urban ngahere to multiply these benefits and address distributional inequity. By expanding and enriching its urban ngahere, Auckland will maximise the social, environmental, economic and cultural benefits that trees, shrubs and other vegetation bring to an urban environment. |
| **Protecting** | Protecting existing ngahere is crucial to safeguarding the added values and benefits mature trees provide. Caring for saplings is critical for ensuring older trees are replenished before the end of their life, our urban ngahere grows over time, and publicly-funded planting is successful. |

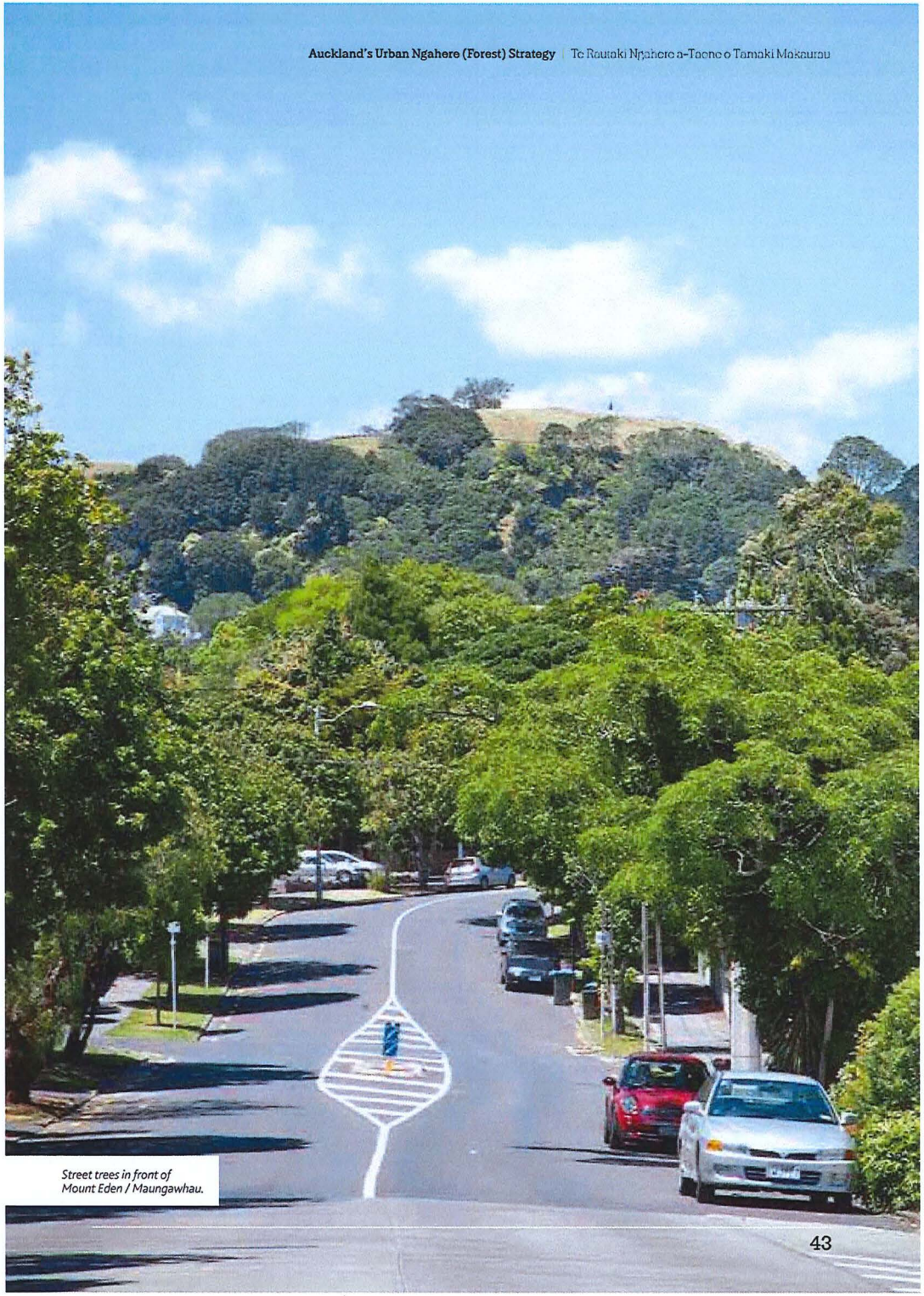
## 4.3 | Ngā tikanga whakahaere Mechanisms

To achieve these objectives, Auckland Council needs to engage and manage.

| | |
|---|---|
| **Engage** | Engage with partners and stakeholders – with mana whenua, residents, private landowners, community organisations and the private sector to ensure the urban ngahere is well managed, its benefits are well recognised and that growing and protecting the urban ngahere on public and private land is widely supported. |
| **Manage** | Manage the city's urban ngahere on public land through coordinated planning, strategic planting, smart and innovative urban design while facilitating best practice standards for work on and around trees through maintenance contracts. |



**Auckland's Urban Ngahere (Forest) Strategy** | Te Rautaki Ngāhere a-Tāone o Tāmaki Makaurau



*Street trees in front of Mount Eden / Maungawhau.*

# 4.4 | Ngā mātāpono Principles

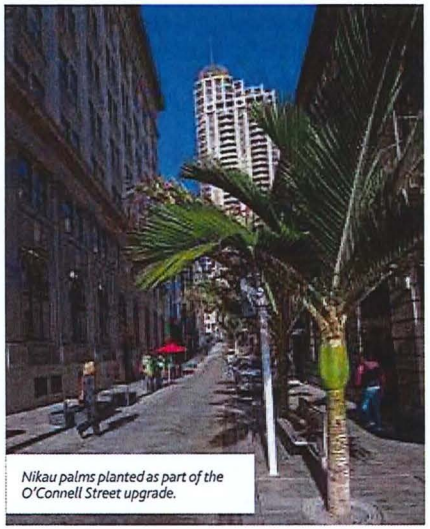
**1. Right tree in the right place**

It's important to consider growing conditions and their impact on proposed tree species, soil type, drainage, slope, sunlight access, the presence of pests and weeds and the potential current and future impacts of proposed tree species on the nature and function of a place. Growth rate and size of a proposed tree species at maturity should be basic considerations in determining suitability for a specific site. Planting the right tree in the right place is an important factor in minimising future maintenance requirements and costs.


*Figure 8 – Consider the context of the site and plant the right tree in the right place*

**2. Preference for native species**

The Auckland Unitary Plan encourages the use of indigenous trees and vegetation for roadside plantings and open spaces to recognise and reflect cultural, amenity, landscape and ecological values. Planting exotic trees may be appropriate in some cases, eg where there is a need for deciduous trees to provide solar access in winter, or fruit trees to establish community orchards. Exotic trees may also be suitable for cultural or heritage reasons in specific locations.



*Nikau palms planted as part of the O'Connell Street upgrade.*





*Urban ngahere alongside motorway interchanges and Te Ara I Whiti – the Lightpath.*

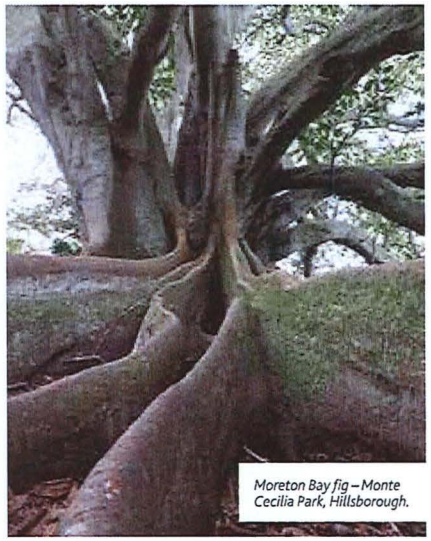
**3. Ensure urban forest diversity**

Planting a range of species increases the urban ngahere's resilience to the impacts of diseases, pests, and climate change. Planting a diverse range of species will ensure only a portion of the urban ngahere will be affected as diseases and pests tend to be limited to a certain tree species or genus. It is also important to maintain genetic diversity for each species to support better resilience, for example through our seed collection programme. Planting trees with varying lifespans helps to avoid a large-scale decline in numbers as trees with similar lifespans reach the end of their lives.

**4. Protect mature, healthy trees**

The benefits provided by trees become exponentially greater as they mature. It's also more cost effective to care for mature trees, as this typically costs less than planting and caring for new trees. The only way to replace a 40-year-old tree is to spend 40 years caring for a new tree.

People often have strong emotional connections to landmark, mature trees in their neighbourhoods, and are more likely to mourn the loss of a large tree. Additionally, some native species, such as kākā, and bats, prefer taller trees and their presence can significantly improve the biodiversity value of an area.



*Moreton Bay fig – Monte Cecilia Park, Hillsborough.*

*Onepoto Domain, Northcote.*

### 5. Create ecological corridors and connections

The urban ngahere is home to a range of ecological groups, such as birds , insects, moths and butterflies. It brings nature into urban environments, a place where the majority of Aucklanders (90 per cent) live and spend most of their time. It can also provide ecological corridors for species migrating through urban environments (see Figure 9). Connecting Auckland's urban ngahere, particularly remnant natural areas, to create ecological corridors and connections between green spaces is important to enhance biodiversity.

### 6. Access for all residents

The unequal distribution of canopy cover across Auckland needs to be addressed when new plantings are planned. Considerations include the delivery of urban ngahere benefits, public demand for a higher canopy cover and physical access to the urban ngahere in a local area.

