

Blue/Green Network Strategy

For Whangarei City



Adopted by Whangarei District Council 10 August 2016

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Note on terms used in this document

These terms where they are capitalised refer to the following:

“**City**” refers to Whangarei City

“**Council**” refers to Whangarei District Council

“**District**” refers to Whangarei District

“**Strategy**” refers to this document – the Blue/Green Network Strategy

A full glossary is located in the Appendices.

EXECUTIVE SUMMARY

Background

Urbanisation has led to a disconnect between humans and nature. As cities have increased in size and extent, natural systems and ecosystem processes have been disrupted, with natural habitat cleared and waterways channelized or filled in entirely. This has created a number of issues for cities including increased flooding, urban heat islands, biodiversity loss and cultural disconnection for indigenous peoples.

Blue/green networks are a holistic way of planning based on two elements. Blue water-based elements – watercourses including rivers, stormwater drains and irrigation channels – and Green vegetation-based elements –including parks and reserves, forests, gardens, riparian strips and amenity planting. By connecting and managing the two elements in conjunction as a blue/green network, while recognising their relationship to urban grey space, a number of benefits can be achieved for communities through sustainable development.

Whangarei's harbourside location between two areas of native bush, with numerous water courses throughout the built area, makes it an ideal candidate for a blue/green network management approach. By adopting a Blue/Green Network for Whangarei City a number of issues can be addressed simultaneously to provide multiple benefits over time. Benefits include reduced risk of flooding, enhanced ecological corridors and riparian margins, improved water quality, increased amenity and sense of place, better connectivity, extended walkways/cycleways/shared use

paths, increased tourism and migration, and protection of cultural and spiritual values of Maori.

Themes

Four themes have been developed in line with the concept of sustainable development including socio-cultural, environment, economic and flood management elements.

Theme 1. Enhancing and connecting our communities

This theme looks at the socio-cultural issues facing urban communities, considering the effects that a blue/green network approach could have on engaging communities with nature, increasing connectivity throughout the City and improving mental and physical health outcomes. Benefits could include:

- Increased amenity in the urban and rural environments.
- Increased greenspace and off road cycleways promoting physical recreation and increasing a sense of wellbeing.
- Increased connectivity between neighbourhoods and parks.
- Connecting destinations for commuters and visitors.
- Maintaining and protecting the cultural and spiritual values tangata whenua attach to water bodies – mauri, mahinga kai, waahi tapu, taonga, etc.

Theme 2. Enhancing ecosystem services and ecological connectivity

This theme looks at the environmental issues facing our City and considers the effects that a blue/green network approach could have on

restoring biodiversity and improving water quality in the City. Benefits could include:

- Improved biodiversity outcomes through increased areas of native planting, increasing habitat and corridors between habitat for fauna.
- Improved water quality by using vegetation or filtration devices to filter stormwater before it enters rivers/streams.
- Improved ecological processes and services in an urban environment.

Theme 3. Providing opportunities for economic development

This theme looks at the economic benefits of improving the waterways and enhancing the urban area under a blue/green network approach.

Benefits could include:

- Increase in foot traffic through business areas along the network with high amenity values.
- Increased land value of properties overlooking greenspace/attractive waterways.
- Possible residential development along restored waterways.
- Potential tourism/migration increase as the City becomes a more attractive environment to live/work/play.

Theme 4. Protecting our communities from natural hazards

This theme looks specifically at flood mitigation through surface water, overland flow (stormwater) and the potential for more frequent events under climate change predictions. Taking a blue/green network approach combines traditional flood protection with ecological and amenity values, and could include the following benefits:

- Greenway flood corridors provide increased capacity for water during flooding events.

- Reduced overland flow to stormwater from vegetated areas.
- Reduce the costs of major flooding events through increased water retention in the network.
- The cost of flood mitigation works can be partially offset by opportunities for multiple benefits e.g. shared use pathways, ecological corridors, socio-cultural values and increased land values.
- Future-proof the City against the effects of climate change.

Blue/Green Network Plans

This section highlights the options raised in the Themes section for each of the waterways individually. The Hatea River and Waiarohia Stream are broken down further into sections for ease of analysis. The major waterways will act as primary recreational corridors, where recreation, connectivity and community engagement is prioritised and enhanced. These waterways will also provide the greatest opportunity for economic development. Minor waterways will focus on ecological corridors and amenity values. Additionally, cross city connections are addressed, where key pathways will connect suburban areas, away from the riparian corridors. Implementation diagrams and maps are presented for each pathway or waterway and are intended to provide a quick reference guide for users.

Implementation

The creation of a Blue/Green Network in the City will create an attractive and environmentally sustainable urban environment where people want to live, work, play and visit. This section outlines potential management

actions and strategic opportunities that could be taken to assist staff with implementing the recommendations made in the Strategy.

There are a number of issues that will need to be considered when projects are designed and budgeted for. These are anticipated in this section of the document, to ensure that consideration is taken by all parties involved at the planning stage. Collaboration and communication will be key to ensuring that these issues are dealt with promptly at the beginning of the process to ensure that implementation runs smoothly.

The project is a long term strategy and will be implemented over an extended period of time (i.e. 50 years) as funding becomes available and opportunities arise. Putting a strategy in place ensures that as various initiatives are undertaken (e.g. flood works, walkway/cycleway/shared use path extensions, infrastructure planning, policy etc.), the Blue/Green Network Strategy will act as an overarching framework that will ensure multiple benefits are realised over time. By adopting this approach, all four themes can be integrated in a holistic manner that will ensure more effective and efficient outcomes for the Whangarei community and its environment.

INTRODUCTION

BACKGROUND

The Problems

A rapid increase in urbanisation since the industrial age has led to a disconnect between humans and nature. As cities have increased in size and extent, natural systems and ecosystem processes have been disrupted. Priority has been placed on the urban form, with natural habitat cleared and waterways channelized or covered over with concrete. In addition to the destruction and fragmentation of habitat for native species, urbanisation has come with a range of other issues.

As most urban areas have a high level of impermeable surfaces (roads, roofs, car parks etc.) flooding events tend to be more frequent, and of greater intensity. Traditional flood protection and stormwater infrastructure has involved piping and channelizing waterways to increase flow speed, removing the water as quickly as possible, and often removing the water from human view. This destroys the natural form of the waterway, reducing its ecological function.

Ecosystem services, which are the services and processes provided by the natural environment that humans benefit from, such as temperature regulation and water and air filtration, have been negatively impacted by urbanisation. Urban infrastructure has been facilitated by the covering of waterways and stripping of riparian vegetation. This has removed the natural cooling effect provided by water bodies and vegetation, exacerbating the urban heat island effect, where temperatures in urban areas are higher than surrounding rural landscapes due to high levels of concrete and steel. Where urban waterways have been blocked off,

channelized or covered over, the loss of riparian vegetation has removed the ability to filter stormwater runoff, polluting waterways and degrading the habitat of freshwater species.

An increase in urbanisation has also led to social and cultural separation from nature. Biophilia is the concept that humans have a biological need to interact with nature, suggesting that this disconnect from nature may have broader cultural and health impacts, particularly amongst indigenous populations and children. Maori have a longstanding connection with nature, and their culture is intrinsically linked with the natural world. Urban development has reduced Maori access to the natural environment and their traditional resources. Globally, children today are spending less time outdoors than previous generations, which has led to the idea of a 'nature deficit disorder', where children growing up disconnected from nature suffer from a range of negative effects, including depression, obesity and attention disorders (Louv, 2008).

Climate change will have an impact on cities globally. Rising sea levels, droughts, changes in temperature extremes (i.e. summer heat waves and severe winters) and increasing frequency of high intensity storm events are a few of the challenges predicted for cities over the next century. Building resilience into cities will be an important factor in dealing with the effects of climate change and should be taken into account for all planning and infrastructure projects in the urban environment.

Whangarei's Neglected Asset

The state of our waterways is degraded. The City has turned its back on its urban streams and currently many of the waterways are neglected and disconnected from the urban landscape and population. Throughout much of the urban area light industrial and trade retail premises back on to waterways. In places, the built surface reaches right to the edge of the waterway, with natural form and function lost (Figure 1). With the majority of waterways bounded by private land, what values remain are at risk from further development along the riverbanks.

In the suburbs the minor streams run largely through gullies at the bottom of steep slopes or behind houses. Stormwater runoff is currently piped directly to streams or flows overland into the streams, with no

filtration prior to discharge. Natural features and riparian vegetation are degraded where present, and there are a number of barriers to fish migration.

Treating the waterways as a hindrance, rather than an asset, gives an appearance of neglect. This creates an impression of the waterway corridor as an unsafe and undesirable location. There is little sense of place or ownership from the community and rubbish dumping is common (Figure 2). Stream banks are weed-infested and neglected, with little ecological value. Amenity is low and the community is disengaged from what little natural value remains.



Figure 1 Carpark encroaching on riparian zone, Waiarohia Stream

*A nuisance
or a
valuable
asset?*



Figure 2 Rubbish in Otangarei Stream at the Otangarei Sportsgrounds

The Solutions

In recent years there has been increasing acknowledgment that there are a number of benefits that a more natural environment can provide. In addition to increased biodiversity and an improvement in natural habitat, 'ecosystem services' is a term coined to describe the services that the environment provides for humans, such as the air we breathe and the water we drink. In an urban environment ecosystem services could also include flood protection, water filtering and temperature cooling.

