APPENDIX B - Plants for regenerating Te Puhinui

Appendix B - Plants for regenerating Te Puhinui is intended to help realise te ora oo whakapapa and the establishment of a healthy viable and diverse seed stock for the intergenerational regeneration of Te Puhinui. Through the pursuit of this goal Te Puhinui's ecosystems will be regenerated to health.

The first four pages identify links to other strategic initiatives and sub-initiatives within the broader Te Whakaoranga o Te Puhinui: Puhinui Regeneration Strategy, give guidance for the selection of seeds and the propagation of plant material, and provide an overview of the three broad ecosystem types within Puhinui Catchment - upper, middle, lower catchment and coastal environs.

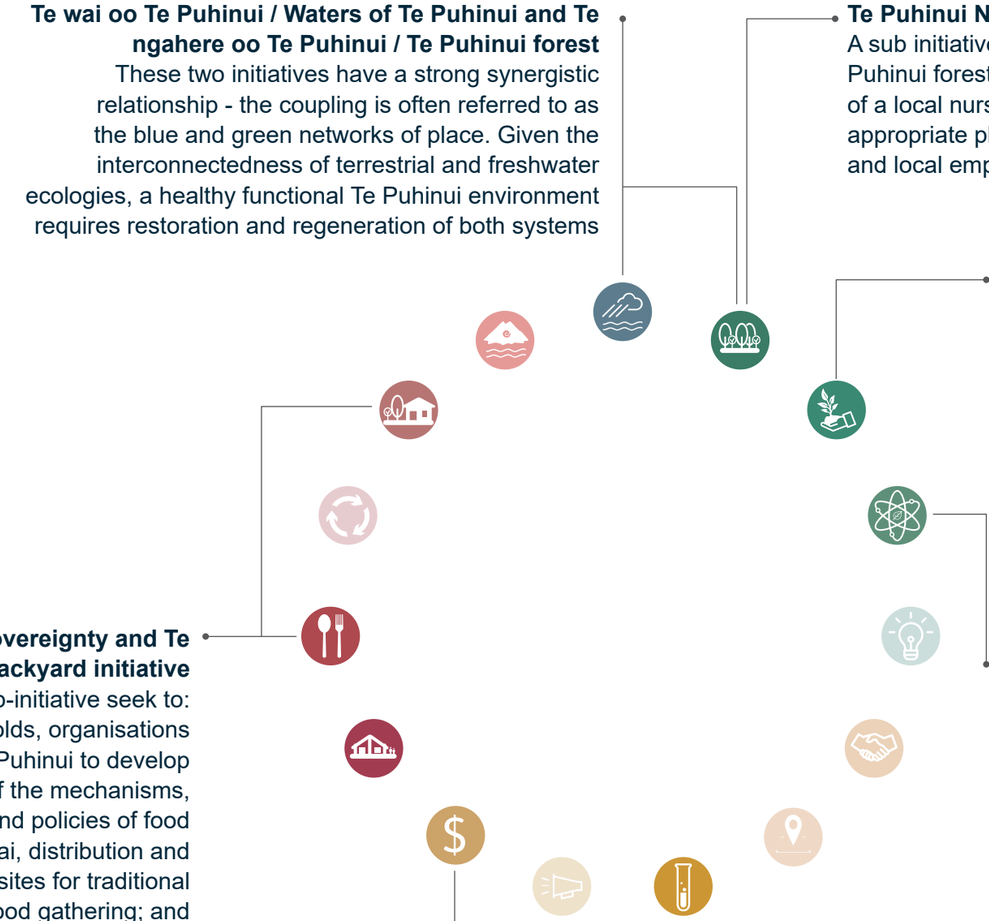
The remainder of the appendix outlines plants for revegetating Te Puhinui that have been selected based on their historical occurrence within the catchment, their suitability to the underlying natural characteristics and features of the local environs, and the infrastructure requirements of Te Puhinui. Plants have also been selected based on their contribution to biodiversity outcomes, including threatened species, as well as for the local provision of food, medicine and fibre for the people of Te Puhinui.

Revegetating and sustaining Te Puhinui is intended for use by any agency, operator, practitioner, or nursery working in the catchment area.

This document uses te reo Waiohua conventions, notably the use of double vowels - Refer to Te Reo Waiohua Strategy/Te Waiohua Language Strategy sub-initiative for more information about te reo Waiohua.

Links to Strategic Initiatives

Plants for regenerating Te Puhinui link to, and support, a range of strategic initiatives. This diagram identifies all the strategic initiatives and sub initiatives that plants for regenerating Te Puhinui will support. See Te Whakaoranga o Te Puhinui: Te Rautaki/Te Puhinui Regeneration Strategy for a complete list and description of all the strategy initiatives and sub-initiatives.



Te wai oo Te Puhinui / Waters of Te Puhinui and Te ngahere oo Te Puhinui / Te Puhinui forest
These two initiatives have a strong synergistic relationship - the coupling is often referred to as the blue and green networks of place. Given the interconnectedness of terrestrial and freshwater ecologies, a healthy functional Te Puhinui environment requires restoration and regeneration of both systems

Te Puhinui Nursery
A sub initiative of the Te ngahere oo Te Puhinui/Te Puhinui forest strategic initiative is the establishment of a local nursery for Te Puhinui to provide appropriate plant stock for catchment revegetation and local employment and training opportunities

Te Kaititakitanga me te Tiakitanga oo Te Puhinui / Te Puhinui Stewardship
This initiative supports the people of Te Puhinui, including mana whenua, local businesses, organisations and residents, to play an active role in the care, protection, restoration and regeneration of their environment.

Te maramataka oo Te Waiohua / Te Waiohua lunar cycles
This initiative recognises the importance of the cycles and rhythms of nature in the regeneration of Te Puhinui and seeks to reinvigorate, celebrate, and apply Te Waiohua lunar cycles to the planning, design, operations and delivery of a wide range of activities within Te Puhinui.

Te Puhinui food sovereignty and Te Puhinui backyard initiative
This initiative and sub-initiative seek to: support individuals, households, organisations and institutions of Te Puhinui to develop greater control of the mechanisms, infrastructure and policies of food production and mahinga kai, distribution and consumption; re-establish sites for traditional wild harvest and food gathering; and encourage people and organisations to turn their backyards into productive landscapes for growing food, fibre, medicine, water care and providing a sanctuary for wildlife.

Te Whanaketanga Oohanga o Te Puhinui / Te Puhinui economic development
This initiative focuses on the well-being of the communities of Te Puhinui, place based livelihoods and long term local careers through the creation of a pipeline of work and by developing pathways to employment. This initiative includes the related sub initiatives Indigenous and social procurement and Rangatahi tuu kaha/Te Puhinui youth development programme which acknowledge the role of mana whenua, youth and local organisations and residents in regenerating Te Puhinui including ecological restoration and guardianship/stewardship.

PATHWAYs to healthy plants and seeds

This diagram outlines the key features and stages for establishing healthy plants and seeds necessary to effectively revegetate, regenerate and sustain Te Puhinui's ecosystems. Opportunities for social procurement and local economic development are also identified.

All stages of the process should follow best practice and recognised industry standards, and where appropriate should be undertaken by a qualified professional.