*Kākā*
*Photo: Tim Lovegrove*



### 7. Manage urban forest on public and private land

Around 61 per cent of Auckland's urban ngahere canopy is on privately-owned land, with 39 per cent on public land. However, many of the benefits of trees are realised beyond private property boundaries and by many more people than just individual landowners. A loss of urban ngahere on private land is also a loss for the city. While there are opportunities for Auckland Council to grow and protect the urban ngahere on public land, the overall status of the urban ngahere is, to a large degree, dependent on the decisions of private landowners. Managing Auckland's urban ngahere requires private landowners' support and cooperation. Engagement is crucial and is one of two key delivery mechanisms for the proposed strategic framework.

### 8. Deploy regulatory and non-regulatory tools

Auckland Council has a range of regulatory tools to protect the urban ngahere, such as rules relating to Significant Ecological Areas (SEAs), the schedule of Notable trees, and rules to limit the extent of vegetation removal in sensitive environments, like streams and coastlines. These regulatory tools apply to trees and vegetation on private properties. However, since amendments to the Resource Management Act (RMA) came into effect in 2015, lifting blanket tree protection in urban areas councils depend mainly on non-regulatory tools to control the removal of trees and vegetation on private properties. Examples include landowner advice and assistance with tree care and planting, community education and outreach programmes, and raising awareness of the value and benefits of the urban ngahere.

*Urban ngahere on public and private land, Mount Eden.*

### 9. Manage the whole lifecycle of urban trees

Achieving the long-term vision to grow Auckland's urban ngahere for a flourishing future not only depends on planting more trees and vegetation but also looking after them during their lifecycle. New plantings may not be able to flourish (or even survive) without ongoing aftercare and maintenance. Investing in maintenance and proactive management will yield greater long-term benefits, as well as ensure money is well spent, with less wastage and repeated effort.

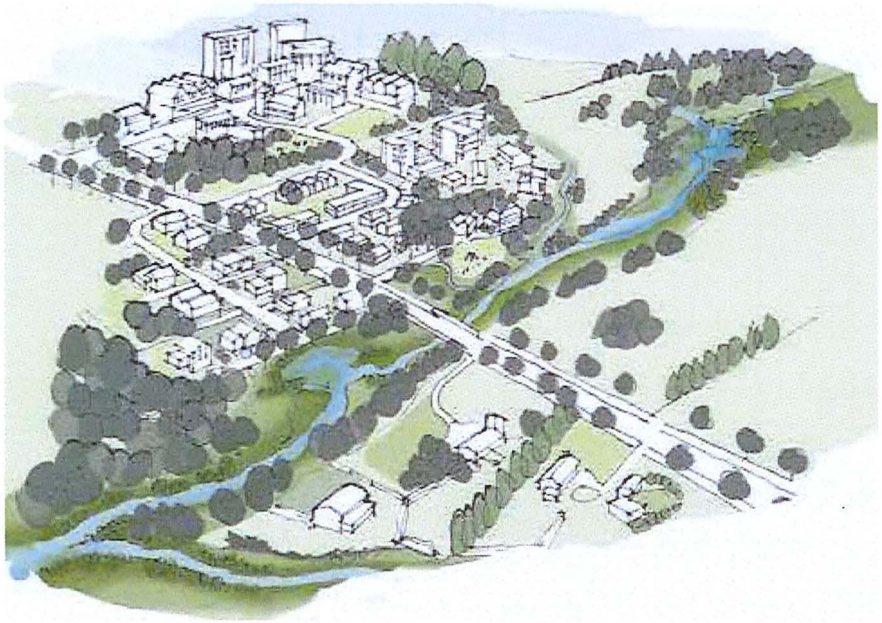
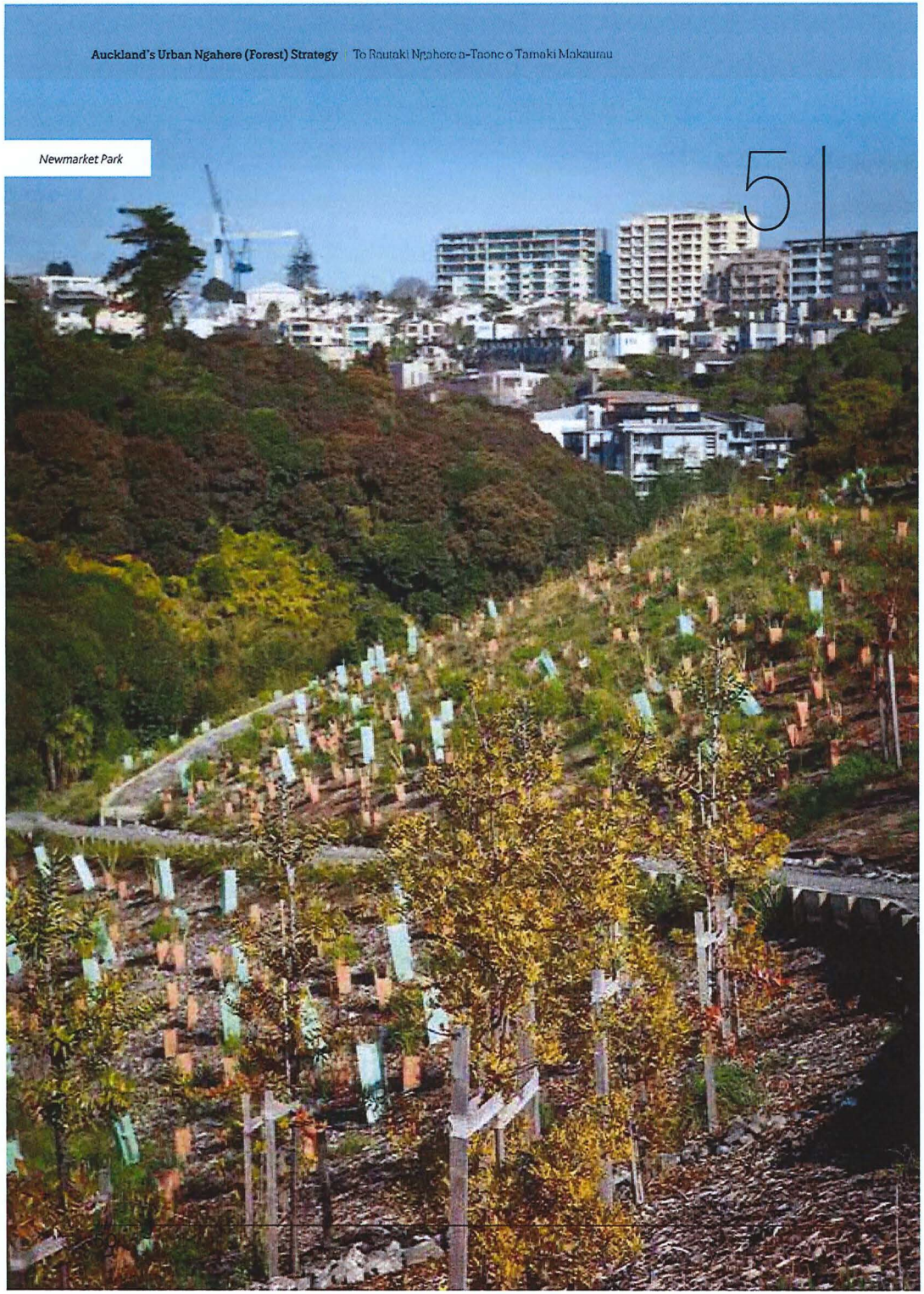


*Figure 9 - the potential for ecological connections across urban and rural landscapes (adapted from Meurk & Hall, 2006[12])*





*Trees towards the start and end of their lifecycle –Coyle Park, Point Chevalier.*



Newmarket Park



# 5 Ngā hua ā-rautaki Strategy Outcomes

The strategy outcomes are underpinned by an implementation framework and high level actions outlined in the next section.

## 5.1 Te mōhio ki ngā mea ka hua Knowing outcomes

To better understand the status and value of Auckland's urban ngahere.

Improved knowledge will assist us to make more informed and strategic decisions on how to manage our urban ngahere.

The knowing outcomes will give us a better understanding of the status and trends of important indicators, such as canopy cover, height and age distribution and species diversity across both public and private land. Understanding these factors will enable us to better evaluate and understand the value of our urban ngahere. i-Tree Eco software[13] could present an opportunity to do this, however at present additional research is required to fully adapt i-Tree data and analysis to a New Zealand context.

A better understanding of the trends and status of the canopy cover can direct planting efforts to where the most value can be realised. Potential future impacts and pressures on Auckland's urban ngahere, such as climate change and new pests and diseases, can also be better managed and minimised.