In recognition of this, flood control internationally is moving away from highly channelized systems to a more natural approach to stormwater control and flood corridors. Previously channelized and piped waterways are being returned to a more natural state to combat flooding, heat island effects and low water quality, whilst providing enhanced amenity and improved biodiversity.

Increasing greenspace in cities also increases habitat available for birds, insects and animals and provides ecological connections through the urban environment, allowing movement through urban areas to more suitable areas of habitat. In addition to providing the opportunity for urban biodiversity to flourish, attractive urban green corridors also enhance a sense of place, encourage people to walk or cycle and increases continuity and connection between areas of the city. Research suggests that a number of health benefits, both physical and mental, can be derived from good quality greenspace. Evidence indicates that improving access encourages people to engage more in physical activity and social interaction (Lee and Maheswaran, 2010).

Internationally, it has been recognised that restoring waterways to a more natural state is a progressive way to improve a number of social,

economic and environmental outcomes for cities. Whangarei is in a good position to restore local waterways, as they have not been extensively modified. Unlike many international cities, Whangarei has not buried the waterways or channelized them with concrete. There are a number of issues to be addressed, but they are not insurmountable and can be addressed progressively over time, rather than requiring major high cost engineering works immediately.

A Comprehensive Way Forward

The blue/green concept has been in use internationally for some time, under a number of different names. In essence, it is a holistic approach to planning around waterways (blue elements) and open or vegetated spaces (green elements). Comprehensive blue/green networks combine elements of recreation, amenity, infrastructure and natural features to enhance sense of place and wellbeing, creating an attractive urban environment with good environmental values. In planning terms, combining all elements into one document provides a more cohesive approach and holistic view, enabling decision makers to have a greater oversight on projects and their interaction.

Blue/green networks are comprised of two elements. Blue elements are water based including:

- Large watercourses including rivers, streams and lakes.
- Stormwater channels.
- Wetlands/estuaries.
- Marine environment.

Green elements are comprised of open space and natural areas including:

- Smaller neighbourhood parks and open space.
 - Larger parks and reserves with a focus on nature (tree dominant).
-

- Larger parks and sports grounds with a focus on amenity and public recreation (grass dominant).
- Riparian zones along waterways.
- Gardens.

By connecting and managing the two elements in unison as a Blue/Green Network, a number of benefits can be achieved for communities. By taking a sustainable development approach, socio-cultural, environmental, economic and flood mitigation aspects can be addressed to enhance a city, whilst reducing negative environmental effects such as flooding, fragmented habitat, heat island effects and poor water quality.

The backdrop for a blue/green network is the urban environment and the relationship between urban grey space and blue/green elements is important. Grey space impacts on blue elements through stormwater runoff and waste disposal, green elements through building and infrastructure encroachment in riparian margins. A blue/green network approach can enhance air quality, amenity and connectivity through urban areas.

In the past most blue/green projects were developed in an ad hoc fashion. These projects were limited in size and were largely site specific, with the use and extent of blue/green elements differing between projects depending on their purpose and the topography of the area. A common theme has been restoring or resurfacing degraded and channelized waterways and providing access and pathways to reconnect them with their communities. The 'greenway' concept is popular in the USA and is based around off-road walking and cycling paths, often along waterways and disused infrastructure, with high amenity values.

Recently, this ad hoc approach has been superseded, with cities like Lodz (Poland), Oslo (Norway) and Singapore basing their city-wide planning on sustainable development, which includes blue/green elements in all new developments and urban renewal projects (Figure 3). The aim is to create a healthy, environmentally integrated city. This approach allows cities to future proof against the effects of climate change, while allowing for population growth and development.



Figure 3 A map of the blue-green network in Lodz, Poland

Adapting the Concept for Whangarei

Whangarei's harbourside location between two areas of native bush, with numerous water courses throughout the built area, makes it an ideal candidate for a blue/green network management approach. The implementation of a Blue/Green Network in the City will create an

attractive and environmentally sustainable urban environment where people want to live, work and play.

Restoring our urban waterways and riparian zones will provide Whangarei with more efficient stormwater filtration, retention and flood control, as well as improving habitat for native flora and fauna and increasing urban biodiversity. Improved connectivity between the waterways, greenspace, neighbourhoods, the CBD and Town Basin along the new shared use paths, cycleways and walkways will improve social and cultural wellbeing, by increasing access, connectivity and providing opportunities for recreation. This connectivity, along with enhanced urban amenity will increase sense of place in the City and increase economic opportunities for tourism and urban development.

The Strategy is expected to be implemented over an extended period of time (i.e. 50 years) as funding becomes available and opportunities arise. Putting a strategy in place ensures that as various initiatives are undertaken, (e.g. flood works, walkway/cycleway/shared use path extensions, infrastructure planning, policy etc.) the Blue/Green Network Strategy will act as an overarching framework that will ensure multiple benefits are realised over time. The Strategy can also inform urban planning, open space provision, transport strategies, asset management planning and climate change strategies.



Figure 4 A vision of the future – Hihiaua Peninsula – a new stage of development

VISION



Figure 5 Waiarohia Stream at Cafler Park – an ecological corridor

What could Whangarei's waterways look like in 50 years?

Creating Value

The overall vision for Whangarei, outlined in the Long Term Plan 2015-2025, is *'to be a vibrant, attractive and thriving District by developing sustainable lifestyles based around our unique environment; the envy of New Zealand and recognised worldwide.'*

Sustainable development is a key part of this vision. In order to attract people to live, work and play in the City we need to provide a range of amenities, facilities and economic opportunities. The waterways provide an opportunity for redevelopment in the central City and extending facilities for the community out to the suburbs. Connecting popular shopping precincts, neighbourhoods and greenspace will enhance accessibility and connectivity and will add to community sense of place. The realisation of a functioning, attractive network of urban waterways is attainable, but will be challenging to achieve.

Multiple Benefits

The creation of the Blue/Green Network is based on integrating four elements. These will be looked at as individual themes in the following chapter. Each aspect has a vision for the future, that fits within Council's overarching vision and assists in achieving Council's mission - *'Creating the Ultimate Living Environment'*.

Socio-Cultural

Theme 1. Enhancing and connecting our communities

Landscaped shared use paths extend along all urban watercourses, linking with large parks and reserves. People are recreating and commuting in a more active fashion and there are opportunities for children, older people and those with disabilities to access these facilities. Social wellbeing is improved and cultural and spiritual connection to the waterways is enhanced. Restoration has increased the mauri of our waterways, improving outcomes for Maori.



Economic

Theme 3. Providing opportunities for economic development

The City is attractive and vibrant with people living, working and engaging in activities along the waterways and in our urban parks. There is increased value of land along waterways, with areas transformed into mixed use residential developments where people can live, work and play. There are increased incentives and enhanced connections between areas of economic activity. Tourism is enhanced and visitors are easily able to navigate the City on foot or bicycle.



A vision of the future



Environmental

Theme 2. Enhancing ecosystem services and ecological connectivity

Riparian planting extends along all waterways to provide corridors across the City for our flora and fauna. Barriers to fish passage have been removed and migration routes are re-established. Landscaping along pathways and parks are designed to encourage native birds to travel through the City. Water quality is improved and ecosystem services are being provided and valued by the community. Taonga species and traditional customary resources are protected and enhanced, enabling sustainable harvest.



Flood Mitigation

Theme 4. Protecting our communities from natural hazards

The risk to flooding in the CBD is reduced, and achieved through a combination of traditional grey infrastructure, wider flood corridors and green infrastructure. Flood protection works become opportunities to enhance urban amenity and increase sense of place, providing additional benefits for the community. A future proofed system is in place that can cope with the challenges climate change will bring in the future.



Figure 6 A vision of the future - Water Street Carpark – a recreational pathway doubling as flood protection



Figure 7 A vision of the future - Kamo Route – connecting the suburbs to the City centre

Scope

The Strategy provides a long-term vision for the future of Whangarei's waterways and greenspace. The Strategy will act as an overarching framework, and while implementation guidance is provided at a high level, more intensive work will need to be done at a practical level as projects are undertaken. This will give the community a chance to be involved in the planning process, when the time comes for engineering and design. The Strategy is expected to be implemented over an extended period of time as opportunities arise, potentially as far out as 50 years. While acknowledging that attaining the vision could take decades, each completed section of cycleway, restored habitat or flood control work will contribute over time to implementing the overall Strategy.

Strategic Direction

The Strategy will cover recommendations on three levels.

- Physical changes and improvements e.g. infrastructure, planting, and asset management.
- Policy and planning initiatives to facilitate physical changes e.g. changes in land use, infrastructure and movement.
- Cross-agency collaboration to enable flood management to be integrated effectively, possible cost sharing and more effective stormwater management.

Geographical Scope

The geographic scope of the Strategy is shown in the area outlined in Figure 8. Recommendations will cover the following.

- Within the stream channel and riparian margins.
- Connections between greenspace elements and the waterways.
- Access to greenspace, the waterways and recreational corridors.
- Grey space along the network and potential land use changes.