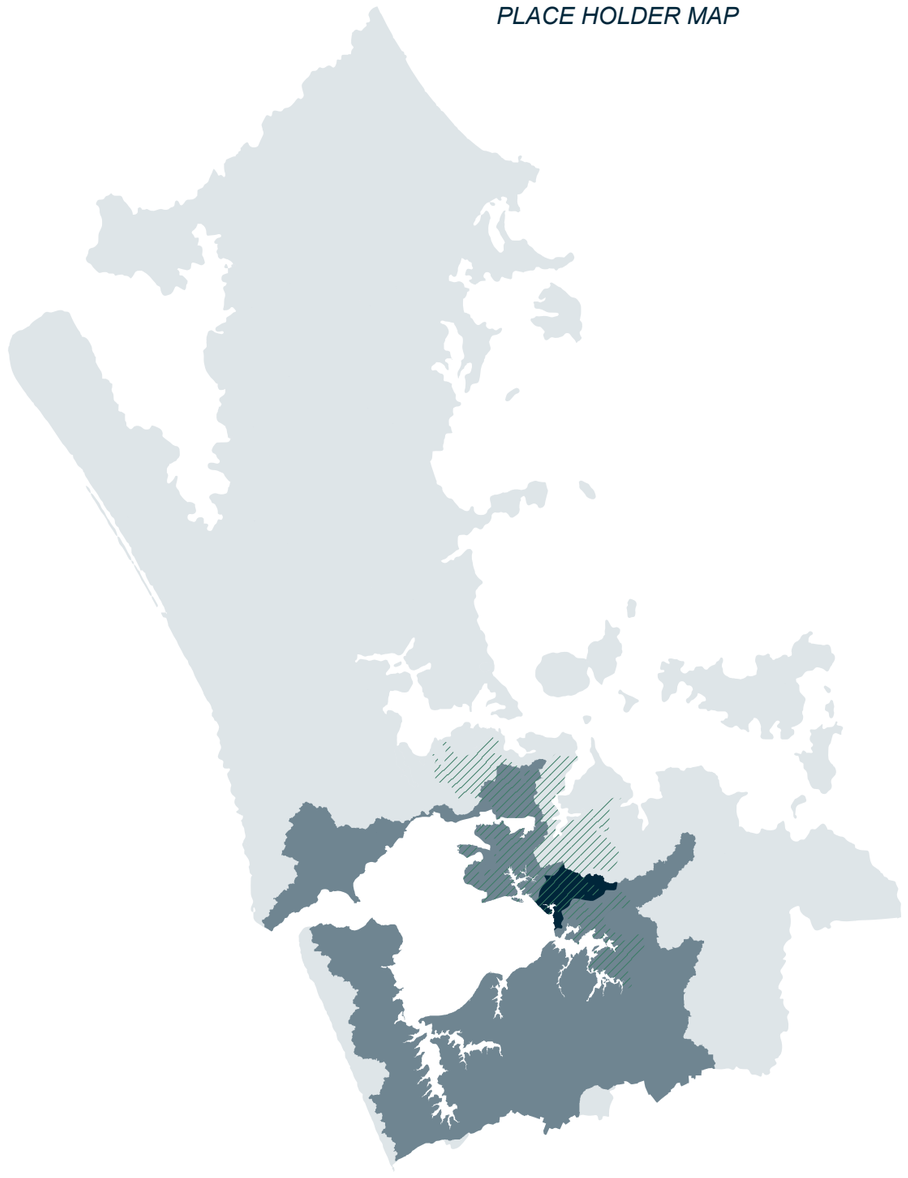
**Many of the plant species appropriate for regenerating Te Puhinui require future planning if they are going to be available for implementation as they have a long lead in time. For example miro/Prumnopitys ferruginea can take two or more years before germinating and several more years before it has established enough to plant out. Project forecasting and procurement of specific plant species need careful consideration well in advance to achieve the range of biodiversity required to achieve a healthy Te Puhinui ecosystem.*

Sourcing Seed and Propagating plant material

In order to restore the natural and cultural heritage of Te Puhinui, plants for regenerating Te Puhinui should, wherever possible, be sourced from the local Te Puhinui environs. The ecosystems of Te Puhinui have been significantly modified and the underlying characteristics that determine the range and extent of plants and different ecosystems have been permanently altered. As a result there are not necessarily viable, local seed sources for many of the plants that once existed in Te Puhinui. To balance the trade off between the desire to utilise seeds sourced from the local environment on the one hand, and to regenerate the catchment with a wide range of species suitable for the new urban context of Te Puhinui on the other, the following considerations need to be applied for sourcing and propagating seeds and plant material:

- Indigenous species found historically within the local Te Puhinui environs with existing, viable sources of seed or plant material.
- Indigenous species found historically within the local Te Puhinui environs without existing, viable, local sources of seed or plant material, but with existing, viable, bio-regional sources as close to and as practical as possible to the project area.
- New Zealand native species that have demonstrated performance in similar urban environments within the Taamaki Makaurau bio-region.
- Species that provide food, medicine or fibre for use by tangata/people without displacing or replacing indigenous species or negatively impacting the environment.

PLACE HOLDER MAP



Plant Lists for Regenerating Te Puhinui

Plant lists for regenerating Te Puhinui are organised into three broad ecosystem types that relate to their location within the catchment and the associated land uses. Each ecosystem type is organised into plant communities that relate to specific environments and applications.

Please note that the plant lists provided herein are a guide only. They represent a starting point for individual projects that will require further refinement and enrichment with additional species specific to each project's context and conditions.

Te Ngahere oo Te Puhinui/Te Puhinui Forest
The plant lists for Te Ngahere oo Te Puhinui provide a broad list of forest species suitable for Te Puhinui. The plant lists are organised into six plant communities which cover the broad forest types of Te Puhinui:

- Inland forests including pūriri forest; taraire, tawa, podocarp forest; and kauri, podocarp, broadleaved, beech forest - organised into upper, middle and lower catchment.
- Coastal forests - excluding plant communities within the tidal zone such as mangrove forests and seagrass meadows.
- Stream and aquatic habitats - represented here as a riparian corridor.
- Street trees - a plant community that did not exist prior to urbanisation that is now a significant part of the catchment's ecology.

Te Wai oo Te Puhinui/Waters of Te Puhinui
The plant lists for Te Wai oo Te Puhinui/Waters of Te Puhinui provide guidance for three distinct water sensitive design devices that incorporate natural and constructed elements designed to deliver a wide range of ecological functions.

- Wetlands - large shallow planted ponds incorporating a wide variety of species that allow sediment to settle and the biofiltration of contaminants.
- Rain gardens and urban swales - constructed depressions and drainage courses planted with a variety of indigenous species to filter contaminants and in some cases, infiltration to groundwater.
- Earth roofs - Partially or completely planted roof to filter water and air and provide a degree of stormwater detention.

Productive gardens
The plant lists for productive gardens are organised into forest gardens and medicinal plants. A forest garden is a productive ecosystem based on the structure and function of a forest of diverse species, which can include a range of fruit and nut trees, shrubs, herbs, vines and perennial vegetables which have yields directly useful to people.