*Table 1 – Knowing outcomes*

| Objective | Outcomes |
|---|---|
| Knowing | Better understanding of the status and trends on private and public land over time. |
| | Better understanding of the diverse values and benefits of Auckland's urban forest. |
| | Better understanding of existing and future risks and pressures. |

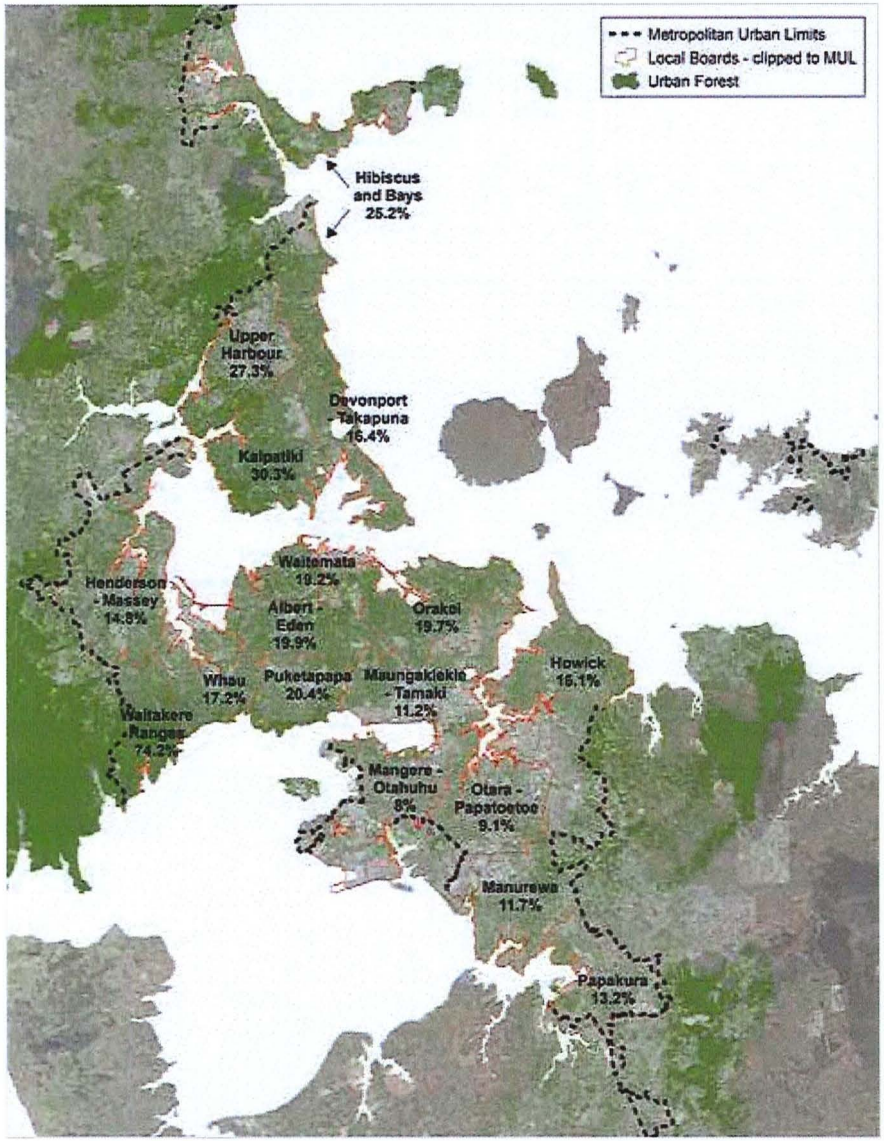



*Figure 10 - unequal canopy cover at a local board level (2013 LiDAR survey)*





## 5.2 | Te whakatupu i ngā mea ka hua
## Growing outcomes

To grow Auckland's urban ngahere and grow it more equitably.

Growing our urban ngahere will increase the average canopy cover and also provide a fairer distribution of the urban ngahere and associated benefits across Auckland (see Figure 10).

We can grow our urban ngahere and increase resilience to existing and future pressures, such as pests, diseases and climate change, through the application of the strategic framework's nine principles.

*Table 2 – Growing outcomes*

| Objective | Outcomes |
|---|---|
| Growing | Increase the average canopy cover to 30 per cent across Auckland's urban area with no local board area having less than 15 per cent canopy cover. |
| | Increased resilience to existing and future pressures. |

## 5.3 | Te tiaki i ngā mea ka hua
## Protecting outcomes

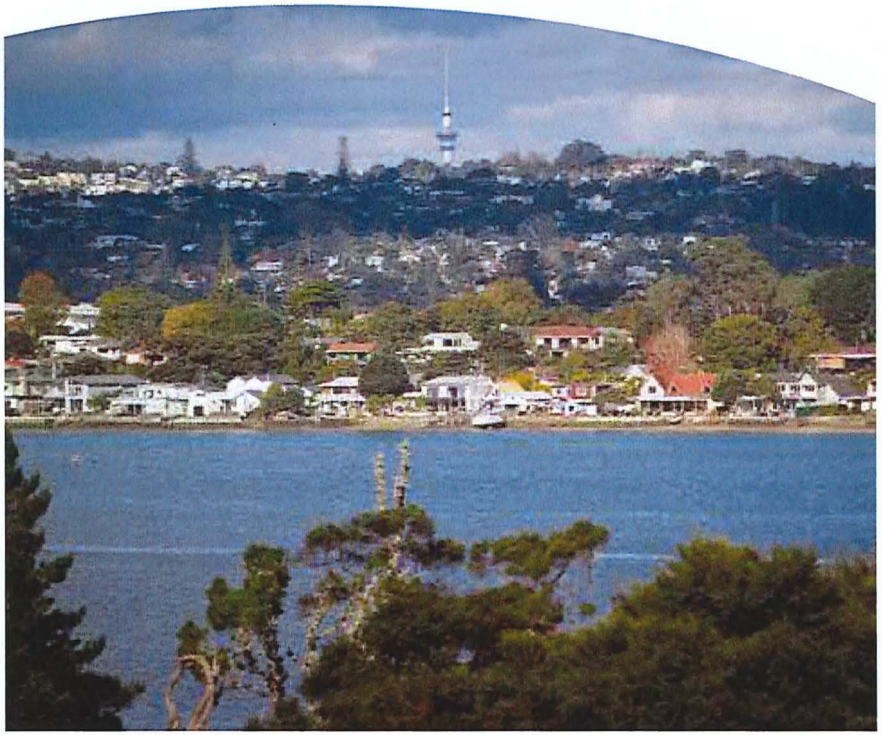
To protect and maintain Auckland's existing and future urban ngahere.

Protecting our existing urban ngahere is crucial to realising the values and benefits of mature trees. Caring for new plantings and young trees is essential to ensure that older trees are replaced at the end of their life and our urban ngahere grows over time.

Achieving no net loss ensures that any losses are balanced by a gain elsewhere. At a local board level, any loss will need to be balanced out by a gain in canopy cover elsewhere within the local board area.

*Table 3 – Protecting outcomes*

| Objective | Outcomes |
|---|---|
| Protecting | No net loss of canopy cover at the scale of local board areas. |
| | No loss of percentage of trees larger than 10 metres. |
| | No net loss of notable trees. |







## 5.4 | Ngā tikanga whakahaere ka hua
## Mechanism outcomes

Engage and Manage are the two mechanisms Auckland Council will use to achieve the Knowing, Growing and Protecting objectives. For example, increasing the canopy cover and prioritising options for future planting on public and private land will only be possible through engaging and working collaboratively with communities and partners.

### Engage

Community support is critical for fulfilling all three main objectives. Auckland Council must engage with relevant partners and stakeholders – mana whenua, private landowners, community groups, and the private sector –to support the growth and protection of Auckland's urban ngahere. The council must also engage with the public more widely about the benefits of urban ngahere to ensure they are understood and recognised.

*Table 4 – Engage outcomes*

| Mechanism | Outcomes |
|---|---|
| Engage | A well-established community engagement programme. |
| | Increased public awareness of the values and benefits of Auckland's urban ngahere. |

A community engagement programme is needed that addresses Growing and Protecting and is supported by partnerships with relevant stakeholders. The programme must also integrate the aspirations of Māori, in accordance with the principle of partnership enshrined in te Tiriti o Waitangi and recognise the special role of mana whenua as kaitiaki (guardians) whereby ngahere and whenua ora (environmental services) are intimately connected to Māori wellbeing. As the programme evolves, we will develop a better understanding of community aspirations, and knowledge gaps relating to urban ngahere benefits and value.

### Manage

Another key mechanism in successfully implementing the vision is the effective management of existing and future urban ngahere on public land through coordinated planning, strategic planting, smart and innovative urban design, and facilitating best practice standards for work on and around trees through maintenance contracts.

*Table 5 – Manage outcomes*

| Mechanism | Outcomes |
|---|---|
| Manage | Increased survival rate of new plantings and sustainability of Auckland's urban ngahere on public land. |

As noted in section 2.2, tree size matters when it comes to the scale of benefits delivered. Central to effective management is the requirement to nurture growing trees and increase the proportion of larger trees.

# 6 Tarāwaho whakatinana Implementation framework

The implementation framework consists of high level actions that are central to achieving the strategy outcomes. In addition to the high level actions, collaboration, funding and partnerships and area specific implementation are all fundamental to the strategy's success.

## 6.1 Te mahi tahi mō te rautaki ngahere ā-tāone Urban ngahere strategy collaboration

Success will require close collaboration with many partners at various levels across operational boundaries and disciplines, within the municipality and beyond. Some of the key cross boundary groups are:

**Cross-council collaboration:**
This involves collaboration between internal stakeholders, interdepartmental cooperation and working closely with council controlled organisations. In the urban context, planners should work with foresters and arborists to effectively integrate policy and knowledge management tools to grow and protect the urban ngahere.

**Community and council collaboration:**
Effective implementation of the strategy requires effective engagement with community groups and institutions that play a role in growing and protecting the urban ngahere.

**Business and council collaboration:**
Insight provided by business groups, including developers, is important to support the strategy's successful implementation. The decisions and actions of business groups can have a significant influence on the urban ngahere.

**International cooperation:**
This strategy draws on the knowledge and experience of many leading cities that have developed their own urban forest strategies. Continued sharing of technical, governance and community know-how will help to achieve better outcomes for Auckland.