The following urban waterways are assessed:

- Hatea River from Gillingham Road to the Harbour at the Te Matau a Pohe Bridge.
- Raumanga Stream from Hopua te Nihotetea Dam site to where it joins the Waiarohia Stream.
- Waiarohia Stream from Whau Valley Dam to the Harbour at the Te Matau a Pohe Bridge.
- Te Hihi Stream from Golf Harbour Drive to where it joins the Raumanga Stream.
- Otangarei Stream from Denby Reserve to where it joins the Hatea River.
- Kirikiri Stream from Pukenui Forest edge to where it joins the Raumanga Stream.
- Waikoromiko Stream from Clapham Road to where it joins the Hatea River.

A number of parks and reserves are included within the area identified in Figure 8. Along with many smaller local parks the major areas of greenspace are as follows:

- Coronation Scenic Reserve.
- Parihaka Reserves (including Mair Park, Dobbies Park and Mackesy Bush).
- Pohe Island.
- Maunu Scenic Reserve.
- Raumanga Valley Scenic Reserve.
- Whangarei Falls Scenic Reserve.

As much of the City's open space is associated with sports fields and school playing fields, access and connections to the City's schools and sports facilities are also considered.

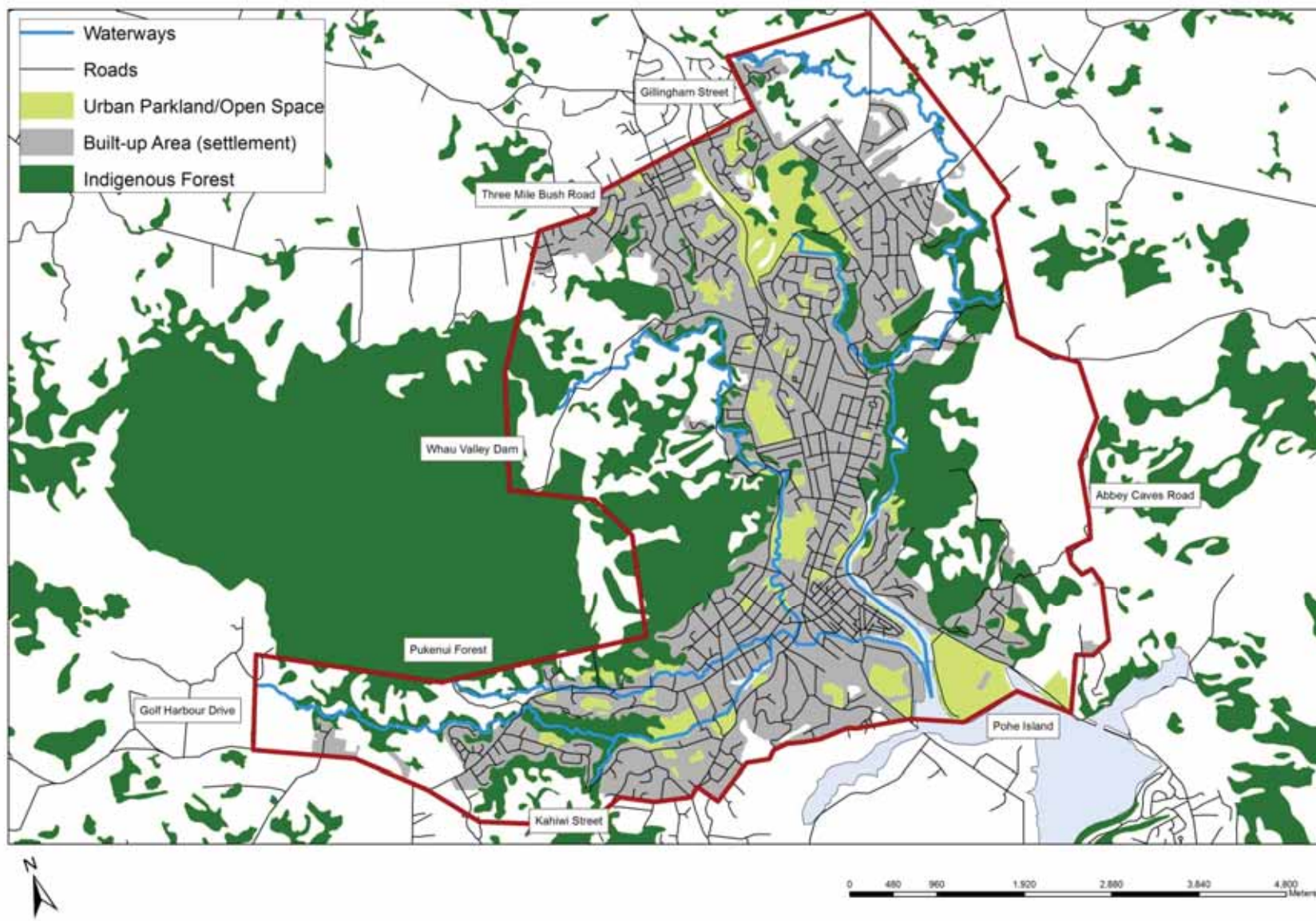


Figure 8 Extent of the study area of Whangarei City

HISTORICAL AND CULTURAL HERITAGE

History of Whangarei

The Northland Region has historical and cultural significance as a site of early occupation by both Maori and European settlers. Whangarei was settled early by Maori with numerous archaeological sites around the Harbour.

Northland Maori occupied territory from the Far North down to Auckland (Tamaki). Many hapu, connected by family links, lived along the coast trading with each other. In earlier times Whangarei was primarily occupied by Ngai Tāhūhū to whom the majority of Whangarei hapu can trace their ancestry. Other key iwi of the District include Ngapuhi and Ngatiwai. Hapu holding lands and interests within Whangarei's urban boundaries from the 19th century through to contemporary times include Te Parawhau, Ngati Kahu o Torongare, Ngati Hau and Te Uriroiroi.

The Whangarei Harbour - Whangarei Terenga Paraoa – means “the gathering place of the whales” reflecting that in days past parāoa (Sperm Whales) were frequent visitors to the Harbour and Bream Bay beyond. Tribal warfare with more southern iwi was common and the name also became associated with the occasion when Ngapuhi war parties and their chiefs met at Whangarei Harbour in preparation for war.

The first European settlers arrived in the late 1830s, however all the settlers left Whangarei when Hone Heke attacked the area in 1845. Settlers returned in 1847 and Mr Cafler opened the first store in 1855 along the waterfront. The geography of the town has changed

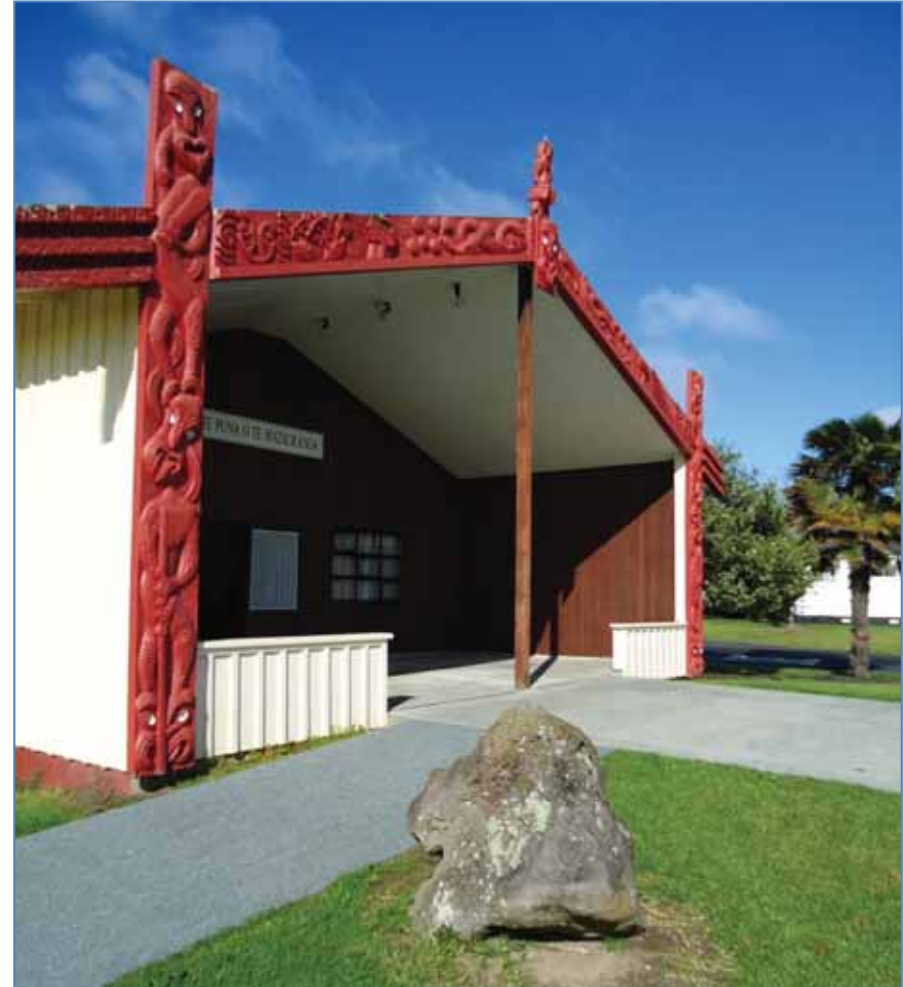


Figure 9 Terenga Paraoa marae on Porowini Ave is named in reference to the Whangarei Harbour

considerably since then. There are records showing that mangrove flats originally covered much of the current central business district, and dinghies were rowed as far as Cameron Street. The town developed without a layout or plan in mind, and subsequently has misaligned roads and largely ad hoc development.