[1]Plants for intensive gardens are not included in this document. For information on intensive gardens for annual vegetables, salad mixes, and herbs; flowers for cutting and beneficial insects suitable for Te Puhinui see:

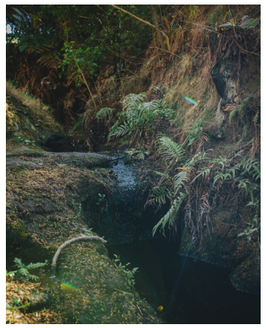
- Organic Edible Garden - https://organicediblegarden.co.nz/
- Garden Grow: Keep your garden growing - see what to plant right now - https://www.gardengrow.co.nz/

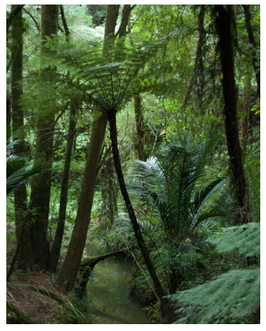
Auckland's unique and highly productive environment is one of very few places in the world where it is possible to grow three different types of forest garden in the same location - deciduous, mediterranean and subtropical.

Medicinal plants outline a range of plants for well-being and include a range of rongoaa Maaori/traditional Maaori medicinal plants.

CATCHMENT overview

UPPER CATCHMENT




The upper catchment/headwaters are the source point of Puhinui Stream. Groundwater infiltration and aquifer recharge in this area of the catchment is crucial in maintaining base flow of Te Puhinui Stream. The mature native forest that surrounds Puhinui Stream and its tributaries is a representative example of remnant forest of the Manukau Lowlands comprising of ancient podocarp forests of mature rimu, kahikatea, miro, mataii and tootara and kauri . These ancient forest patches are some of the best stands of mataii and tootara in the region, with almost all that is left of the alluvial flat forests once dominant in Manukau.

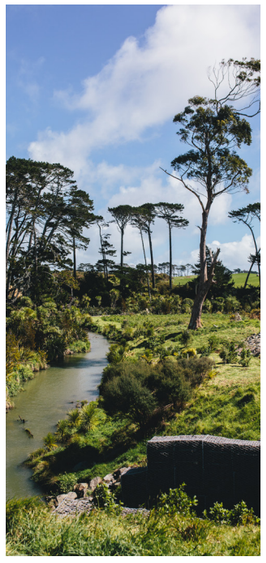
MIDDLE CATCHMENT




The mid catchment includes gently rolling landforms where stormwater run-off merges together to form larger stream and wetland systems. Originally the mid catchment was dominated by puuriri forest on alluvial and volcanic soils. This area of the catchment is now highly modified through urbanisation and the stream conditions vary from narrow, often channelised stream corridors in dense urban areas with some areas of wider floodplains in open spaces and undeveloped land.

The riparian networks through these areas are often highly constrained and require protection and enhancement through planted buffers and increased stewardship. In combination with a patchwork of native forests, groves of trees and wetlands; the riparian network forms the foundation for the urban ngahere network through the mid catchment.

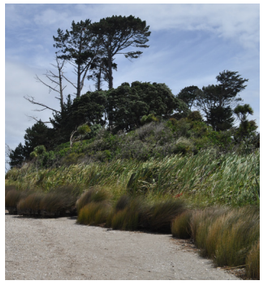
LOWER CATCHMENT

The lowland and coastal environment is characterised by extensive areas of low lying, flat to undulating land. Historically consisting of kahikatea swamp forest, boggy streams and wetlands on alluvial substrates where water would have dispersed widely across the landscape to provide a rich environment for freshwater and saline wetlands, estuaries and coastal forests. The remaining forest fragments consist of mixed podocarp-broadleaf secondary forests, in which kahikatea, lowland totara and puuriri are the prominent species.

This land is highly modified, particularly the commercial centres and industrial zones that characterise Puhinui Catchment. Restoration of stream margins, gullies and floodplains with riparian planting help to prevent erosion, mitigate contaminants and connect ecological fragments.

COASTAL





The coastal edge is the interface of freshwater, marine and terrestrial environments, providing diverse community assemblages and unique coastal and marine habitats. This environment consists of muddy shorelines, bands of mangroves, intertidal wetlands, salt marsh and salt meadows, rushlands and herb fields. The upper clay banks are populated with coastal forest species which tolerate harsh coastal conditions including poohutukawa, puuriri, kohekohe, taraire, karaka, tiitoki, mangeao, rewarewa and niikau. This unique marine environment supports an important breeding and feeding habitat to coastal fish, shellfish and marine birds. Estuarine habitats within this environment encourage diverse food webs for freshwater and marine fish as well as migratory birds.

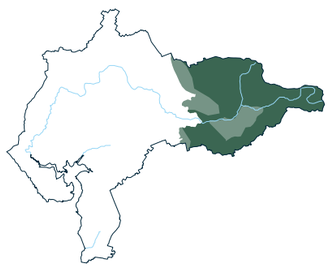
The coastal edge is now a highly modified environment contributing toward ongoing and increasing stresses from changing climatic conditions and coastal inundation. Restoring coastal ecosystems and the hydrological function of the coastal margin will help to mitigate against these stresses and significantly improve the adaptive capacity of this dynamic environment.

Te Ngahere oo Te Puhinui / Te Puhinui Forest

UPPER CATCHMENT

The upper catchment consists of two forest types - puuriri forest and kauri, podocarp, broadleaved and beach forest which also includes taanekaha, tootara, rimu, miro, tawa, hiinau, raataa, rewarewa, toowai, kohekohe, maire and taawari.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
LOW GROWING GROUND COVERS 0 - 0.3m					
Poohuehue	Muehlenbeckia axillaris	✔	✔		
Paanakenake	Pratia angulata	✔	✔		
	Libertia Peregrinans	✔	✔		Nationally vulnerable species
Tuukaauki	Libertia grandiflora	✔	✔		
Miikoikoi	Libertia ixioides	✔	✔		
Totara	Fuchsia procumbens	✔	✔		
LOW GROWING 0.3 - 1M					
Puukio	Carex virgata	✔	✔		
Toetoe	Chionochloa flavicans	✔	✔		
Pukupuku	Blechnum parrisiae	✔	✔		
Kiokio	Blechnum novae-zelandiae				
Piupiu	Blechnum discolor				
MEDIUM HEIGHT/SHRUB UNDERSTORY - 1-3M					
Mingimingi	Coprosma virescens	✔	✔		
Houpara	Pseudopanax lessonii	✔	✔		
Patete	Schefflera digitata	✔	✔		
Taawhiri karo	Pittosporum cornifolium	✔	✔	✔	
Mingimingi	Coprosma propinqua	✔	✔		



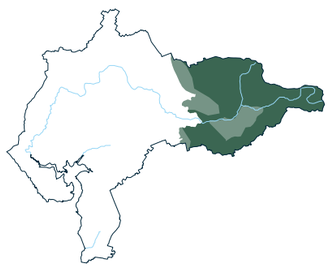
Kauri, podocarp, broadleaved, beech forest (WF12)