## 6.2 Ngā tahua pūtea me ngā hononga ā-hoa
## Funding and partnerships

Continuing support from Auckland Council, developers, businesses and the wider community is fundamental to successfully growing and protecting Auckland's urban ngahere. For example, leading developers understand that delivering a successful and sustainable project is not just about building design, but also the surrounding environment and the outcomes this can deliver. Businesses can also contribute to the growth and protection of the urban ngahere through financial support, planting initiatives and effective maintenance of trees on their properties. Most importantly, having financial support from the council ensures the development of knowledge, growth and protection of urban ngahere on public and private land.

Effective communication on the benefits of urban ngahere, such as better stormwater management, carbon sequestration, lower infrastructure costs, enhanced biodiversity and community health – not to mention the city's aesthetic enhancement – is an important tool to justify project costs to stakeholders and partners. It's important to document and disseminate urban ngahere benefits to gain continuous support from all Aucklanders.

## 6.3 Whakatinanatanga ā-wāhi motuhake
## Area specific implementation

The strategy must take an area specific approach to implementation. This will require engaging with each local board, partners and stakeholders to discuss needs and drivers for growing and protecting Auckland's urban ngahere. This will ensure the strategy's high level actions are defined and implemented in a way that matches the needs of each local area.





## 6.4 Kaupapa mahi matua
## High level actions

The Engage and Manage mechanisms identified in the strategy framework run through all the high level actions and are central to their successful implementation.

*Table 6 – Knowing high level actions*

**Knowing**

High level actions to support the following outcomes:

- better understanding of the status and trends on private and public land over time
- better understanding of the diverse values and benefits of Auckland's urban forest
- better understanding of existing and future risks and pressures.

| | High level actions | Implementation timeframe (years) | | |
|---|---|---|---|---|
| | | 1-2 | 3-5 | Ongoing |
| 1 | Incorporate three-yearly LiDAR surveys in council work programmes. | | | • |
| 2 | Create database for existing assets within two years. | • | | |
| 3 | Integrate scientific knowledge of the urban ngahere with mātauranga Māori in partnership with mana whenua of the urban ngahere. | | | • |
| 4 | Quantify values and benefits (within 12-18 months). | • | | |
| 5 | Determine survival rates of new council plantings. | | | • |
| 6 | Identify key pressures and risks in partnership with mana whenua and local boards. | • | | |

*Table 7 – Growing high level actions*

**Growing**

High level actions to support the following outcomes:

- increase the average canopy cover to 30 per cent across Auckland's urban area with no local board area having less than 15 per cent canopy cover
- increased resilience to existing and future pressures.

| High level actions | | Implementation timeframe (years) | | |
|---|---|---|---|---|
| | | 1-2 | 3-5 | Ongoing |
| 1 | Increase canopy cover in road corridors, parks and open spaces to support an average of 30 per cent canopy cover across Auckland's urban area with no local board area having less than 15 per cent canopy cover. | | | ● |
| 2 | Identify and prioritise locations for future planting on public land in partnership with mana whenua and local boards. | ● | | |
| 3 | Use science and ongoing engagement with local boards, mana whenua and communities to inform decisions in relation to types of planting. | | | ● |
| 4 | Increase the capacity of nursery programmes (including maraes) to increase the supply of eco-sourced plants. | | | ● |
| 5 | Leverage partnerships established through existing initiatives (eg the Mayor's Million Trees programme). | | ● | |





*Table 8 – Protecting high level actions*

**Protecting**

High level actions to support the following outcomes:

- no net loss of canopy cover at the scale of local board areas
- no loss of percentage of trees larger than 10 metres
- no net loss of notable trees.

| High level actions | | Implementation timeframe (years) | | |
|---|---|---|---|---|
| | | 1-2 | 3-5 | Ongoing |
| 1 | Complete a comprehensive review of tree protection under the Auckland Unitary Plan Operative in part. | ● | | |
| 2 | Explore potential for new regulatory tools to protect trees on private properties (eg working with central government). | ● | | |
| 3 | Increase landowner grants and incentive programmes (eg heritage tree fund for private property owners). | | | ● |
| 4 | Address current and future pressures to Auckland's urban ngahere and protection. | | | ● |
| 5 | Raise public awareness of the values and benefits of the urban ngahere (eg status and trends, pressures, planting guidelines, proper tree care). | | | ● |
| 6 | Raise arboriculture maintenance programme from two to five years or until new plantings are well established (a target survival rate of 70-80 per cent). | ● | | |
| 7 | Establish a labelling programme for protected trees within 12 months (eg species, age and benefits). | ● | | |

*Fort Street*





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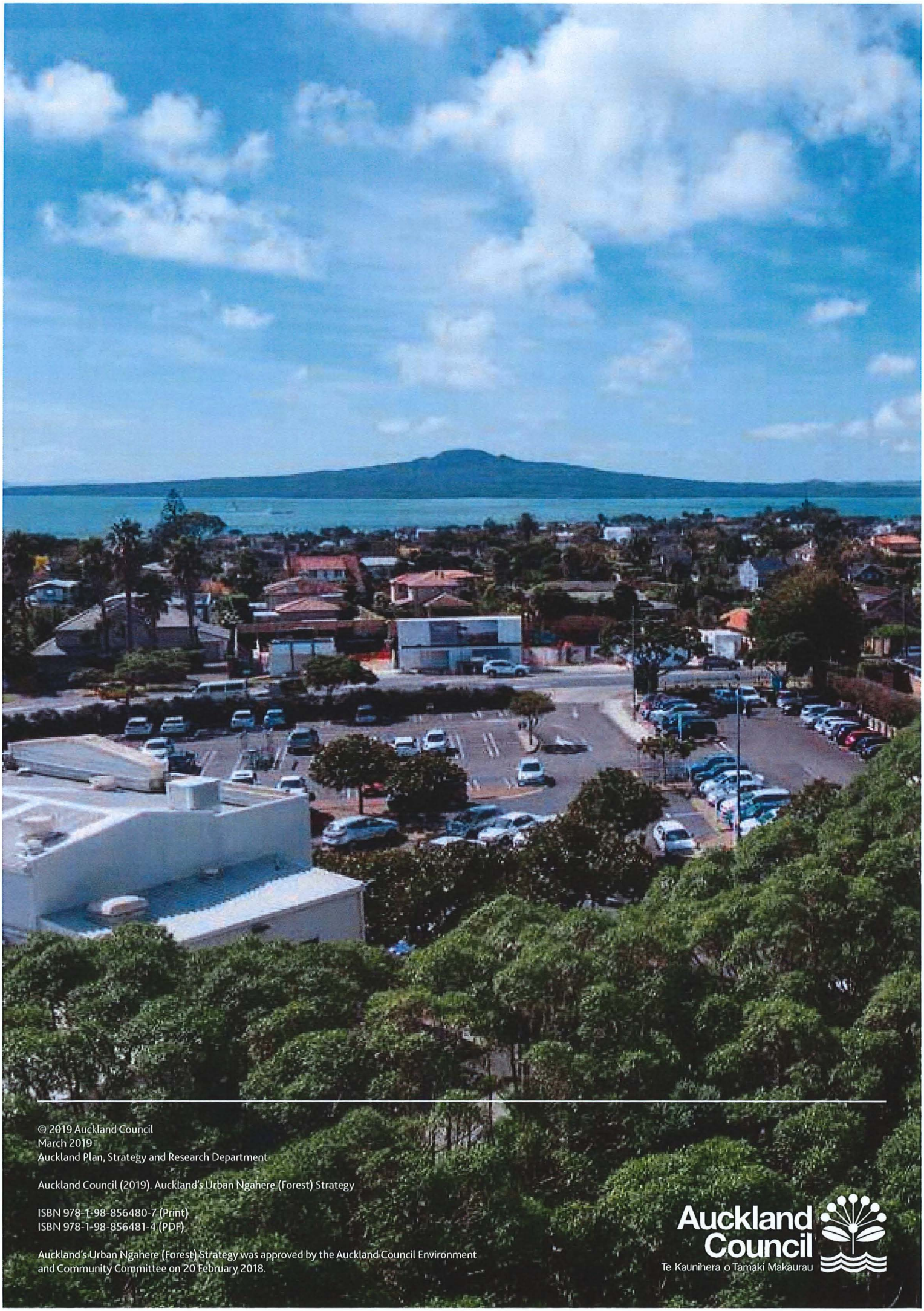


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Auckland Council
Te Kaunihera o Tāmaki Makaurau

"B"

Te Ngahere
Native Forest Management

# Ōwairaka/Te Ahi-kā-a-Rakataura Assessment of Ecological Effects

This is the annexure marked "**B**" referred to in the affidavit of ~~Andrew Francis~~ Barrell sworn at Auckland this 6th day of December 2019 before me:

Barrister/~~Solicitor~~ of the High Court of New Zealand

Ana Lenard
Barrister

Ecological Restoration and Consultancy

# Ōwairaka/ Te Ahi-kā-a-Rakataura Assessment of Ecological Effects

Final 2nd of October 2018

Prepared on Behalf of:

**Tūpuna Maunga Authority**

Prepared By:

Anna Mairs, Richard Mairs, Jessica Le Grice and Kelvin Floyd

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Te Ngahere

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# 1 Introduction

| | |
|---|---|
| Applicant(s): | Tūpuna Maunga Authority |
| Site address: | 27 Summit Drive, Mount Albert, Auckland 1025 |
| Legal description: | SEC 1 SO 454869 |
| Site Area: | 9.5470 Ha |
| Operative Plan: | Auckland Unitary Plan Operative in part (updated 13th of July 2018) (Auckland Council, 2018a) |
| Zoning: | Open Space - Sport and Active Recreation Zone and Open Space-Conservation Zone |
| Overlay(s): | Significant Ecological Area (SEA_T_6016), Historic Heritage, Outstanding Natural Feature, Quality-Sensitive Aquifer Management Area, Regionally Significant Volcanic Viewshaft |