Cultural Connection

Te Ao Maori

The Maori world view (Te Ao Maori) regards the environment as a holistic entity, where the physical and spiritual are intertwined and cannot be considered separately. As a result, traditional Maori culture and values are closely linked to the environment. Maori consider people are genealogically related to all aspects of the natural world through their descent from Ranginui (Sky Father) and Papatuanuku (Earth Mother). It is through Ranginui and Papatuanuku, along with their children, that all parts of the natural world (including people) came into existence. The concept of whakapapa (genealogy) captures this spiritual and physical connection and interrelatedness of people, plants, animals and the environment. In a practical sense, whakapapa forms the foundation of the Maori framework for managing resources.

For Maori, land is more than a place to live, or derive a living from. It also provides a sense of identity and belonging through a spiritual connection to their whakapapa, heritage and future generations (the concept of turangawaewae). Indigenous biodiversity are taonga tuku iho (treasures passed down) to Maori and were essential for survival, as early Maori brought few plants and animal species with them.

To tangata whenua, water, in all its forms, has its own life-sustaining intrinsic value (mauri). Water is a sacred taonga that pervades all aspects of our environment and is central to the spiritual and physical wellbeing of people. Mauri can also be understood as a measure of the health and vitality of those elements. If water is in a healthy state, so too are all species within the catchment as a whole, including people and communities. Degradation of waterways, through sedimentation, land use changes, water takes and discharges of nutrients, chemicals or human waste has diminished the mauri of the water and affected access to traditional resources.

As water bodies are places of mahinga kai (food gathering sites) it is important to restore degraded waterways to enable traditional food sources to be harvested safely and sustainably. These traditional resources have been degraded throughout the District, but particularly around the Upper Harbour, where remaining shellfish are likely to be unsafe for human consumption. Spawning and harvesting sites for freshwater resources such as tuna (eel), koura (freshwater crayfish), watercress and inanga (whitebait) are also no longer viable. Urbanisation has caused loss and fragmentation of sites formerly utilised for gathering rongoa (medicinal) plants and raranga (weaving) species.

The concept of kaitiakitanga is fundamental to the relationship between iwi/hapu and water. This duty of care and obligation toward taonga tuku iho is an intergenerational responsibility rather than a right. Loss of access to resources impacts on the ability to practice kaitiakitanga and can cause a subsequent loss of matauranga maori (traditional and contemporary body of ecological knowledge).



Figure 10 Water quality is important for Moana, Connor and Ariki Henare, of Ngati Hau, at Otuihau (Whangarei Falls)

Wai Maori

The Maori classification of water illustrates the vital importance and value of water. Key categories include:

- *Wai-ora*: (pure water). This is water in its purest form. It is used in rituals to purify and sanctify and has the power to give life, sustain wellbeing and counteract evil. *Waiora* also means health.
- *Wai-tapu* – sacred water, waters used for ceremonial purposes.
- *Wai-maori*: (freshwater). This is referred to as ordinary water which runs free or unrestrained and it has no sacred associations.
- *Wai-kino*: (polluted). The mauri of the water has been altered through pollution or corruption and has the potential to do harm to humans.
- *Wai-mate*: (dead water). This class of water has lost its mauri and is dead. It is dangerous to humans because it can cause illness or misfortune.

These categories remain in use today for many iwi/hapu when monitoring the health of their significant waterways.

Waahi Tapu

Water bodies are also central to the cultural identity of tangata whenua. The names of awa (rivers) are narrated in pepeha (aphorism/recital of tribal genealogy), waiata (songs), and whakatauki (proverbs). They are markers of tribal boundaries and a central part of cultural landscape in the same way as maunga (mountains). Waterways were essential for navigation, playing a central role in transport, trade and connecting iwi and hapu. Whangarei's waterways and adjacent lands contain a range of sites such as; historic kainga (homes), gardens, trails, ceremonial areas, waka landing sites, fishing sites, battle sites, urupa or burial sites, places where bodies were washed, baptism sites, healing waters and places where taonga were secreted away. All these places were named by tupuna (ancestors) as were the rivers themselves.

There are variations to naming traditions amongst hapu when it comes to the Hatea River. One tradition records that this river was actually named the "Hoteo". Hoteo referring to a "stone calabash" and signifying the calabash-shaped pool where the Whangarei Falls discharges into the Hatea. This account states that Hatea was actually the original name of a tributary of the Hoteo, now filled in, that flowed from the Bank Street area. The name Hatea is thought to describe a type of pounamu (greenstone), which was a prized possession for Rangatira (chiefs). Hatea greenstone is flecked with cream and brown swirls – evoking the similar patterns observed in the river as the tide is coming in.

Naming conventions also provide context around the values and associations with sites and waterways. For example, for the Waiarohia Stream the literal translation of aro(hia) can mean "out at the front" or "forefront" or even denote a "focal point." Some kaumatua have suggested this would indicate the importance of this source of wai/water, indicating a pure form at the source. This is of note as the dam at Whau Valley is now the source of reticulated water for the City. This interpretation also supports the idea of the sanctity of waterways – their connection to the source and their significance as a living entity.

According to Ngati Hau tradition the waters at Otuihau/Whangarei Falls contained healing properties. The shallow pools at the top of the falls would warm up in the sun and people would sit there to recover from ailments. Other korero mentions the sick or ailing being washed in the pools beneath the falls. Above the falls the Waitaua and Mangakino streams were known for the abundant eel populations and contained a number of eel weirs.

Numerous sites of significance to Maori are associated with Parihaka - the site of one of the most impressive and largest pa complexes and settlements in New Zealand (Figure 11). These sites are prevalent on both sides of the Hatea River with the main kainga or village attached to the pa known as Tawatawhiti being situated in Mairtown.

An important tauranga waka was sited on the banks of the Hatea River near the Vale Road entrance to the Hatea River Walkway. The site was the location where Hongi Hika and his taua (war party) of up to 40 waka landed in 1822 to rest, strategise and amass supplies prior to their southern campaign.

The Waikoromiko waterway and the surrounding remnant of original kauri forest (A H Reed Memorial Kauri Park) is also a significant cultural site. Ngati Tu were the original kaitiaki for this area and protected the bush from fire because of its beauty and the berries it produced for the kukupa. Its greatest importance, however, lay in its use as a burial place for chiefs. An extensive rock cave was located in this area in the past but has since been destroyed by rock fall.

The Raumanga Valley was also a key area of habitation for Whangarei Maori. The archaeological record shows that the area of the river in the vicinity of the Hopua te Nihotetea Dam contained pa, kainga and gardening complexes. Indeed until quite recently, remnant taro cultivations were still visible on the stream banks and in the stream bed.

Te Hihi Stream traverses the Barge Park Reserve in Maunu and also retains cultural significance due to its history and the cultural taonga still present. Accounts of waka (canoes) buried in the wetland are well established and a wooden digging stick has previously been recovered

from the area. A burial mound and collapsed burial cave are located in close proximity to the stream. As with other Whangarei waterways, this stream likely provided access historically from Whangarei Harbour to the hinterland.



Figure 11 A kohatu carved to represent Papatuanuku sits at the peak of Mt Parihaka, a former Pa site

Treaty of Waitangi (Te Tiriti o Waitangi)

As tangata whenua and co-signatories (with the Crown) of the Treaty of Waitangi, Maori have an important role in the process and decision making of how natural and physical resources in the District are used, protected and monitored.

The Resource Management Act 1991 (RMA) contains a number of provisions requiring Council to recognise and include tangata whenua issues, interests and values, providing a basis for the engagement and participation of Maori. Three main sections 6(e), 7(a) and 8, are central to achieving this purpose.

- **Section 6** relates to matters of national importance that are *to be recognised and provided for*. This includes a requirement for local government to recognise and provide for the *“relationship of Maori and their culture and traditions with their ancestral lands, waters, sites, wahi tapu and other taonga”* (s.6(e)).
- **Section 7** includes additional matters to which *“particular regard”* must be given. This requires local government to have particular regard to *“kaitiakitanga”*.
- **Section 8** (the principles of Te Tiriti o Waitangi):
“In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).”

The Local Government Act 2002 (LGA) also contains provisions requiring Council to recognise and include tangata whenua issues, interests and values, providing a basis for the engagement and participation of Maori.

While Section 4 of the LGA clearly acknowledges that responsibility for the Treaty obligations lie with the Crown, Parts 2 and 6 of the Act are intended to facilitate participation of Maori in local government.

“In order to recognise and respect the Crown’s responsibility to take appropriate account of the principles of the Treaty of Waitangi and to maintain and improve opportunities for Maori to contribute to local government decision-making processes, Parts 2 and 6 provide principles and requirements for local authorities that are intended to facilitate participation by Maori in local authority decision-making processes.”

Local government is charged with the responsibility to promote opportunities for Māori to contribute to its decision-making processes. Relevant sections of the Act include:

- **Section 14** requires local government to *“ensure they provide opportunities for Maori to contribute to decision-making processes”*.
- **Section 81(1) and 82(2)** require local government to establish and maintain processes for Maori to contribute to decision-making.
- **Section 81(1)** also requires local government to consider ways in which they can foster the development of Maori capacity to contribute to decision-making processes; and
- **Section 77(1)(c)** requires local government to take into account the relationship of Maori and their culture and traditions with their ancestral land, water, sites, wahi tapu, valued flora and fauna, and other taonga.