Puuriri Forest (W7)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

UPPER CATCHMENT

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
TALLER SHRUBS/INFILL - 3-6M					
Tarata	Pittosporum eugenioides	✔	✔		
Koohuuhuu, rautaahiri	Pittosporum tenuifolium	✔	✔		
Patete	Schefflera digitata	✔	✔		
Kawakawa	Macropiper excelsum		✔		
Koowhai	Sophora microphylla	✔	✔	✔	
Maapou, maapau	Myrsine australis	✔	✔		
Houhere	Hoheria populnea	✔	✔		
NGAHERE/FOREST CANOPY - 6M ABOVE					
Kauri	Agathis australis			✔	
Taawai	Nothofagus truncata			✔	
Tootara	Podocarpus totara	✔	✔	✔	
Rimu	Dacrydium cupressinum			✔	
Karaka	Corynocarpus laevigatus	✔	✔	✔	
Taanekaha	Phyllocladus trichomanoides			✔	
Miro	Prumnopitys ferruginea			✔	
Tawa	Beilschmiedia tawa			✔	
Taraire	Beilschmiedia tarairi			✔	
Hiinau	Elaeocarpus dentatus			✔	
Raataa	Metrosideros robusta			✔	
Rewarewa	Knightia excelsa	✔	✔	✔	
Toro	Myrsine salicina			✔	
Taawari	Ixerba brexioides			✔	
Kohekohe	Dysoxylum spectabile			✔	
Mataii	Prumnopitys taxifolia			✔	
Tiitoki	Alectryon excelsa		✔	✔	
Porokaiwhiri	Hedycarya arborea			✔	
Kaikomako	Pennantia corymbosa			✔	Regionally rare species



Kauri, podocarp, broadleaved, beech forest (WF12)
Puuriri Forest (W7)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

MID CATCHMENT

The middle catchment consists of the Pururi forest type and is characterised by puuriri, karaka, kohekohe and taraire. The mid catchment would have also supported stands of kahikatea swamp forest with maire, tiitoki and pukatea along boggy streams and in wetlands.

Kauri, podocarp, broadleaved, beech forest (WF12)
Puuriri Forest (W7)
Poohutukawa, puuriri, broadleaved forest (WF4)

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
LOW GROWING GROUNDCOVERS 0 - 0.3m					
Poohuehue	Muehlenbeckia axillaris	✔	✔		
Paanakenake	Pratia angulata	✔	✔		
Pinaatoro	Pimelea prostrata	✔	✔		
Miikoikoi	Libertia peregrinans	✔	✔		Nationally vulnerable species
Tuukaauki	Libertia grandiflora	✔	✔		
Miikoikoi	Libertia ixioides	✔	✔		
LOW GROWING - 0.3 - 1M					
Puukio	Carex virgata	✔	✔		
Toetoe	Chionochloa flavicans	✔	✔		
Pukupuku	Blechnum parrisiae		✔		
Oioi	Apodasmium similis	✔	✔		
Rengarenga	Arthropodium cirratum		✔		
	Blechnum neohollandicum		✔		
Kiokio	Blechnum novae-zelandiae				
Piupiu	Blechnum discolor				
MEDIUM HEIGHT/SHRUB UNDERSTORY - 1-3M					
Mingimingi	Coprosma virescens	✔	✔		
Houpara	Pseudopanax lessonii		✔		
Patete	Schefflera digitata		✔		
Taawhiri karo	Pittosporum cornifolium		✔	✔	
Mingimingi	Coprosma propinqua		✔		
Tuuhara, Peepepe	Machaerina sinclairii	✔	✔		

Te Ngahere oo Te Puhinui / Te Puhinui Forest

MID CATCHMENT

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
TALLER SHRUBS/INFILL - 3-6M AND ABOVE					
Tarata	Pittosporum eugenioides	✔	✔		
Koohuuhuu, rautaahiri	Pittosporum tenuifolium	✔	✔		
Kawakawa	Macropiper excelsum		✔		
Koowhai	Sophora microphylla	✔	✔	✔	
Maapou, maapau	Myrsine australis	✔	✔		
Houhere	Hoheria populnea	✔	✔		
Maahoe	Melicytus ramiflorus	✔	✔		
	Coprosma areolata	✔	✔		
Koonini, kootukutuku	Fuchsia excorticata			✔	
Houpara	Pseudopanax lessonii		✔		
Whekii	Dicksonia squarrosa			✔	
Maamaangi	Coprosma arborea	✔	✔		

Kauri, podocarp, broadleaved, beech forest (WF12)
Puuriri Forest (W7)
Poohutukawa, puuriri, broadleaved forest (WF4)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

MID CATCHMENT

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
NGAHERE/FOREST CANOPY - 6M ABOVE					
Puuriri	Vitex lucern	✔	✔	✔	
Kohekohe	Dysoxylum spectabile			✔	
Maatai	Prumnopitys taxifolia			✔	
Tiitoki	Alectryon excelsus			✔	
Koowhai	Sophora microphylla	✔	✔	✔	
Kahikatea	Dacrycarpus dacrydioides			✔	
Tootara	Podocarpus totara		✔	✔	
Karaka	Corynocarpus laevigatus	✔	✔	✔	
Rewarewa	Knightia excelsa	✔	✔	✔	
Taraire	Beilschmiedia tarairi			✔	
Pukatea	Laurelia novae-zelandiae			✔	
Tawa	Beilschmiedia tawa			✔	
Raataa	Metrosideros robusta			✔	
Rimu	Dacrydium cupressinum			✔	
Toowai, Tawhero	Weinmannia silvicola			✔	
Hiinau	Elaeocarpus dentatus			✔	
Miro	Prumnopitys ferruginea			✔	
Niikau	Rhopalostylis sapida		✔	✔	

Kauri, podocarp, broadleaved, beech forest (WF12)
Puuriri Forest (W7)
Poohutukawa, puuriri, broadleaved forest (WF4)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

LOWER CATCHMENT

The lower catchment is composed of three forest types - Puuriri forest; Poohutukawa, puuriri, broadleaved forest which includes puuriri, karaka, and taraire as well as koowhai, niikau and kohekohe; and Taraire, tawa, podocarp forest which includes rimu, raataa with kahikatea, hiinau, rewarewa, pukatea, miro, puuriri, karaka, niikau and ponga.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
LOW GROWING GROUNDCOVERS 0 - 0.3m					
Poohuehue	Muehlenbeckia axillaris	✔	✔		
Paanakenake	Pratia angulata	✔	✔		
Pinaatoro	Pimelea prostrata	✔	✔		
Miikoikoi	Libertia Peregrinans	✔	✔		Nationally vulnerable species
Tuukaauki	Libertia grandiflora	✔	✔		
Miikoikoi	Libertia ixioides	✔	✔		
Remuremu	Selliera radicans	✔	✔		
Haawera	Coprosma hawera	✔	✔		
Totara	Fuchsia procumbens	✔	✔		

- Taraire, Tawa, Podocarp forest (WF9)
- Puuriri Forest (W7)
- Poohutukawa, puuriri, broadleaved forest (WF4)
- Mangrove Forest and Scrub (SA1)
- Searush, Oioi, Glasswort, Sea Primrose Rushland/Herbfield (SA2)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