Ōwairaka is managed by the Tūpuna Maunga Authority supported by Auckland Council. The maunga is a sacred place for mana whenua. Tūpuna Maunga Authority (2016) noted in reference to maunga Wairuatanga/ spiritual value that:

*"They are taonga tuku iho (treasures handed down the generations) and inspire reverence and aroha.*

*The Tūpuna Maunga are restorative nourishing places. This is an expression of the inherent connection between people and place.*

*Protection and enhancement of the mauri and wairu of the Tūpuna Maunga is paramount.*

*The tihi is the most sacred part of the maunga to mana whenua and this will be reflected in the nature of activities that are appropriate on different parts of the maunga."*

It is proposed that in order to restore the tihi/summit, removal of exotic trees is undertaken to open up sightlines in conjunction with native plantings in appropriate areas to increase native biodiversity values without impeding sightlines or effecting archaeological sites. This report covers the ecological effects of these proposed works on Ōwairaka/ Mount Albert outlined in:

1. *Owairaka / Mt Albert Tree Removal Methodology* ( Treescape Ltd, 2018)
2. *Ōwairaka/Te Ahi-kā-a-Rakataura Planting Plan 2018* (Te Ngahere, 2018a).

This report only covers ecological effects and does not cover amenity and arboricultural effects of exotic tree removal. A second AEE has been prepared by Bell 2018 covering herpetological effects *Assessment of Environmental Effects of tree removals and habitat restoration activities on lizards at Ōwairaka/ Mt Albert.*

## 1.1 Site description

Ōwairaka is located within the Albert/ Eden Local Board and is administered by the Tūpuna Maunga Authority with some adjoining government body land administered by Watercare (see Figure 1).

Land use includes cultural activities, sports facilities, underground reservoir/ infrastructure and leashed/ unleashed dog areas. Currently vehicles also have access to the road around the maunga (Tūpuna Maunga Authority, 2016).

The geology of the site includes main rock of basalt and scoria bassanite sub rocks (GNS Science, 2016). This volcanic rock was heavily quarried for railway ballast and roading material (Dunsford, 2016) on the northern side of Ōwairaka.

The site has no streams present with some over and underground flow paths and a flood area on the archery field (old quarry). Flow paths connect to two catchments Waitītiko/ Meola Creek and Te Auaunga/ Oakley Creek (Watercare area). Both awa lead to the Waitematā harbour.

## 1.2 Methodology

A site visit was undertaken on the 30th of August and the 8th of September including a walkover survey of the whole site noting existing ecological values. A literature and botanical collections search, correspondence with Auckland Council and review of the Auckland Unitary Plan were also undertaken in order to assess the current and historical ecological values of the site.

# 2 Ecological values

## 2.1 Historical vegetation

The vegetation of the maunga has been influenced historically by Māori land use, quarrying, planting and farming practices. This is reflected by the open nature of most of the site with a range of large exotic trees, dominance of kikuyu grass (*Cenchrus clandestinus*) and scattered areas of native trees and grasses present today.

Based on Auckland Council (2018a) the site has been broadly categorised as potential WF7 Pūriri, podocarp, broadleaf forest/ngahere prior to human influence. WF7 - Pūriri Ngahere is an ecosystem type present in highly fertile areas associated with volcanic and alluvial deposits, which is now classified as Critically Endangered in the Regional IUCN Threat Status (Singers et al., 2017). Three distinct variations of this ecosystem type occur, dependent on characteristics associated with differences in alluvial components and volcanic composition of the soil (Singers et al., 2017).

In all cases pūriri (*Vitex lucens*) is present as a significant component within the mixed broadleaf canopy. Other prominent species include kohekohe (*Dysoxylum spectabile*), karaka (*Corynocarpus laevigatus*), and taraire (*Beilschmedia taraire*), with additional species composition varying dependent on soil and site characteristics. Podocarps including kaihikatea (*Dacrycarpus dacrydioides*) and tōtara (*Podocarpus totara*) are present as secondary successional species along with a mix of smaller broadleaf species (Singers et al., 2017).

Tāmaki Makaurau has had human occupation for around 1000 years (Tūpuna Maunga Authority, 2016). Historic management of the site would have included clearance of tall vegetation replaced with native grasslands such as *Microlaena stipoides* and *Rytidosperma* spp. in addition to cultivated areas with large gardens extending into surrounding fertile lands (Esler, 2004; Tūpuna Maunga Authority, 2016; Burns et al., 2013).

Esler (2004) discusses pasture management on Auckland maunga and notes that following European settlement many of Auckland's maunga were extensively quarried. Once these were returned to pasture, kikuyu and buffalo grass were often used to cover scars of mis-management. Kikuyu spread across many of the maunga and cattle were used to control its spread and minimise the increased fire risk. In 1974 Ōwairaka pasture was predominantly *Microlaena*-ryegrass pasture with kikuyu on the archery lawn and reservoir and danthonia (*Rytidosperma sp*) on sunny faces. However by 2001 kikuyu was in most places with grazing saving the less palatable native grasses from being overwhelmed in the short term. Elser (2004) points out that a number of mistakes made on the maunga have led to the dominance of kikuyu and that grazing and plantings have tried to recreate cover the native *Microlaena* and *Rytidosperma* provided a century ago.

## 2.2 Existing vegetation

The vegetation of Ōwairaka is currently classified by Auckland Council (2018a) as Tree Land where tree canopy cover is between 20% and 80%. Based on the outline of trees from the Treescape Ltd (2018) 56% of the trees are native species making the site TL.2 variant *Mixed native/ exotic treeland* (25-75% native tree cover) (Singers et al., 2017). Treescape Ltd (2018) noted that native species consisted of 19% pōhutukawa, 17% tōtara, 7% pūriri and some mānuka, ngaio, and karaka.
The site also includes a number of existing native plantings. These have been outlined in Figure 1.


**Figure 1 Outline of vegetation categories on Ōwairaka**

## 2.3 Native plantings

Ōwairaka does not contain any remnant or mature native forest. However there are several native plantings with complete canopy cover such as native planting area 2 (Figure 2). Native plantings consist of three areas shown in Figure 1 and discussed below in Table 1.

These areas are of moderate ecological value.

**Figure 2 Photo of Native Planting Area 2.**

**Table 1 Existing Native Plantings on Ōwairaka**

| Area | Native vegetation | Exotic vegetation |
|---|---|---|
| Native Planting Area 1 | This area is the most mature of the native plantings and consists of primarily pōhutukawa (*Metrosideros excelsus*) and pūriri canopy with an understorey of regenerating native species including porokaiwhiri (*Hedycarya arborea*), karamū (*Coprosma robusta* and *Coprosma robusta x macrocarpa subsp. minor*) karaka (*Corynocarpus laevigatus*) karo (*Pittosporum crassifolium*) and *Microlaena stipoides.* | This area has large coastal banksia (*Banksia integrifolia*) along with and understorey weeds such as Jerusalem cherry (*Solanum pseudocapsicum*), panic veldt grass (*Ehrharta erecta*), *Carex divulsa*, viola (*Viola odorata*), stinking iris (*Iris foetidissima*), Chinese fan palm (*Trachycarpus fortunei*) and tradescantia (*Tradescantia fluminensis*). |
| Native Planting Area 2 | This is a more recent planting and consists of a wide range of native species (many consistent with WF7) interspersed with larger established native and exotic trees (pre- planting) such as pūriri and olive. Key native species noted include kānuka (*Kunzea robusta*), turepo (*Streblus banksii*), tōtara (*Podocarpus totara*), whau (*Entelea* | Olive (*Olea europaea* subsp. *europaea*), tradescantia, cotoneaster (*Cotoneaster glaucophyllus*), panic veldt grass, flame/ coral tree (*Erythina xskyeskii*) and nasturtium (*Tropaeolum majus*). |

| Area | Native vegetation | Exotic vegetation |
|---|---|---|
| | *arboresens*), māhoe (*Melicytus ramiflorus*), tītoki (*Alectryon excelsus* subsp. *excelsus*), kawakawa (*Piper excelsum* subsp. *excelsum*), kōhūhū (*Pittosporum tenuifolium*), tarata (*Pittosporum eugenioides*), karaka (*Corynocarpus laevigatus*), rimu (*Dacrycarpus dacrydioides*), nīkau (*Rhopalostylis sapida*), taraire (*Bleischmiedia tarairi*), kāramu and tawapou (*Planchonella costata*). | |
| Native Planting Area 3 | This planting has complete canopy closure. Species noted include mānuka, māhoe, kawakawa, kōhūhū, karo, tarata, harakeke, kāramu, coastal tree daisy (*Olearia solandri*), tanguru (*Olearia albida*), Tī kōuka (*Cordyline australis*), kāpuka (*Griselinia littoralis*) and other likely self-established species including shaking brake fern (*Pteris* tremula) and pukupuku (*Doodia australis*). An older large pōhutukawa is also within the area. | Exotic species include tree privet (*Ligustrum lucidum*), Taiwan cherry (*Prunus campanulata*), onion weed (*Allium triquetrum*), forget-me-not (*Myosotis* sp.), blue morning glory (*Ipomoea indica*), agapanthus (*Agapathus praecox* subsp. *orientalis*), Japanese spindle (*Euonymus japonicus*), panic veldt grass, Italian arum (*Arum italicum*), bear's breeches (*Acanthus mollis*), tuber ladder fern (*Nephrolepis cordifolia*) and tradescantia |
| Watercare planting (outside of project scope area) | Native plantings include kānuka, mānuka, ngaio, karo, harakeke (*Phormium tenax*), kāramu, kōhūhū, māhoe, rewarewa (*Knightia excelsa*) and ngaio (*Myoporum laetum*). | Cotoneaster, Montpellier broom (*Genista monspessulana*), eucalyptus (*Eucalyptus* spp.), brush wattle (*Paraserianthes lophantha*), boneseed (*Chrysanthermoides monilifera* subsp. *monilifera*), black passionfruit (*Passiflora edulis* f. *edulis*) (see section 2.6 ) and Japanese honeysuckle (*Lonicera japonica*). |

## 2.4 Exotic tree land

Ōwairaka has been designated a current ecosystem by Auckland Council (2018a) as *"Treeland"* this is described by Singers et al. (2017) as *"Tree canopy cover 20-80%, tree cover exceeding that for any other growth form, but tree canopy discontinuous above lower non-woody vegetation".* This has been sub categorised in Figure 1 into two areas based on amount of native canopy cover. Within both areas there is a mixture of mature native and exotic species likely to be local sources for natural regeneration and provide habitat to both native and exotic fauna.