POLICY AND PLANNING

Strategic Framework

The Local Government Act 2002 (LGA) states that a sustainable development approach should be taken by local authorities in performing their functions. This includes taking into account maintaining and enhancing the quality of the environment.

Local authorities must also give effect to the Resource Management Act 1991 (RMA), the purpose of which is to promote the sustainable management of natural and physical resources. This includes ensuring that natural and physical resources are managed effectively to reduce adverse effects on the environment and safeguard resources and services provided by the environment for future generations.

Whangarei District Growth Strategy: Sustainable Futures 30/50 2010

The Whangarei District Growth Strategy sets out a strategic direction for the District over the next 30/50 years. Sustainable development is the key concept underlying the strategy, focusing on how the District can best meet the needs of future populations. The Growth Strategy promotes strong sense of place, including historic and cultural heritage, natural heritage and the built environment encompassing such aspects as local character and amenity, neighbourhood identity, and urban design. The strategy anticipates that with an increase in the older population there will be an increased demand for apartment style living in locations with high amenity. Future blue/green corridors are identified in the strategy as

being able to contribute to the amenity, ecological, social and cultural values of the City and to its sense of place, as a water-based settlement.

The strategy identified the potential of the waterways in the City. *“These waterways should be an asset to the City but at present they are largely ignored except as a drainage network... The streams flowing through the City should act as ‘green/blue corridors’ through the urban fabric”.*

Actions to create a Blue/Green Network were then outlined in the Whangarei District Growth Strategy Implementation Plan (adopted by Council in 2012).

Part A Section 3.6

Action 4.1 Undertake restoration/rehabilitation of water quality and riparian margins in Whangarei City to provide blue/green corridors through the urban area. Also promote the naturalisation of waterways within growth strategy nodes especially the larger urban and urbanising nodes to develop the connections between riparian and terrestrial habitats.

Part B: Section 3

Action 1.8 Incorporate strong blue/green space provisions in the structure plan for Whangarei City and the comprehensive development plan for the inner city and ensure that a comprehensive network of open space, ecological corridors, urban trees and gardens, are a feature of both plans. Include

relevant aspects of the long term open space management plan for Whangarei City when completed.

Action 1.9 Incorporate flood/inundation hazard mitigation measures into the structure plan for Whangarei City and the comprehensive development plan for the inner city and combine flood attenuation measures with the establishment of a network of open space and ecological (blue/green) corridors in the city area. Include relevant aspects of the long term flood/inundation attenuation strategy and management plan for Whangarei City when completed.

Action 3.1 Develop and implement a long term open space management plan for Whangarei City to establish a network of urban parks and reserves, blue/green (ecological) corridors, urban trees and gardens that maintain and enhance biodiversity, ecosystem services and urban amenity. This should cover a 30/50 year time frame.

Biodiversity Strategy 2012

The strategy identified a number of threats to our biodiversity and the natural environment. Actions were identified in the strategy to further develop a blue/green network across the District and rehabilitate waterways throughout the urban area.

Action 1.1.2 Identify ecological linkages, including potential linkages between habitats, and riparian connections for a 'green and blue' network across the district.

Action 2.2.3 In conjunction with other agencies, establish a network of connected protected areas (taking into account linkage

areas identified in 1.1.2) to ensure habitat availability for indigenous biodiversity.

Action 2.4.3 Undertake restoration/rehabilitation of water quality and riparian margins in Whangarei City to provide blue/green corridors through the urban area.

Action 2.4.4 Promote the naturalisation of waterways within Growth Strategy nodes, especially the larger urban and urbanising nodes, to develop effective connections between riparian and terrestrial habitat.

Whangarei Open Space Strategy 2001

The strategy includes an assessment of existing spaces in 2001, and priorities and future visions for open space. A need for a network of linkages, both ecological and recreational, was identified and riparian areas were identified as important locations for both ecological and recreational enhancement. The strategy proposes the development of recreational networks and ecological corridors along Whangarei's waterways and advocates for linking reserves, parks and riparian corridors with walking and cycling facilities.

Walking and Cycling Strategy 2012

The strategy provides a limited plan for the creation of future off-road connections, focusing on a few arterial routes, and is lacking a comprehensive future plan for a network across the whole City. The proposed paths are primarily designed for commuters, although technically a shared space for pedestrians and cyclists. The strategy also addresses the promotion of walking and cycling and cyclist safety.

Whangarei District Plan

The Whangarei District Plan is prepared under the RMA and sets out the regulatory framework for resource management in the District. Policies and rules direct the use and development of land in order to manage effects on the environment. This includes a number of policies and rules relating to water bodies, riparian areas and open space.

Long Term Plan (LTP) 2015 – 2025

The Long Term Plan sets territorial authorities' commitments and priorities for the following 3-10 years and how these are to be achieved. The LTP also outlines budget commitments over the 10 year period and allocates funding to projects.

Youth Policy 2013

This policy has been developed to enhance and support the experience of youth in the District, including provision of recreation spaces. As there are a number of young people in the District, it is important that they are engaged and feel part of the community.

Positive Ageing Strategy 2005-2015

This strategy was developed as a result of the New Zealand Positive Ageing Strategy. There are a number of objectives aimed at supporting older people in the community and enhancing their quality of life. As the District is expected to have greater numbers of older people in the future, including positive ageing initiatives in policies and strategies is important in connecting a large proportion of our community.

Accessibility Policy 2014

This policy recognises the diverse needs of people with disabilities. The policy focuses on three areas of concern – consultation; education,

understanding and communication; facilities, services and access. Of particular importance to this document is the need to enable and facilitate access of people with mobility issues to be able to engage and enjoy recreational opportunities within the Blue/Green Network.

Arts, Culture and Heritage Policy 2009

The policy focuses on Whangarei's role as an arts, culture and heritage hub for the region, by promoting a number of cultural precincts within the City. These are based on Forum North, the Town Basin (Figure 12) and the Quarry, areas which currently fulfil these roles. Council aims to facilitate and support the development of arts and culture, however there is no implementation plan associated with this policy, and most of the work surrounding arts, culture and heritage in the district comes from private and community interests.



Figure 12 Art Park on the Hatea Loop Walkway

Hihiaua Precinct Plan 2015

Hihiaua Peninsula is bordered by the Waiarohia Stream, Hatea River and Reyburn Street. The land is largely owned by Whangarei District Council and Northland Regional Council. The area has been identified by Council as a strategic location for residential/mixed use development. At present the precinct is predominantly light industrial in nature, however a plan change to the District Plan is underway that will provide for residential and mixed use activities. The plan outlines Council's direction to manage growth and development in the Precinct, and is intended to assist with the efficient delivery of key infrastructure, land use planning and community services for the area.



Figure 13 Hihiaua Precinct as a mixed use residential neighbourhood

Inner City Development Plan (under development)

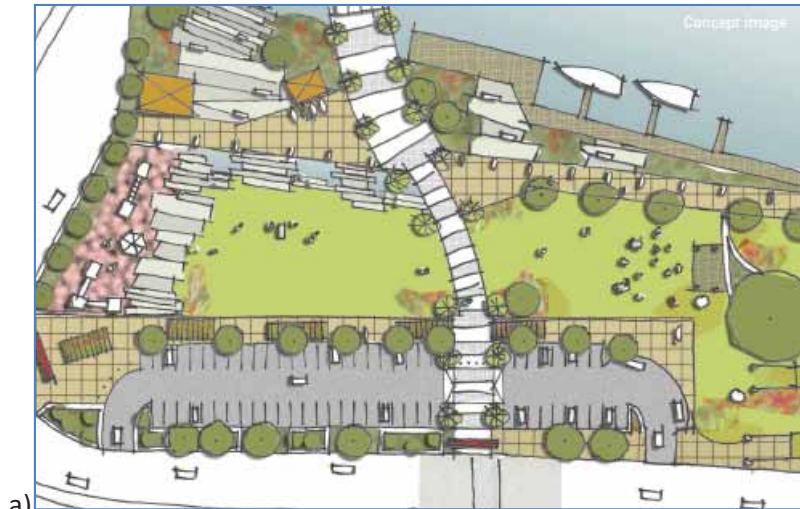
The plan will set out Council's direction on development and growth in the Inner City area over the next 20-30 years, which includes the CBD and Town Basin. As with the Hihiaua Precinct Plan, the Inner City Development Plan is intended to assist with the efficient delivery of key infrastructure, land use planning and community services for the area.

Weekend and Night Time Economy Strategy

Adopted in February 2014, the Weekend and Night time Economy Strategy was created to address issues with the vitality of the central City outside of normal business hours. The strategy looks at provision for mixed use environments, provision of infrastructure and improved connections to encourage people to move between points of interest, including blue/green connections which also serve a recreational purpose.