LOWER CATCHMENT

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
LOW GROWING - 0.3 - 1M					
Puukio	Carex virgata	✔	✔		
Toetoe	Chionochloa flavicans	✔	✔		
Taataraheke	Coprosma acerosa		✔		At risk species
Pukupuku	Blechnum parrisiae		✔		
Korokio taaranga	Corokia cotoneaster		✔		
Oioi	Apodasmium similis	✔	✔		
Waiuu atua	Euphorbia glauca	✔	✔		At risk species
MEDIUM HEIGHT/SHRUB UNDERSTORY - 1-3M					
Mingimingi	Coprosma virescens		✔		At risk species
Houpara	Pseudopanax lessonii		✔		
Whararikiki	Phormium cookianum	✔	✔		
Patete	Schefflera digitata		✔		
Taawhiri karo	Pittosporum cornifolium		✔	✔	
Mingimingi	Coprosma propinqua		✔		
Tuuhara, Peepepe	Machaerina sinclairii	✔	✔		
	Olearia solandri		✔		
Maakaka	Plagianthus divaricatus		✔	✔	
	Baumea juncea				
Koromiko	Hebe stricta	✔	✔		
Kawakawa	Macropiper excelsum		✔		
Taurepo	Rhabdothamnus solandri		✔		

- Taraire, Tawa, Podocarp forest (WF9)
- Puuriri Forest (W7)
- Poohutukawa, puuriri, broadleaved forest (WF4)
- Mangrove Forest and Scrub (SA1)
- Searush, Oioi, Glasswort, Sea Primrose Rushland/Herbfield (SA2)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

LOWER CATCHMENT

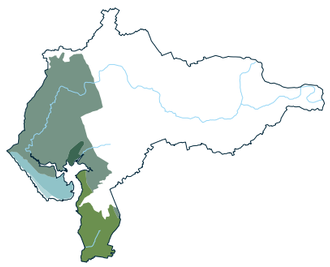
MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
TALLER SHRUBS/INFILL - 3M AND ABOVE					
Tarata	Pittosporum eugenioides	✔	✔		
Koohuuhuu, rautaahiri	Pittosporum tenuifolium	✔	✔		
Patete	Schefflera digitata		✔		
Kawakawa	Macropiper excelsum		✔		
Koowhai	Sophora microphylla	✔	✔	✔	
Maapou, maapau	Myrsine australis	✔	✔		
Houhere	Hoheria populnea	✔	✔		
	Coprosma areolata	✔	✔		
Tii koouka	Cordyline australis	✔	✔		
Kaaramuramu	Coprosma robusta	✔	✔		
Kaanuka	Kunzea ericoides	✔	✔		
Maahoe	Melicytus ramiflorus	✔	✔		

- Taraire, Tawa, Podocarp forest (WF9)
- Puuriri Forest (W7)
- Poohutukawa, puuriri, broadleaved forest (WF4)
- Mangrove Forest and Scrub (SA1)
- Searush, Oioi, Glasswort, Sea Primrose Rushland/Herbfield (SA2)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

LOWER CATCHMENT

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
NGAHERE/FOREST CANOPY - 6M ABOVE					
Puuriri	Vitex lucern	✔	✔	✔	
Poohutukawa	Metrosideros excelsa		✔	✔	
Kohekohe	Dysoxylum spectabile			✔	
Karaka	Karaka	✔	✔	✔	
Rewarewa	Knightia excelsa	✔	✔	✔	
Tawaapou	Planchonella constata			✔	
Tiitoki	Alectryon excelsus		✔	✔	
Akeake	Dodonaea viscosa		✔	✔	
Koowhai	Sophora microphylla	✔	✔	✔	
Karo	Pittosporum crassifolium	✔	✔	✔	
Taraire	Beilschmiedia tarairi			✔	
Tawa	Beilschmiedia tawa			✔	
Mangeao	Litsea calicaris			✔	
Ngaio	Myoporum laetum			✔	
Niikau	Rhopalostylis sapida		✔	✔	
Taurepo	Rhabdothamnus solandri		✔		
Tii koouka	Cordyline australis	✔	✔		
Maahoe	Melicytus ramiflorus	✔	✔		
Houpara	Pseudopanax lessonii		✔		
Kaanuka	Kunzea ericoides	✔	✔		
Maanuka	Leptospermum scoparium	✔	✔		
Akapuka	Griselinia lucida		✔		



- Taraire, Tawa, Podocarp forest (WF9)
- Puuriri Forest (W7)
- Poohutukawa, puuriri, broadleaved forest (WF4)
- Mangrove Forest and Scrub (SA1)
- Searush, Oioi, Glasswort, Sea Primrose Rushland/Herbfield (SA2)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

COASTAL EDGE

The coastal edge is a unique and diverse group of ecosystems consisting of poohutukawa, puuriri and broadleaved forests fringed with mangrove forest, scrub, saltmarsh, rushland and herbfield within brackish tidal estuaries, inlets, rivers, streams and gravel beaches. Plants have been selected to tolerate the exposed and volatile extremes of these environments.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
SWAMP/SALT MARSH/SALT MEADOWS - AQUATIC					
Upokotangata	Cyperus ustulatus		✔		
Wiwi	Ficinia nodosa		✔		
Oioi	Apodasmia similis		✔		
Maakoako	Samolus repens		✔		
Waawaa, koopuungaawhaa	Schoenoplectus validus/ tabernaemontani		✔		
	Stipa stipoides		✔		
SWAMP/SALT MARSH/SALT MEADOWS - SRUBS/HERBS/RUSHES					
	Olearia solandri		✔		
Maakaka	Plagianthus divaricatus		✔		
	Cotula coronopifolia		✔		
Remuremu	Selliera radicans	✔			
Ureure	Sarcocornia quinqueflora		✔		
	Baumea juncea		✔		
Waiuu atua	Euphorbia glauca		✔		At risk species
Koromiko	Hebe stricta	✔	✔		
Wiwi	Ficinia nodosa	✔	✔		

TE WAI OO TE PUHINUI / WATERS OF TE PUHINUI

RIPARIAN CORRIDOR

Stream riparian corridors run along the length of the stream and form the interface between land and water ecosystems. Riparian planting filters run-off from adjacent land uses, stabilises the bank and prevents erosion through root binding of the soil. The buffer effect of riparian vegetation acts like sponge by absorbing and retaining water, helping to protect the land from flood damage.

Riparian planting helps to form aquatic ecosystems by creating habitat and regulating light, oxygen levels and temperature of the water. This in turn creates ecological connectivity along the stream and between habitats.