Kikuyu appears to be the dominant groundcover throughout these areas. However as Burns et al. (2013) found on other maunga native *Microlaena stipoides* grass appears to have persisted in some areas such as below tree cover on medium slopes, likely due to its wide light

tolerance, preference for low fertility soils, ability to compete with other species and low palatability.

These areas are of low ecological value.

### 2.4.1 Treeland 1

Categorised (TL.2 *Mixed native/ exotic treeland*) where there is 25-75% native tree cover. This area has a greater canopy cover and is interspersed by unmown (generally shaded) grass and naturally regenerating native and exotic plant species (Figure 1 & Figure 3). Exotic groundcovers include kikuyu, panic veldt grass, *Carex divulsa*, viola, jasmine (*Jasminum polyanthum*), pink-headed knotweed (*Persicaria capitata*) and cineraria (*Pericallis* x *hybrida*). Native ferns established in the area include shaking brake fern, pukupuku, New Zealand cliff brake (*Pellaea rotundifolia*) and rereti *(Asplenium polyodon*).

Tree cover in this area includes:

1. Large proportion of native trees contributing to canopy cover. This includes pūriri, tōtara and pōhutukawa. Many are likely to have been self-established particularly tōtara as this withstands grazing. Other smaller naturally regenerating trees include māhoe, kāramu, kōhūhū and karo.
2. Exotic trees with Auckland Regional Pest Management Strategy (RPMS) designations including species to be researched (ARC, 2007) including monkey apple (*Syzygium smithii*), coastal banksia, Taiwan cherry and olive. Smaller exotic species include agapanthus, Japanese honeysuckle, climbing dock (*Rumex sagittatus*), tree privet and Chinese privet (*Ligustrum sinense*).
3. Other scattered exotic trees without RPMS designation include wonder tree (*Idesia polycarpa*), and eucalyptus. Please refer to Treescape Ltd (2018) for full list of trees over 3m in height.

**Figure 3 Photo example of Treeland 1**

### 2.4.2 Treeland 2

Catergorised (TL.3 *Exotic-dominated treeland*) where <25% native tree cover with exotic cover dominant (Figure 1 & Figure 4).

Scattered trees are interspersed with open areas of pasture that has been retired from grazing. Other occasional groundcovers include tradescantia (shaded sites), panic veldt grass and *Microlaena stipoides*. Within areas of rank kikuyu there are occasional plants that have naturally regenerated such as kāramu, mānuka, kāro and pōhutukawa along with exotic Japanese spindle, loquat (*Eriobotrya japonica*), Taiwan cherry and a single bougainvillea (*Bougainvillea glabra*).

Large scattered trees include a mix of species such as:

1. Native pūriri, karaka, tōtara and pōhutukawa.
2. Exotic trees with Auckland Regional Pest Management Strategy (RPMS) designations including species to be researched (ARC, 2007) such as monkey apple, Taiwan cherry, Norfolk Island hibiscus (*Lagunaria patersonii*) and willow (*Salix* sp.).
3. Other scatted exotic trees without RPMPS designation including a *Eucalyptus* spp., holm oak (*Quercus ilex*) and macrocarpa (*Cupressus macrocarpa*). Please refer to Treescape Ltd (2018) for full list of tree species.

It should also be noted that the stone wall beside the soccer field which is present below a mix of large exotic trees included several weed species growing among the rocks such as Mexican daisy (*Erigeron karvinskianus*) and tuber ladder fern, in addition to the regionally threatened native fern (*Pellaea calidirupium*).

**Figure 4 Photo example of Treeland 2**

## 2.5 Threatened plant species

Ōwairaka does not contain any threatened ecosystems, however a number of plant species have been noted that have a national or regional threat status (Table 2).

**Table 2 Summary of threatened vascular plant species of Ōwairaka**

| Name | National threat status (de Lange et al., 2017) | Regional threat status (Stanley et al., 2005) | Notes |
|---|---|---|---|
| Kānuka (*Kunzea robusta*) | Species now considered Threatened (Nationally Vulnerable) due to the unknown potential effect of Myrtle Rust. Qualifiers include designated and data poor. | | Plantings 2, 3 and Watercare area. (Planted) |
| Kōwhai (*Sophora microphylla*) | Not Threatened | Regionally at Risk (Sparse) | Historical recording of seedlings. Mature tree located in nearby street. No seedlings noted on site. |
| Mānuka (*Leptospermum scoparium* var. *scoparium)* | Species now considered At Risk (Declining) due to the unknown potential effect of Myrtle Rust. Qualifiers include designated and data poor. | | Watercare and Native Planting Area 2. (Planted and naturally regenerating). |
| Pōhukukawa (*Metrosideros excelsus*) | Species now considered Threatened (Nationally Vulnerable) due to the unknown potential effect of Myrtle Rust. Qualifiers include designated and data poor. | | Throughout, likely a mix of planted and self-established. |
| [redacted] | [redacted] | [redacted] | [redacted] |
| [redacted] | [redacted] | [redacted] | [redacted] |

| Name | National threat status (de Lange et al., 2017) | Regional threat status (Stanley et al., 2005) | Notes |
|---|---|---|---|
| [redacted] | [redacted] | [redacted] | [redacted] |

## 2.6 Auckland Unitary Plan

The area has a Significant Ecological Area overlay across the whole site from the Auckland Unitary Plan (Auckland Council, 2018b). The designation is SEA_T_6016, qualifier 5.d "*Supports species of type locality for taxon*". A type locality is a site where material was used to describe a species. Ōwairaka is the type locality for two species of fungi:

1. *Nectaria manuka*

This species is native to New Zealand and was found on *Leptospermum scoparium* (Mānuka) habitat on an unknown host (Dingley, 1951). It has also been recorded elsewhere in association with tree ferns *Cyathea dealbata* and *C.medullaris* (Manaki Whenua Landcare Research, 2018).

Within the site there are no areas of mānuka or tree fern canopy. Two areas of plantings beside the boundaries (Native planting areas 2 and 3) of Ōwairaka have been planted mixed natives including a small portion of mānuka and ponga (*Cyathea dealbata*). Mānuka can also be found on the adjoining governing body land (Watercare) on the planted slopes outside the scope of these works.

*2. Microdochium passiflorae* (syn. *Monographella passifloraea)*

This species is exotic (Manaaki Whenua Landcare Research, 2018) despite New Zealand being the type locality and has been found on dead stems of *Passiflora edulis* (black passionfruit) (CABI, 2018). One black passionfruit was found on the adjoining governing body land (Watercare) outside the scope of these works.

## 2.7 Fauna

### 2.7.1 Birds

Four native bird species were observed during site visits: riroriro/grey warbler (*Gerygone igata*), tūī (*Prosthemadera novaeseelandiae novaeseelandiae*), pīwakawaka/fantail (*Rhipidura fuliginosa placabilis*) and kōtare/kingfisher (*Todiramphus sanctus vagans*). These species are listed as not threatened (Robertson et al., 2017). Two introduced species; eastern rosella (*Platycercus eximius*) and blackbird (*Turdus merula*) were also observed. Additional urban native and exotic species will also use this site.

### 2.7.2 Bats

A frequency compression automatic bat recorder was set up to remotely record echolocation calls at a potential foraging site at the edge of vegetation in the southwest of the maunga (Te Ngahere, 2018b). The recorder was set up to record between 20:00 to 08:00 New Zealand Daylight Savings Time (NZDT) and left in place over 14 nights (2/02/2018-16/02/2018). Recordings were analysed using BatSearch 3.05. A brief walkover survey was undertaken to assess the suitability of habitat.

The recorder did not record any evidence of the presence of long-tailed bats. There is minimal habitat suitable for communal bat roosts (maternity roosts). Given the marginal habitat and distance to known colonies it is also unlikely that bats use these sites as solitary roosts or to forage. Therefore the effects of any removal of trees at these sites are considered to be nil. However, surveying for bats in New Zealand is difficult because they occur in low numbers and have cryptic behaviours (Sedgeley et al., 2012). They are also highly mobile and use different habitats and many different roost sites throughout the year (O'Donnell, 2001; O'Donnell and Sedgeley, 1999). Therefore bats can use sites where their presence is not recorded.