Whangarei 20/20 Momentum 2016

This document is a continuation of work identified in the Whangarei 20/20 Plus document (adopted in 2006). The document summarises a number of projects within the central City area, including public projects, public/private partnerships and privately funded projects. The document sets out the proposed projects over the next 10 years, with indicative dates for completion. Several projects have been completed including the Hatea Loop Walkway, the Laurie Hall Park war memorial upgrade and the Te Matau a Pohe Bridge. There are a number of projects identified that will intersect with the Blue/Green Network Strategy, particularly the Emerald Necklace project (walkways along the Waiarohia, Raumanga and Hatea waterways), the projects at Pohe Island and at the Town Basin, including Bascule Park and the Car Park to Park projects (Figure 14).



a)



b)

Figure 14 Projects included in 20/20 Momentum at the Town Basin a) Concept image for the Car Park to Park project b) the Hatea Loop Walkway

Northland Regional Policy Statement (proposed)

The Regional Policy Statement (RPS) for Northland covers the management of natural and physical resources in the Northland Region, including land and water management, natural hazards and biodiversity. The current version of the RPS became operative in 2002. The proposed RPS is anticipated to become operational in 2016.

Northland Regional Plans

There are currently three regional plans – the Regional Air Quality Plan, the Regional Coastal Plan and the Regional Water And Soil Plan. These three plans set out policies and rules for managing Northland’s air, coast, water and soil. Development of a new regional plan has begun and will consolidate the three plans into one document. The Regional Water and Soil Plan is of particular relevance to this Strategy as it contains policies and rules around flood protection works, riparian areas and stormwater and wastewater discharges.

Iwi/Hapu Management Plans

A number of iwi and hapu include the City of Whangarei as part of their rohe. In addition to consultation with the relevant iwi/hapu, there are three iwi/hapu management plans that need to be considered when undertaking work in this area. Te Iwi o Ngatiwai Iwi Environmental Policy Document (2007), the Ngati Hine Iwi Environmental Management Plan (2008) and the Ngati Hau Hapu Environmental Management Plan (2016) all outline policies relating to Kaitakitanga in their rohe, which includes Whangarei.

THEMES

ENHANCING AND CONNECTING OUR COMMUNITIES

Case Study: French Broad River Greenway



Asheville (North Carolina, USA) is a small city with a population of approximately 80,000 located on two converging rivers, with nearby forest and a number of local parks and reserves. Asheville has developed a “Greenways” plan, primarily cycling and walking trails along the river corridors or connecting parks and reserves. In 2009 five miles (8km) of greenways had been developed or were under development with another 85 miles (137km) identified for future greenway development. Priority greenways have been identified. The council has been successful in negotiating access to private land for the greenways, which reduces the need to purchase land, making the project more cost effective.

Urban biodiversity plays an important role in enhancing urban amenity. Features such as green walls, roadside planting, rehabilitated waterways and open park spaces, increase the area of accessible nature available in an urban environment.

Urban design and planning is moving away from focusing solely on functionality and focusing more on place-making and place-shaping. Developing a sense of identity for a location or community fosters ownership and a collective responsibility for that environment. This can lead to a reduction of negative impacts such as rubbish dumping and graffiti and assists in creating a vibrant place people want to interact with. People place a high value on having attractive, well thought out living environments that are people-centric, rather than focusing purely on cars and functional infrastructure.

Areas with high amenity promote a sense of wellbeing and are sought out by people for recreation, relaxation and living. It is well known that physical activity has health benefits. However, a number of studies now suggest that undertaking physical activity in greenspace or a more natural environment also reduces stress and improves mental health (WHO, 2015). This is only true of high amenity greenspace as degraded environments discourage people from using them due to an impression of neglect and safety concerns (Parks Victoria, 2015). Providing a free, accessible and attractive environment for exercise and activity is key to facilitating a happy, healthy population.

Current State

Internationally, rates of obesity have increased dramatically over the past few decades. The increased availability of cheap, energy-dense, nutrient-poor foods and a reduction in physical activity, both at work and in the home environment, have created an obesogenic environment. Using a variety of indicators (Body Mass Index, Waist-to-Height Ratio and Waist Circumference), the Ministry of Health report on Understanding Excess Body Weight (2015) illustrates the issue of obesity nationally. Over half the population are estimated as being overweight (Figure 15), with three in ten people categorised as obese.



Figure 15 Obesity figures for 2011-2013

Importantly, people living in deprived areas were four times more likely to be extremely obese than those in more well off areas, and Maori were 1.8 times more likely to be obese than non-Maori. While there are no statistics on obesity available for Whangarei, our District has a number of deprived areas, and Maori represent a quarter of the District's population. Obesity is likely to be and remain a major health issue for our adult population.

Individuals from deprived communities are more likely to have barriers to more formal exercise arrangements and would benefit the most from additional services. Within the area in scope a number of area units (as

defined by Statistics New Zealand) have over 30% of households earning under \$30,000 p.a. before tax. These areas would benefit the most from having good active transport connections and additional greenspace for recreation.

Case Study: Hatea Loop Walkway.



Increased connectivity around the Upper Harbour through the new Hatea Loop Walkway has resulted in a large increase in the number of people using the public spaces along the walkway following its completion (WDC, 2015b). This is now a successful recreational corridor with many people using it for exercise purposes. Active recreation areas on the loop currently include a playground at the Town Basin and a BMX track, skate park and dog park on the Pohe Island section of the track. The recent addition of a dedicated exercise station for all ages at Hihiaua has added to the facilities available for exercise. A new BBQ area provides space for passive recreation.

The obesity issue is not limited to adults, with three in nine children considered overweight. With 22% of the District's population under 15 (at 2013 census), providing a safe recreational environment for cycling, walking and other physical activity away from the dangers of the road is important in promoting active recreation for school children and their families. For older children and teenagers, cycling also provides them with a measure of independence. An extensive network of walkways and cycleways would provide them with an opportunity to travel to and from education, entertainment, retail and recreation centres without relying on public transport, family or friends, in a safe, off-road environment.

Whangarei is also typical of much of New Zealand, with an ageing population. By 2043 it is estimated that 30% of our population will be over the age of 65 (Statistics NZ, 2015). Combating sedentary behaviour in older people is important, as sedentary behaviour contributes to obesity and increases the risk of additional health problems such as falls, type 2 diabetes, heart disease and depression. Ministry of Health guidelines (2013) recommend walking as a good physical activity for older people. It also recommends group exercise, as this increases social interaction and has positive effects on mental health as well as physical health.

There are a number of walking, cycling and shared use paths already in the City, however these are disconnected from each other. There are numerous proposed shared use paths in the Walking and Cycling Strategy 2012. However the majority of these are not yet at the planning/construction stage, and those that are in the pipeline are focused on commuters.

The planned Kamo Route, connecting Station Road, Kamo to Rust Avenue, along the railway corridor, will be a shared use path that will link a number of educational and recreational facilities. Work on this route will commence April 2016 and will be completed in stages, with the entire project expected to be completed in May 2018.

Providing cycleways for commuters to access work places is an essential part of encouraging active transport and an important part of the Blue/Green Network. However, in addition to providing commuter focused pathways, recreational focused pathways should be provided to encourage exercise. Connecting areas of open space, parks and waterways allow movement between recreation zones and neighbourhoods and encourages people to access these areas.



Figure 16 The BMX track on Pohe Island provides a family friendly exercise option connected to the City centre by the Hatea Loop Walkway

Enhancing and Connecting our Communities

GOALS

Increase connectivity between neighbourhoods, waterways and open space

Increase amenity in the urban and suburban environments

Increase use of urban areas by residents and visitors

Enhance and protect cultural and spiritual values of tangata whenua

Create a comprehensive system of walkways/cycleways/shared use paths

Enhance use of art along walkways/cycleways/shared use paths

Provide connections with transport options

Ensure water quality goals are met

Implement wayfinding signage along all routes

Landscape sections of walkways/cycleways/shared use paths

Connect high use areas

Involve local Maori in decision making

Create recreational walking and cycling loops

Create additional greenspace

Ensure appropriate facilities are available

Enable access to areas of cultural and spiritual value for tangata whenua

Ensure that schools are near or connected to walkways/cycleways/shared use paths

Ensure accessibility needs are met where practicable

Assist in protecting and enhancing traditional resources

Increase Connectivity between Neighbourhoods, Waterways and Open Space

Create a comprehensive system of walkways/cycleways/shared use paths

Extending the recreational walkways/cycleways/shared use paths from the Hatea Loop up the Waiarohia Stream will provide additional routes for exercise and recreation. However, these walkways/cycleways/shared use paths are in the City centre and do not provide for neighbourhood routes in the suburban area. An extended walkway/cycleway/shared use path network throughout the suburbs and City centre will provide commuters with a safe alternative to cycling on the road and will assist in promoting cycling and walking as a recreational activity throughout the City (Figure 17). It is important to connect suburbs, open spaces and amenities to ensure that people see these walkways/cycleways/shared use paths as a valid alternative to driving to get them to their desired destination. The walkways/cycleways/shared use paths will need to cater for a wide range of users. It is anticipated that recreational users of all ages and varying levels of mobility, commuters and tourists will engage with different routes across the City. Not all walkways/cycleways/shared use paths will be able to be fully shared use, or to the highest level of service. Demographics and expected users will need to be considered when designing and engineering each route.

Implement wayfinding signage along all routes

Wayfinding signage is important in directing people to where they want to go and advising them of how long journeys will take. For commuters and regular users this is unlikely to be an issue, but for light recreational users and tourists, being able to confidently find their way along clearly

marked routes is important. Additional information, such as how long it will take to reach a particular attraction and what level of service the track provides (e.g. wheelchair/mobility scooter friendly, lighting), can also be obtained from well designed signage. Signage should be clear and consistent, whether it is a small sign indicating exit points along a trail, or a larger sign at an attraction or in the urban centre with additional information. Consistency with standard international symbols and national signage should also be maintained.