Stream Margin
Stream margin planting occurs along the edges of the stream channel and is typically composed of grass-like sedges up to one meter tall. This area of the stream is particularly vulnerable to erosion and planting in this area should aim to provide bank stabilisation, regulate stream temperatures and be able to lie flat and manoeuvre when inundated by flood waters.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
STREAM MARGIN					
Puukio	Carex virgata	✔	✔		
Puurei	Carex secta	✔	✔		
Rautahi	Carex germinata/lessoniana	✔	✔		
	Carex dissita	✔	✔		
Upokotangata	Cyperus ustulatus	✔	✔		
STREAM BANK LOWER					
Maapere	Gahnia setifolia	✔	✔		
Paakauroharoha	Pneumatopteris pennigera	✔	✔		
Kiokio	Blechnum novae-zelandiae		✔		
Kukuraho	Bolboschoenus fluviatilis		✔		
Tuuhara, Peepepe	Machaerina sinclairii	✔	✔		
Turawera	Pteris tremula	✔	✔		
STREAM BANK UPPER					
Oioi	Apodasmia similis	✔	✔		
Koromiko	Hebe stricta	✔	✔		
Makomako	Aristotelia serrata	✔	✔		
Toetoe	Austroderia fulvida	✔	✔		
Hukihuki	Coprosma tenuicaulis	✔	✔		
Tuurutu	Dianella nigra	✔	✔		
Harakeke	Phormium tenax	✔	✔		

TE WAI OO TE PUHINUI / WATERS OF TE PUHINUI

RIPARIAN CORRIDOR

Stream Bank (Lower)
The stream bank sits adjacent to the stream margin planting and has very similar characteristics and functional requirements. This area is flat and is typically wet and boggy over winter and dry in summer. The plant selection for this area will accommodate high moisture levels during winter and flooding events as well as coping with periods of drought over the summer months. The species must be able to manoeuvre with and not restrict water during flooding events.

Stream Bank (Upper)
The upper stream bank has a similar planting selection with the addition of shrubs to bind the soil for bank stabilisation. Groundcovers are added to absorb and filter nutrient and sediment run-off.

Riparian Trees + Shrubs
Riparian trees and shrubs provide structure, frame adjacent spaces, provide habitat for birds and insects and help to regulate the temperature of the water by shading the stream. Trees and shrubs help to stabilise bankside and prevent erosion as well as absorb excess water through deep root penetration into the soil. The species selected are hardy and tolerant of damp soils and flooding events. The planting will also provide clear zones and unobstructed sight lines and view shafts, enhancing public safety.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
RIPARIAN SHRUBS & TREES					
Putaputaweetaa	Carpodetus serratus		✔	✔	
Kaaramuramu	Coprosma robusta	✔	✔		
Maanuka	Leptospermum scoparium	✔	✔		
Maahoe	Melicytus ramiflorus	✔	✔		
Maapou, maapau	Myrsine australis	✔	✔		
Houhere	Hoheria populnea	✔	✔		
Porokaiwhiri	Hedycarya arborea		✔	✔	
Kohukohu	Pittosporum tenuifolium	✔	✔		
Tarata	Pittosporum eugenioides	✔	✔		
Patete	Schefflera digitata	✔	✔	✔	
Kawakawa	Macropiper excelsum		✔	✔	
Kaanuka	Kunzea ericoides	✔	✔	✔	
Maanuka	Leptospermum scoparium	✔	✔	✔	
Whekii	Dicksonia squarrosa			✔	
Houpara	Pseudopanax lessonii		✔	✔	
Tii koouka	Cordyline australis	✔	✔		
Pukatea	Laurelia novae-zelandiae			✔	
Kahikatea	Dacrycarpus dacrydioides			✔	
Maire tawake	Syzygium maire			✔	
Rewarewa	Knightia excelsa	✔	✔	✔	
Pukatea	Laurelia novae-zelandiae			✔	
Puuriri	Vitex lucens	✔	✔	✔	
Tuurepo	Streblus heterophyllus			✔	
Tootara	Podocarpus totara	✔	✔	✔	

Te Ngahere oo Te Puhinui / Te Puhinui Forest

STREET TREES

Street trees provide a significant structural element to the streetscape and are often a defining characteristic by framing the street, defining space for pedestrians and by helping to separate the footpath from the carriageway. They are symbolic of the landscapes' cultural heritage and contribute positively to Te Puhinui by:

- Providing habitat and increasing biodiversity
- Regulating local climate and mitigating against the urban heat island effect
- Improving air quality by filtering air borne particulates and pollutants including sulphur dioxide, nitrogen oxides, carbon monoxide, cadmium, nickel and lead
- Sequestering CO^2 (a mature tree absorbs approximately 21kg per year)
- Reducing stormwater run-off
- Improving water quality when incorporated into storm water
- management systems
- Providing a high amenity green leafy environment
- Improving and/or creating legibility and identity.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	ECOSYSTEM	NOTES
UPPER CATCHMENT						
Tootara	Podocarpus totara		✔	✔	WF7, WF12	
Taanekaha	Phyllocladus trichomanoides			✔	WF12	
Taraire	Beilschmiedia tarairi			✔	WF7	
Rewarewa	Knightia excelsa	✔	✔	✔	WF7, WF12	
Kohekohe	Dysoxylum spectabile			✔	WF7, WF12	
Tiitoki	Alectryon excelsa		✔	✔	WF7	
MIDDLE CATCHMENT						
Puuriri	Vitex lucern	✔	✔	✔	WF7	
Niikau	Rhopalostylis sapida		✔	✔	WF7, WF4	
Taraire	Beilschmiedia tarairi			✔	WF7, WF4	
Rewarewa	Knightia excelsa	✔	✔	✔	WF12 , WF4	
Kohekohe	Dysoxylum spectabile			✔	WF7, WF4	
Tiitoki	Alectryon excelsa			✔	WF7, WF4	
Koowhai	Sophora microphylla	✔	✔	✔	WF4, WF7	
Karaka	Corynocarpus laevigatus	✔	✔	✔	WF7, WF4	

Poohutukawa, puuriri, broadleaved forest (WF4)
Puuriri Forest (W7)
Taraire, Tawa, Podocarp forest (WF9)
Kauri, podocarp, broadleaved, beech forest (WF12)

Te Ngahere oo Te Puhinui / Te Puhinui Forest

STREET TREES

The selection of street trees need to consider:

Durability and Resilience
Street trees need to be durable in a street environment and resistant to the effects of trampling, physical 'mishandling', vandalism, pollutants and a range of environmental conditions such as drought and wind exposure.

Form + Consistency
The ideal street tree will display a consistent form with a wide, open canopy that can be shaped around street lights, traffic and other structures without compromising its growth and overall form.

Nuisance
Street trees should not present a challenge to surface drainage through excessive leaf fall or root trespass to below ground drains or cause unnecessary nuisance or danger to people and property from shedding of limbs and excessive leaf fall.

Solar Access
The placement and density of street trees should give consideration to the impact shade will have on the streetscape environment and adjacent land uses. Light penetration in winter and shade/ cooling in summer are preferred characteristics of selected trees as well as the ability to train and manage the trees structure and form for light availability and visibility.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	ECOSYSTEM	NOTES
LOWER CATCHMENT						
Puuriri	Vitex lucern	✔	✔	✔	WF7	
Poohutukawa	Metrosideros excelsa		✔	✔	WF4	
Kohekohe	Dysoxylum spectabile			✔	WF4, WF7, WF9	
Rewarewa	Knightia excelsa	✔	✔	✔	WF4, WF7, WF9	
Tiitoki	Alectryon excelsa			✔	WF4, WF7	
Karaka	Corynocarpus laevigatus	✔	✔	✔	WF4, WF7, WF9	

Poohutukawa, puuriri, broadleaved forest (WF4)
Puuriri Forest (W7)
Taraire, Tawa, Podocarp forest (WF9)
Kauri, podocarp, broadleaved, beech forest (WF12)

TE WAI OO TE PUHINUI / WATERS OF TE PUHINUI

WETLAND

Wetlands are permanently or intermittently wet areas that support a natural ecosystem of plants and animals adapted to wet conditions. Wetlands provide amenity and ecological value through diverse, self selecting and resilient species which are tolerant of drought and inundation, as well as promoting shade and providing habitat for wildlife.