Crewther (2016) modelled the distribution of long-tailed bats for Auckland Council. Ōwairaka is located within an area considered not to be suitable habitat under the model. The model considers distance to roads and rivers, temperature, land cover, population density, elevation and precipitation.

### 2.7.3 Reptiles/ Herpetofauna

No formal survey of herpetofauna has been undertaken yet. Bell 2018 has identified [redacted] no invasive plague skink (*Lampropholis delicata*). please refer to this for more details.

### 2.7.4 Invertebrates

No surveys were undertaken. However is likely that due to the historical habitat loss on the site and dominance of kikuyu as pasture that diversity would be low especially within open areas.

### 2.7.5 Animal pests

Animal pests are present on the maunga including rats (*Rattus* spp.) and possums (*Trichosurus vulpecula*) and volunteer and contractor control is undertaken (see section 3.2.2 ).

## 2.8 Biosecurity

The Tūpuna Maunga Authority has a programme of environmental weed control and animal pest control (as discussed on pages 15 and 20).

Myrtle rust (*Austropuccinia psidii*) is a risk for the site as a significant proportion of the vegetation is established pōhutukawa trees. Some risk will be reduced through the removal of exotic myrtle species such as eucalyptus and monkey apple. However there is also a risk to

the site through the introduction of new nursery stock of mānuka and kānuka in the proposed restoration plantings.

Kauri dieback (*Phytophthora agathidicida*) is not a risk for the site as no kauri (*Agathis australis*) are present.

Plague skink are also a risk to the site if none are found to already be present as they will compete for habitat with native species. These could potentially be introduced or spread further within the site by the introduction of plants from nurseries where they are present.

# 3 Assessment of Ecological Effects

## 3.1 Proposed works

The proposed works on Ōwairaka have been initiated to restore the sightlines to and from the tihi and enhance the ecological values of the site. This includes the removal of exotic trees that inhibit tihi sightlines and selective restoration planting where sightlines and archaeological sites will not be disturbed.

### 3.1.1 Exotic tree removal

Proposed exotic tree removal from the site includes up to 345 exotic trees within the Tūpuna Maunga Authority administered areas of Ōwairaka Domain. Key species are outlined below in Table 3 and their Regional Pest Management Strategy status (ARC, 2007) noted. The RPMS species are currently under review by Auckland Council so are subject to possible status change as more species are added. For a full list see Treescape Ltd (2018).

**Table 3 Key exotic trees including those noted by Treescape Ltd (2018) and RPMS status (ARC, 2007)**

| Botanical Name | Common Name | RPMS (ARC, 2007) Status |
|---|---|---|
| *Banksia integrifolia* | Coastal banksia | Surveillance |
| *Callistemon rigidus* | Bottle brush | |
| *Cotoneaster* sp. | Cotoneaster | Surveillance |
| *Cryptomeria japonica* | Japanese cedar | |
| *Cupressus macrocarpa* | Macrocarpa | |
| *Erythrina* sp. | Flame/ coral tree | No but can be weedy |
| *Eucalyptus* sp. | Gum, eucalyptus | |
| *Fraxinus sp.* | Ash | |
| *Grevillea robusta* | Silky oak | |
| *Ilex* sp. | Holy | |
| *Jacaranda sp.* | Jacaranda | |
| *Lagunaria patersonii* | Norfolk island hibiscus | Surveillance |
| *Ligustrum lucidum* | Tree privet | Surveillance |
| *Magnolia grandiflora* | Evergreen magnolia | |
| *Olea europaea* subsp. *europaea* | European olive | Species to be researched |
| *Plantanus x acerifolia* | London plane | |
| *Populus x euramericana (P. nigra x P.deltoides)* | Lombardy polar | |
| *Prunus sp* (Possibly *Prunus campanulata* and *P. serrulata*) | Taiwan cherry and Japanese hill cherry | Species to be researched (Taiwan cherry) |
| *Quercus coccinea* | Scarlet oak | |
| *Quercus ilex* | Holm Oak | |
| *Quercus robur* | Oak | |
| *Salix* sp. | Willow | (Surveillance if found to be *Salix fragilis* or *S. cinerea*) |
| *Syzygium smithii* | Monkey apple | Surveillance |

Treescape Ltd (2018) has considered a range of assessment factors in determining trees for removal and proposed methods including natural features, archaeological sensitivity, physical

features, tree factors, regulatory and cost. Methods include manual dismantling and helicopter or crane assisted dismantling (see Treescape Ltd (2018) for full list and descriptions).

Under the Auckland Unitary Plan (Operative in Part) the exotic tree removal within the SEA area is a Discretionary Activity (Table E15.4.2 Vegetation and Biodiversity Management in Overlays (A43) any vegetation alteration or removal not otherwise provided for).

### 3.1.2 Planting plan

The restoration planting plan (Te Nghaere 2018a) includes:

- WF7: this includes the slopes of the old quarry area including among existing established native trees and on bare slopes. Species include those that could facilitate or recreate the WF7 forest type Pūriri Ngahere/ Forest which is now classified as Critically Endangered in the Regional IUCN Threat Status (Singers et al., 2017). Planting also includes some low ferns to provide shelter to skinks.
- Pohuehue: this includes some low native plantings on slopes to be trialled above archaeological features using a no dig methodology. This methodology is currently being trialled on Ōhuiarangi.
- Some of the low planting species mix is also included along the edges of the WF7 (normal planting methodology) to provide good edge habitat for skinks.

These areas are outlined below in Figure 5. Conservation planting is a permitted activity (Auckland Council, 2018b). Only indigenous species have been listed for planting for ecological restoration purposes. The planting plan requires eco-sourcing and/ or culturally appropriate plants to be used.


**Figure 5 Proposed planting areas on Ōwairaka**

## 3.2 Existing ecological restoration works on Ōwairaka

The Tūpuna Maunga Authority already undertakes ecological restoration activities on Ōwairaka including the following:

### 3.2.1 Environmental weed control programme

This includes the targeting of RPMS weed species (below 4m in height) across the Ōwairaka area (excluding the Watercare area).

### 3.2.2 Animal pest programme

Ongoing animal pest control is being undertaken on Ōwairaka. This includes:

- Rabbit control (one night shoot and fumigation) which has been successful (S. Gibbs, pers. comm., September 2018).
- Possum control is undertaken using tree-mounted timms traps and have been serviced by volunteers and contractors over several rounds annually.
- Rat control is undertaken by Ōwairaka ratbaggers using bromadiolone and diphacinone baits in August, November, January and April.
- Please see Bell 2018 for information on more pest recommendations.

## 3.3 Ecological effects

### 3.3.1 Effects on vegetation and fungi

The removal of exotic vegetation and the planting of two types of native habitat will have a positive benefit to the vegetation of the site in the following ways:

1. Increasing the available habitat for a native *Nectaria manuka* a fungal type specimen of Ōwairaka through the planting of suitable habitat (mānuka and tree ferns).
2. Increase in diversity and connectedness of native plant habitat through the introduction of a larger WF7 planting and low pohuehue plantings.
3. Increase in native seed source for the surrounding area.
4. Reduced seed source of RMPS weed species.

Possible adverse effects include:

1. Potential damage to existing large native trees such as pōhutukawa, pūriri and tōtara through the removal process of exotic trees.

### 3.3.2 Faunal effects

Fauna within the site includes native and exotic invertebrates and bird species. No bats have been recorded (Te Ngahere, 2018b) and herpetofauna will be surveyed separately. The removal of exotic vegetation and the planting of two types of native habitat will have a positive benefit to the fauna of the site in the following ways:

1. Increase in habitat availability for native fauna including birds and invertebrates through an increase in habitat heterogeneity including low open native habitat preferred by some species of native invertebrates (such as native butterflies) and skinks. Along with WF7 habitat increasing quality and amount of habitat for species

that prefer more shaded native forest through the establishment of a more continuous area of vegetation.

2. Increase in phenology diversity (fruiting and flowering seasons) through the introducing of a wider range and area of native plant species.

Possible adverse effects include:

1. Loss of exotic habitat including fruit/nectar availability and nesting sites until plantings establish.
2. Disturbance during bid breeding season.

## 3.4 Biosecurity considerations

The Treescape Ltd (2018) also includes the removal of exotic myrtle species (eucalyptus and monkey apple) that could be potential host plants for myrtle rust reducing the potential innoculum within the area. There is potential for mānuka and/ or kānuka plantings to be infected with myrtle rust however pōhutukawa is a more susceptible species and has therefore not been included within the planting plan. Sourcing should be from nurseries that follow the MPI nursery protocols for Myrtle rust. No kauri are present onsite or included in the planting plan.

Planting also could introduce/ further spread plague skink. The introduction of any plants or potting mix (for mound planting) should be this is detailed in Te Ngahere 2018 including:

- Checking prior to transporting.
- Where possible source plants or potting mix from a supplier outside of plague skink distribution or that are undertaking skink management where possible.
- Only use mulch from trees on site.