Existing Walkway/Cycleway/Shared Use Path

This route has already been constructed.

Planned Walkway/Cycleway/Shared Use Path

These are planned routes. They are either budgeted for, the route is being negotiated with landowners, or design and engineering work has commenced.

Future Walkway/Cycleway/Shared Use Path

These are proposed routes. They are not budgeted for and no work has been done on design, feasibility or cost.

Indicative Path

These are not physical paths. They are aimed at guiding pedestrians and cyclists across busy urban areas between physical paths and will be signposted.

Walkway Only

These routes are suitable only for walking and can be steep in gradient and are of a lower level of service.

On Road cycleway (NZTA)

These routes are dedicated cycle lanes forming part of the road corridor on SH1 and SH14. They are currently under construction by NZTA and are not funded or managed by Council.

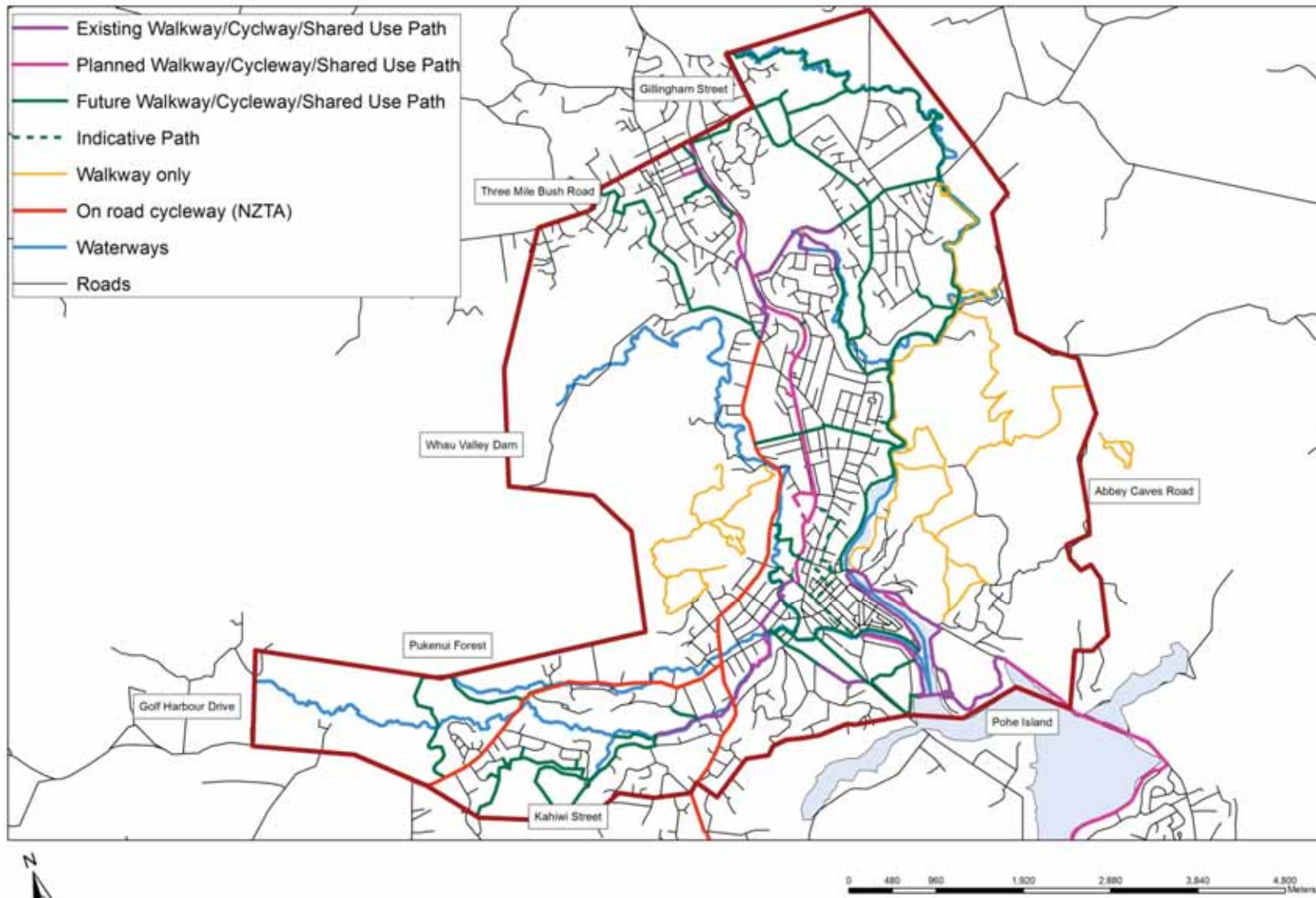


Figure 17 Proposed walkway/cycleway/shared use path network

Create recreational walking and cycling loops

Recreational use of walkways and cycleways in the urban area is likely to be higher than that of commuters, with activity taking place in weekends and after school and work hours during the week. Arterial walkways/cycleways/shared use paths are more likely to be used by commuters. Recreational provision should also be encouraged in the suburbs so that people do not have to travel out of their suburb to recreate. Tourists also need to be considered, as walkways/cycleways/shared use paths connecting to attractions such as the Whangarei Falls, Raumanga Falls and Town Basin are likely to be popular with this group over the summer months.

People are more likely to use a pathway recreationally if it forms a ‘loop’ of a manageable size for their choice of travel (pedestrian or cycling), as they do not have to consider other transport options to return to their point of origin. Loops should ideally take less than an hour to travel, to encourage people to recreate. There is opportunity in the City centre to complete a second urban loop walkway along the Waiarohia Stream, which would complement the existing Hatea Loop Walkway (Figure 18). There are also a number of suburban opportunities to create loops.

People are recreating and commuting in a more active fashion and there are opportunities for children, older people and those with disabilities to access these facilities.



Figure 18 Hatea Loop Walkway

Ensure that schools are near or connected to walkways/cycleways/shared use paths

Figure 19 illustrates the location of the schools in the City area. In order to encourage more children to get to school via active methods (walking, cycling, scooting etc.), a network of safe off-road walkways/cycleways/shared use paths connecting neighbourhoods to schools is desirable. Schools will need to be consulted to ensure that they are able to support cycling for their families. Education and support opportunities, such as Bike Northland’s ‘Bikes in Schools’ program, are already underway in Whangarei which will enable and encourage students to cycle. As the cycleway network expands, it is anticipated that more students and their families will be confident in cycling to school as a real option to private vehicles.