Both constructed and/or restored wetlands provide a very important role in the catchment by providing water quality treatment at the plant-soil-water interface, and by attenuating peak flows.

Wetland planting density should be spaced to accommodate adequate root volume and coverage to suppress weed growth. The planting should also provide clear zones and unobstructed sight lines and view shafts, enhancing public safety.

Open Water 1.0 - 2.0m Deep
This zone includes plants that grow underwater but require light. They are important for the ponds health and assistance in improving water quality and clarity through the reduction of sediment movement through the water. They provide oxygenation and habitat for fish and insects as well as food for birds.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
DEEP POOL - 0.5 - 1.5M DEEP					
	Myriophyllum propinqum		✔		
Maanihi	Potamogeton cheesemanii		✔		
Kuawa	Schoenoplectus validus		✔		
	Baumea articulata		✔		
Kuta	Eleocharis sphacelata		✔		
DEEP MARSH - 0 - 0.5m DEEP					
	Baumea articulata		✔		
	Baumea tenax		✔		
Kukuraho	Bolboschoenus fluviatilus		✔		
Kuta	Eleocharis acuta		✔		
Waawaa, koopuungaawhaa	Schoenoplectus validus/ tabernaemontani		✔		
	Isolepis prolifera		✔		
Wiiwi	Juncus gregiflorus/edgariae		✔		
Kuta	Eleocharis sphacelata		✔		

TE WAI OO TE PUHINUI / WATERS OF TE PUHINUI

WETLAND

Emergent Zone 0.2 - 1.0m Deep
The roots of emergent plants are submerged but foliage is partially above water. Emergent wetland vegetation provides forage and refuge above and below the water line through the diverse microbial assemblages of the aerobic root zone environment as well as anaerobic sediment environments. These environments nutrient levels and water chemistry are determined by the water as opposed to the soil. The vegetation shall be planted in bands perpendicular to the flow ranging in heights from 1m to 0.2m below the water level in two zones; Deep Marsh Zone 0.5 - 1m Deep, Shallow Marsh Zone 0.2 - 0.5m Deep.

Littoral Zone 0.2 - 0.0m
The littoral zone is a nutrient rich, shallow, body of water, located next to the wetland or pond edge where sunlight can still reach rooted plants. This zone usually remains submerged in standing water but at times may dry out near the bankside edge. The vegetation at the wetted edge protects batter slopes from erosion caused by flooding and wet/dry cycles. It also intercepts gross sediments from entering the wetland via overland flow as well as remediating nitrogen and metals via influent groundwater.

Terrestrial Zone
The terrestrial zone includes areas that are expected to be inundated during flood events and therefore comprise a wide variety of floodplain and escarpment vegetation.

The terrestrial zones act as an additional physical buffer from climatic extremes as well as reducing the overland flow rate while still having the ability to maneuver and bend with the direction of water flow. Taller trees further up the escarpment provide shade for open water, shelter, food and habitat for roosting birds as well as prevention of erosion through root stabilisation.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
SHALLOW MARSH/MARGIN - 0.2m DEEP - 0.2m ABOVE WATER LEVEL					
Puurei	Carex Secta				
Puukio	Carex virgata				
Rautahi	Carex lessoniana/germinata				
	Carex dissita				
Hukihuki	Coprosma tenuicaulis				
	Juncus gregiflorus/edgariae				
	Juncus articulatus				
Upokotangata	Cyperus ustulatus				
	Baumea rubiginosa				
Harakeke	Phormium tenax	✔			
Kiokio	Blechnum novae-zelandiae				
Oioi	Apodasmia similis	✔			
RIPARIAN ZONE - 0.2m ABOVE WATER LEVEL					
Kaaramuramu	Coprosma robusta	✔			
Harakeke	Phormium tenax	✔			
Tii koouka	Cordyline australis	✔	✔		
Putputaweetaa	Carpodetus serratus		✔		
Maanuka	Leptospermum scoparium	✔			
Patete	Schefflera digitata		✔		
Maahoe	Melicytus ramiflorus	✔	✔		
Toetoe	Cortaderia fulvida	✔			
Kiokio	Blechnum novae-zelandiae		✔		
Paakauroharoha	Pneumatopteris pennigera			✔	
Pukatea	Laurelia novae-zelandiae			✔	
Kahikatea	Dacrycarpus dacrydioides			✔	
Maire tawake	Syzygium maire			✔	
Tuurepo	Streblus heterophyllus		✔	✔	
Makomako	Aristotelia serrata	✔	✔		

TE WAI OO TE PUHINUI / WATERS OF TE PUHINUI

RAIN GARDENS AND URBAN SWALES

Rain gardens and urban swales are engineered gardens designed to harness the natural ability of vegetation and soils to treat stormwater. An urban swale is a constructed drainage course suitable for constrained environments with vegetation and riprap incorporated. They help absorb high volumes of stormwater, reducing the effects of stormwater volumes, peak flow, treatment of pollutants/contaminants while recharging freshwater bodies and adding amenity to the urban environment. Rain gardens retain stormwater within the specified medium where selected plant species absorb and filter contaminants before being released into groundwater, stormwater discharge pipes, streams, and eventually into the sea.

MAAORI NAME	BOTANICAL NAME	NURSERY SPECIES	SUCCESSIONAL SPECIES	ENRICHMENT SPECIES	NOTES
LOW - MEDIUM PLANTING					
Puukio	Carex virgata	✔	✔		
Rautahi	Carex lessoniana/germinata	✔			
Oioi	Apodasmia similis	✔	✔		
Tuurutu	Dianella nigra	✔			
Wharariki	Phormium cookianum	✔			
Tuukaauki	Libertia grandiflora	✔			
Panakenake	Pratia angulata		✔		
Wiwi	Ficinia nodosa	✔	✔		
TREE SPECIES					
Karaka	Corynocarpus laevigatus	✔	✔	✔	
Niikau	Rhopalostylis sapida				
Koowhai	Sophora microphylla	✔	✔	✔	
Kohekohe	Dysoxylum spectabile				
Puuriri	Vitex lucens	✔	✔	✔	
Taraire	Beilschmiedia tarairi			✔	
Tii koouka	Cordyline australis	✔	✔		
Tiitoki	Alectryon excelsus			✔	

TE WAI OO TE PUHINUI / WATERS OF TE PUHINUI

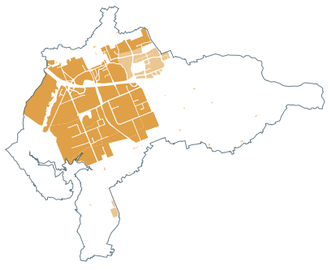
EARTH ROOFS

An earth or living roof is made up of layers of soil and vegetation built up on top of an engineered roof surface. Living roofs provide a multitude of benefits for urban environments including reduction of peak flow rates and run-off volumes, improved micro climate, habitat for wildlife and amenity values as well as providing building insulation and localised cooling.