## 3.5 Summary of ecological effects and proposed mitigation

**Table 4 Summary of Assessment of Ecological Effects**

| Issue | Ecological Effect without mitigation | Recommended avoidance, remediation or mitigation to reduce adverse effects |
|---|---|---|
| Vegetation clearance of exotic trees throughout the site | This will be low with:<br>• Temporary loss of vegetation cover and habitat for native and exotic wildlife (e.g. birds and lizards). Mature native trees and existing plantings will be available for refuge.<br>• Removal of some RPMS species removing weed seed sources.<br>• Potential disturbance to surrounding native vegetation. | Overall there will be a positive effect with:<br>• Minimising damage through tree removal methodology including the use of helicopters, cranes and manual dismantling of the exotic trees ensures minimal damage to surrounding native vegetation.<br>• Continued weed and animal pest control throughout wider site to restore and enhance habitat.<br>• Restoration planting (as per the scope of works) to replace lost vegetation and improve habitat. |
| Restoration planting | This will be negligible with potential introduction of myrtle rust (already present within the Auckland Region). | Overall there will be a positive effect with:<br>• Any myrtle species being planted (such as mānuka or kānuka) must be checked prior to planting for myrtle rust symptoms.<br>• Increase in native vegetation to provide habitat for native fauna and flora will have a positive effect.<br>• Creation of more continuous larger habitat area that can support a greater diversity of native species than current open vegetation (i.e. those that require more forest cover for breeding or feeding). |
| Disturbance to lizards | Please refer to Bell, (2018). | Please refer to Bell (2018). |
| Disturbance to bats | Nil effects. No bats recorded on site in 2018 survey (Te Ngahere, 2018b). Unlikely to be present. | None |
| Disturbance to birds from tree removal | Negligible. Only temporary loss of bird habitat and disturbance during breeding season. | Overall there will be a positive effect with:<br>• Where possible minimise noise and construction activities to outside the peak of the breeding season (August-January).<br>• Continue to carry out animal pest control to support the establishment of native bird populations. This could be increased before, during and after exotic tree removal.<br>• Restoration planting (as per the scope of works) to replace lost vegetation and improve habitat.<br>• Existing native vegetation on the site is to be retained and will provide some refuge. |

[1]Note: This report does not cover amenity and arboricultural effects of exotic tree removal.

# 4 Summary

The proposal by the Tūpuna Maunga Authority to undertake exotic tree removal and restoration planting on Ōwairaka does not include any notable residual ecological effects and will have an overall positive effect on the existing ecological values of the site.

Some potential adverse effects have been noted, and it is recommended that the following is undertaken in addition to the recommendations of the Treescape Ltd (2018) *Owairaka/ Mt Albert Tree Removal Methodology* and Te Ngahere (2018a) Planting Plan to minimise these potential effects:

- Continue the existing environmental weed control programme.
- Continue the Animal pest control throughout the site and include additional animal pest control for rats and possums if tree removal occurs outside the months of August, November, January or April.
- Limit the works to outside the main bird breeding season of August – January.

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# Appendix 1 Native Plant Species Inventory

| Latin name | Common name(s) |
|---|---|
| ***Gymnosperm trees and shrubs*** | |
| *Dacrydium cupressinum* | Rimu |
| *Podocarpus totara* | Tōtara |
| ***Monocotyledonous trees and shrubs*** | |
| *Cordyline australis* | Tī kōuka, cabbage tree |
| *Rhopalostylis sapida* | Nīkau |
| ***Dicotyledonous trees and shrubs*** | |
| *Alectryon excelsus* subsp. *excelsus* | Tītoki |
| *Beilschmiedia tarairi* | Taraire |
| *Coprosma macrocarpa* subsp. *minor* | Coastal karamū, large-fruited karamū |
| *Coprosma robusta* | Karamū |
| *Corynocarpus laevigatus* | Karaka |
| *Dysoxylum spectabile* | Kohekohe |
| *Entelea arboresens* | Whau |
| *Griselinia litoralis* | Pāpāuma, paraparauma, kāpuka, broadleaf |
| *Hedycarya arborea* | Porokaiwhiri, pigeonwood |
| *Hoheria populnea* | Hohere, lacebark |
| *Knightia excelsa* | Rewarewa |
| *Kunzea robusta* | Kānuka |
| *Leptospermum scoparium* var. *scoparium* | Mānuka |
| *Melicytus ramiflorus* | Māhoe |
| *Meryta sinclairii* | Puka |
| *Metrosideros excelsa* | Pōhutukawa |
| *Myoporum laetum* | Ngaio |
| *Myrsine australis* | Māpou, red matipo |
| *Meryta sinclairii* | Pukanui |
| *Olearia albida* | Tanguru |
| *Olearia solandri* | Coastal tree daisy |
| *Piper excelsum* subsp. *excelsum* | Kawakawa |
| *Pittosporum crassifolium* | Karo |
| *Pittosporum eugenioides* | Tarata, lemonwood |
| *Pittosporum tenuifolium* | Kōhūhū, black matipo |
| *Planchonella costata* | Tawapou |
| *Pseudopanax arboreus* | Whauwhaupaku, five finger |
| *Streblus banksii* | Turepo |
| *Vitex lucens* | Pūriri |
| ***Ferns*** | |
| *Asplenium polyodon* | Petako, sickle spleenwort |
| *Austroblechnum lanceolatum* (syn. *Blechnum chambersii*) | Rereti, lance fern |
| *Cyathea dealbata* | Ponga, silver fern |
| *Doodia australis* (syn. *Blechnum parrisiae*) | Rasp fern, pukupuku |

| Latin name | Common name(s) |
|---|---|
| *Parablechnum novae-zelandiae* (syn. *Blechnum novae-zelandiae*) | Kiokio |
| *Pellaea calidirupium* | |
| *Pellaea rotundifolia* | New Zealand cliff brake |
| *Pteris tremula* | Shaking brake, tender brake |
| *Pyrrosia eleagnifolia* | Leather-leaf fern |
| ***Monocotyledonous herbs (other than orchids, grasses, sedges, and rushes)*** | |
| *Phormium tenax* | Harakeke, flax |

# Appendix 2 Exotic Plant Species Inventory

| Latin name | Common name(s) | RPMS status (ARC, 1997) |
|---|---|---|
| ***Gymnosperm trees and shrubs*** | | |
| *Cupressus macrocarpa* | Macrocarpa | |
| ***Monocotyledonous trees and shrubs*** | | |
| *Trachycarpus fortunei* | Chinese windmill palm | To be researched |
| ***Dicotyledonous trees and shrubs*** | | |
| *Banksia integrifolia* | Coastal banksia | Surveillance |
| *Cotoneaster glaucophyllus* | Cotoneaster, large-leaved cotoneaster | Surveillance |
| *Eriobotrya japonica* | Loquat | |
| *Erythrina* sp. | Flame/ Coral tree | |
| *Eucalyptus* spp. | Eucalyptus | |
| *Euonymus japonicus* | Japanese spindleberry | Surveillance |
| *fbonseed* | Montpellier broom | Surveillance |
| *Hydrangea macrophylla* | Hydrangea | |
| *Idesia polycarpa* | Wonder tree | |
| *Lagunaria patersonii* | Norfolk Island Hibiscus | Surveillance |
| *Ligustrum lucidum* | Tree Privet | Surveillance; Community Initiatives |
| *Ligustrum sinense* | Chinese privet | Surveillance; Community Initiatives |
| *Olea europea* | Feral olive | To be researched |
| *Paraserianthes lophantha* | Brush wattle | Surveillance; Community Initiatives |
| *Prunus campanulata* | Taiwan cherry | To be researched |
| *Prunus serrulata* | Japanese hill cherry | |
| *Quercus ilex* | Holm oak | |
| *Solanum mauritianum* | Woolly nightshade | Containment (boundary); Community Initiatives |
| *Syzygium smithii* | Monkey apple | Surveillance; Community Initiatives |
| *Ulex europaeus* | Gorse | Community Initiatives |
| ***Dicotyledonous lianes and related trailing plants*** | | |
| *Hedera helix* | English ivy | Surveillance |
| *Ipomoea indica* | Blue morning glory | Surveillance; Community Initiatives |
| *Jasminum polyanthum* | Jasmine | Surveillance; Community Initiatives |
| *Lonicera japonica* | Japanese honeysuckle | Surveillance; Community Initiatives |
| *Passiflora edulis* f. *edulis* | Black passionfruit | |
| *Rumex sagittatus* | Climbing dock | Surveillance |
| ***Ferns*** | | |
| *Nephrolepis cordifolia* | Tuber ladder fern | Surveillance; Community Initiatives |
| ***Grasses*** | | |
| *Cenchrus clandestinus* | Kikuyu grass | |

| Latin name | Common name(s) | RPMS status (ARC, 1997) |
|---|---|---|
| *Ehrharta erecta* | Panic veldt grass | |
| ***Sedges*** | | |
| *Carex divulsa* | Grey sedge | |
| ***Monocotyledonous herbs (other than orchids, grasses, sedges, and rushes)*** | | |
| *Agapathus praecox* subsp. *orientalis* | Agapanthus | Surveillance |
| *Allium triquetrum* | Three-cornered garlic, onion weed | |
| *Arum italicum* | Italian arum | Surveillance |
| *Crocosmia* x *crocosmiiflora* | Montbretia | Surveillance |
| *Iris foetiissima* | Stinking iris | |
| *Polygonum capitatum* | Pick headed knotweed | |
| *Tradescantia fluminensis* | Tradescantia | Surveillance; Community Initiatives |
| ***Dicotyledonous herbs - Composites*** | | |
| *Pericallis* x *hybrida* | Cineraria | |
| ***Dicotyledonous herbs - other than Composites*** | | |
| *Acanthus mollis* | Bear's breeches | To be researched |
| *Myosotis* sp. | forget-me-not | |
| *Solanum pseudocapsicum* | Jerusalem cherry | |
| *Solanum nigrum* | Black nightshade | |
| *Tropaeolum majus* | Nasturtium | |
| *Viola odorata* | Viola | |