There are two primary types of earth roof - extensive and intensive. Extensive systems involve a thin layer of planting medium and free draining substrate with drought-resistant plant species. Extensive systems can be retrofitted onto some existing flat or sloping structures. Intensive roofs have deep substrate and are capable of supporting a wide range of activities and plant types including trees and shrubs. Intensive systems are substantially heavier than extensive earth roofs and require greater structural support. Continuous irrigation and higher levels of maintenance are also required.

The Earth roof plant list has been selected for extensive earth roofs, favouring low growing, drought resistant species that require low levels of maintenance.

MAAORI NAME	BOTANICAL NAME	NOTES
SOIL PROFILE 100 - 300 MM		
Oioi	Apodasmia similis	
Wharawhara	Astelia banksii	
Nihinihi, panahi, rauparaha	Calystegia soldanella	
	Carex pumila	
	Carex testacea	
Taataraheke	Coprosma acerosa	
Horokaka	Disphyma australe	
	Dichondra brevifolia	
Wiwi	Ficinia nodosa	
	Libertia peregrinans	
Pinatoro	Pimelia prostrata	
Toroheke	Pimelea arenaria	

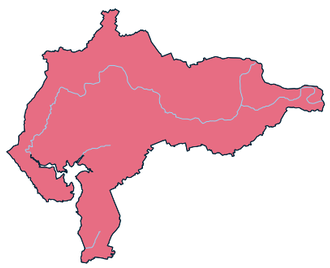


PRODUCTIVE GARDENS

DECIDUOUS FOREST GARDENS

A deciduous forest garden is characterised by deciduous trees and stone fruit species such as apples, plums and pears, with a shrub layer of seasonal berries and dense herbaceous ground cover of perennial and annual species. Deciduous forest gardens are best suited to well drained soils and with good air circulation to reduce the likelihood of mold and fungal infection caused by still humid air.

Because deciduous plants drop their leaves annually, a deciduous forest garden builds a continual layer of leaf mulch and humus which adds to the soil fertility over time.



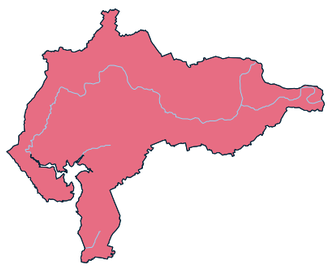
MAAORI NAME	BOTANICAL NAME	NOTES
CANOPY		
Piki	Ficus carica	
Aaporo	Malus domestica	
Paramu	Prunus domestica spp.	
Piititi	Prunus persica	
Pea	Pyrus communis	
Haanati	Corylus avellana	
SHRUB		
Rāhi pere	Rubus idaeus	
Karani	Ribes spp	
Patatini kikorangi	Vaccinium spp	
	Aloysia triphylla	
	Psidium cattleanum	
GROUNDCOVER		
Panakenake	Pratia angulata	
	Dichondra repens	
	Rubus pentalobus	
	Fuchsia procumbens	
Hiioi	Mentha spp.	
	Symphytum officinale	
	Trifolium incarntum	
	Borago officinalis	
	Achillea millefolium	
	Trifolium hybridum	
Hiioi	Mentha cunninghamii	

PRODUCTIVE GARDENS

SUBTROPICAL FOREST GARDENS

A subtropical forest garden is characterised by dense, multi layered foliage with closed canopy cover. Canopy trees can include avocado, bananas, macadamia, cherimoya, and tamarillo, with a shrub and groundcover layers of lush leafy and/or edible plants including guava and taro as well as climbers such as passionfruit. Subtropical forest gardens require sheltered, frost free, warm and humid sites and well drained soils with the exception of bananas and taro which prefer ‘wet feet’.

MAAORI NAME	BOTANICAL NAME	NOTES
CANOPY		
Huakerepe	Citrus paradisi	
Panana	Musa spp	
Toomato raakau	Solanum betaceum	
	Annona cherimola	
Rahopuuru	Persea americana	
	Macadamia tetraphylla	
SHRUB		
	Feijoa sellowiana (syn. Acca sellowiana)	
Manarini	Citrus reticulata	
	Psidium Spp	
	Heliconia psittacorum	
GROUNDCOVER		
	Cucumis melo reticulatus	
	Cucumis melo inodorus	
	Rheum rhabarbarum	
	Colocasia spp	
	Passiflora edulis	Climbing vine

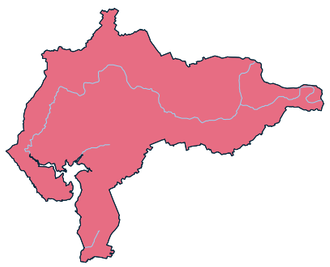


PRODUCTIVE GARDENS

MEDITERANIAN FOREST GARDENS

A mediterranean forest garden is characterised by dry climate trees such as olives, citrus, feijoa and figs with a shrub and ground cover layer of hardy woody perennials including rosemary, oregano, thyme and lavender as well as climbers such as grape. Mediterranean forest gardens are best suited to hot sites with well drained soils but always moist soil conditions.

Because mediterranean are tolerant of drought, they are well suited to drier sites than deciduous and subtropical forest gardens.



MAAORI NAME	BOTANICAL NAME	NOTES
CANOPY		
Kotakota	Citrus aurantifolia	
Reemana	Citrus limon	
Manarini	Citrus reticulata	
Karaka	Citrus sinensis	
Piki	Ficus carica	
Ooriwa	Olea europaea	
SHRUB		
	Psidium cattleanum	
	Rosmarinus officinalis	
	Feijoa sellowiana (syn. Acca sellowiana)	
	Laurus nobilis	
	Vitis vinifera spp	
	Punica granatum (dwarf)	
GROUNDCOVERS		
Taaima	Thymus vulgaris	
	Origanum spp.	
	Rosmarinus officinalis ‘Prostratus’	
Taramea	Artemisia dracunculus	
	Lavandula spp.	
Ruaanuku	Salvia spp.	
Piripiri	Acaena dumicola	

PRODUCTIVE GARDENS

MEDICINAL PLANTS

The medicinal plants listed have been chosen for their size and ability to be grown within a household environment. These are suited to most climatic conditions of the area and can be used as a suite of first aid/rongoā species for home use.

MAAORI NAME	BOTANICAL NAME	NOTES
Karaka	Corynocarpus laevigatus	
Koowhai	Sophora microphylla	
Tii koouka	Cordyline australis	
Tiitoki	Alectryon excelsa	
Maanuka	Leptospermum scoparium	
Patete	Schefflera digitata	
Kaaramuramu	Coprosma robusta	
Houhere	Hoheria populnea	
Mapau	Myrsine australis	
Kawakawa	Macropiper excelsum	
Kuumarahou	Pomaderris kumeraho	
Harakeke	Phormium tenax	
Panakanake	Pratia angulata	
Piripiri	Acaena anserinifolia	
Koromiko	Hebe stricta	
Puawaananga	Clematis paniculata	Climbers
Kaihua	Parsonia heterophylla	Climbers
Koohia	Passiflora tetrandra	Climbers