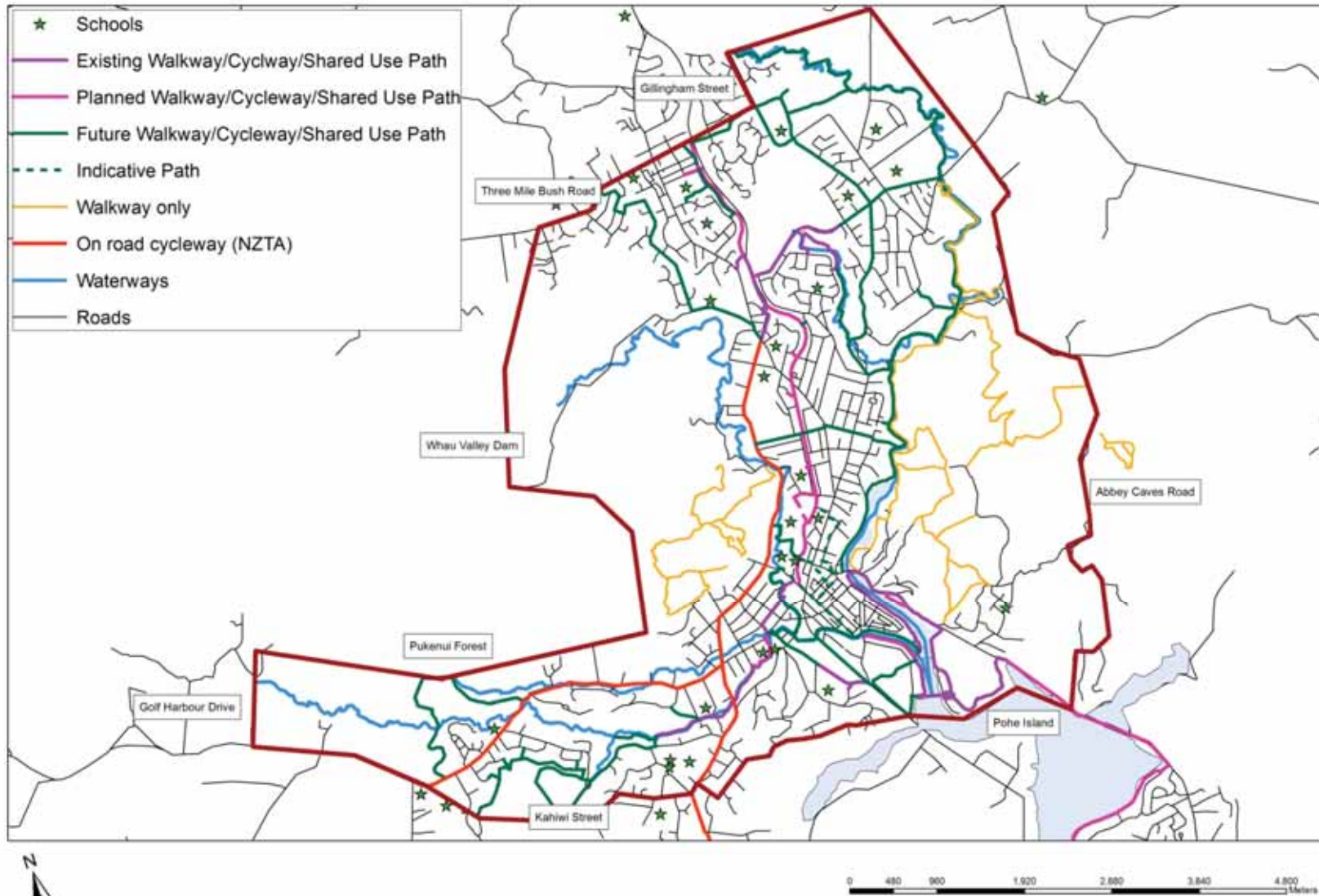


Figure 19 Location of schools in Whangarei

Increase Amenity in the Urban and Suburban Environments

Enhance use of art along walkways/cycleways/shared use paths

Art, and particularly interactive art, is a good way of establishing and affirming the identity of an area. A range of sculptures, murals, and seating, that can be appreciated by all generations are a good way to engage the community in thinking about art, whilst providing an attractive place for people to recreate in.

Whangarei has considerable potential to enhance its arts, culture and civic amenities. The Whangarei Growth Strategy identifies the Town Basin area as a 'heritage and culture experience precinct'. Whangarei Art Museum Te Manawa Toi and the historic Reyburn House, which also hosts an art collection, are located at the Town Basin, along with a number of artisan workshops and galleries. The adjacent Hatea Loop Walkway features an Arts Trail, which contains a number of sculptures, many of which are interactive (Figure 20). The planned Hundertwasser and Wairau Maori Arts Centre (HWMAC) and the Maori Cultural Centre at Hihiaua will further cement this area of the City as a location for art.

Further opportunities lie in extending the use of art along the walkways/cycleways/shared use paths. Art can be used to tell the story of an area, and reflect the current nature of a place. Communities can be involved in helping to determine their own identity through artwork, by being engaged in the concept, design and selection of artwork. Currently, a number of murals can be seen around the City, telling stories of culture, identity and nature. These murals add colour and life to suburban areas and can make confined spaces more welcoming.



Figure 20 Interactive art on the Hatea Loop Walkway

Landscape sections of walkways/cycleways/shared use paths

Landscaping plays a key role in the amenity of walkways/cycleways/shared use paths. Landscaping can either be through cultivation or removal of vegetation to provide the desired outcome. Trees provide shading, maintained grass areas and pocket parks provide places to rest and recreate and plantings enhance a connection to nature, as well as providing habitat for wildlife. Landscaping is crucial in ensuring sightlines are maintained, to create view shafts to draw the eye to the water or bush-clad hills and to maintain visibility along the pathway to ensure safety and reduce the risk of accidents or incidents occurring. Ensuring ecological integrity of the riparian strip will need to be done in a way that maintains amenity values, whilst ensuring that the flow of water is not impeded during flooding events.

Create additional greenspace

While there are already a number of large parks and reserves around the City, there are opportunities to increase greenspace through the creation of the walkway/cycleway/shared use path network, as access to previously inaccessible greenspace is facilitated. There are two main uses of open space – active and passive. Active greenspace is used primarily for recreational activity and includes sports facilities, playgrounds and fitness stations. Passive greenspace is used for aesthetic appreciation and relaxation and includes gardens, native bush, and parks. It is important to ensure that any additional greenspace is fit for the intended purpose and has the appropriate facilities, such as lighting, shade, seating and toilets.

Pocket parks are small spaces that are generally deemed too small to create a meaningful recreational space, but when combined with a walkway/cycleway/shared use path or waterway view, they can greatly enhance the public experience and use of urban space. Pocket parks can be used as access to the recreational corridor or provide a rest stop along a length of walkway/cycleway/shared use path. Features of these places could include facilities such as seating, toilets, signage and fitness equipment, or amenities such as public art, gardens or a gateway experience. Pocket parks are largely passive greenspace, but larger or longer strips can be useful for creating active facilities such as skate parks, play equipment and games areas (Figure 21).

Increased use of Urban Areas

Provide connections with transport options

Recreational walkways and tourist facilities should connect with public transport or car parking sites to allow access for visitors to the area and

those that use the paths for exercise. There is a lack of connection for those who wish to undertake the walk to Whangarei Falls or Raumanga Falls one-way on a weekend, with bus services only running on Saturday mornings. While the bus network needs to be sustainable a smaller shuttle service connecting main tourist, retail and community sites is an option that could be considered.

Connect high use areas

Increased connectivity between areas of high commercial, recreation and tourist value in the inner city such as the Town Basin, CBD, Forum North, and Okara Park, will encourage people to move between these areas without the use of a vehicle. Whilst the distance between these areas is less than 15 minutes walk, people perceive this to be greater and drive between these locations. Linking them to the walkway/cycleway/shared use path network will encourage people to move between areas by active means, or to stop off at a site while recreating.



Figure 21 Outdoor chess set, Cathedral Square, Christchurch

Ensure appropriate facilities are available

In order to encourage increased foot and cycle traffic, appropriate facilities need to be in place. Currently, cycle parking is limited in the City and is not secure. Increasing cycle parking facilities for both commuters and recreational users will assist in promoting cycling as a viable alternative to driving. While there are a number of public toilets located around the City, as the walkway/cycleway/shared use path network expands additional toilet facilities may be needed. Regular rest stops which include seating will be needed on recreational routes to support the mobility impaired, the elderly and children using the walkways/cycleways/shared use paths.



Figure 22 Accessible walkway/cycleway/shared use path at the Town Basin

Ensure accessibility needs are met where practicable

Accessibility is a major barrier for the disabled and mobility impaired in using community facilities. To enable this sector of the community to use the walkways/cycleways/shared use paths, they need to be accessible. For the elderly, flat, shared use paths will enable them to access recreation areas easily through walking or using mobility aids. For those using mobility scooters and wheelchairs it is essential that gradients are low, surfaces are even and there is enough room to allow mobility scooter users to pass one another to ensure public safety (Figure 22). In some locations it will not be possible for walkways/cycleways/shared use paths to be fully accessible, due to engineering and topographical constraints. It is important that where walkways/cycleways/shared use paths have reduced accessibility that they are appropriately labelled and alternative routes are nearby.

Enhance and Protect Cultural and Spiritual Values of Tangata Whenua

Ensure water quality goals are met

Water bodies have significant cultural and spiritual values to tangata whenua. As areas of mahinga kai they provide important traditional food sources such as the tuna (eel). Water quality is important as degradation, pollution or contamination of the waterway lessens the mauri of the water, degrading the spiritual values of the waterbody. Traditional food species, both freshwater and marine, can be contaminated by pollutants directly entering the waterways or through stormwater runoff. This deprives Maori of accessing their traditional food sources, as consumption of contaminated food could cause illness. It also impacts on

the ability to practice kaitiakitanga and can result in a subsequent loss of matauranga maori. Despite degraded water quality, Maori whanau continue to use these waterways (particularly the Otuihau/Whangarei Falls area) to swim. Improving waterways, particularly water quality, enhances the cultural values of Whangarei's waterways and a sense of cultural identity and wellbeing for local Maori. Cultural monitoring of waterways can be undertaken alongside scientific monitoring to provide a more holistic picture of waterway health that encompasses matauranga maori and iwi/hapu goals.

Millan Ruka (Te Uriroi/Te Parawhau/Te Mahurehure) of "Environment River Patrol Aotearoa" is a well known local kaitiaki who walks, paddles and boats up rivers and streams all over the District (Figure 23). His work focuses on the regular monitoring of the health of tuna (eels), cultural sites, and reporting on many matters such as clearance of riparian vegetation, issues with fencing of stock on riparian margins and the waste disposal methods of moored yachts at the Town Basin.

Involve local Maori in decision making

Recognition of Maori cultural values in the policy, planning and decision-making processes of Council is important in meeting obligations under the Treaty of Waitangi, the Resource Management Act 1991 and the Local Government Act 2002. Consultation with local Maori at the design and engineering stage of projects will be essential to retain Maori involvement and engagement and enable the contemporary expression of kaitiakitanga. Iwi/hapu management plans will also need to be considered in the implementation of this Strategy.



Figure 23 Millan Ruka (Te Uriroi/Te Parawhau/Te Mahurehure) of "Environment River Patrol Aotearoa" regularly monitors the cultural health of Whangarei's waterways



Figure 24 Information panels at the Town Basin tell the stories of our shared heritage

Three Iwi/Hapu Management Plans relevant to Whangarei City waterways have been lodged with Council. Common themes in the objectives and policies of these plans that this Strategy will support include:

- A goal of protecting and enhancing the mauri of waterbodies in ways which enable tangata whenua to provide for their social, economic and cultural wellbeing; and that of the plants, animals and all species within them.
- A desire for acknowledgement of tangata whenua as the kaitiaki of waterways within their respective rohe (tribal area).
- Calls for increased tangata whenua involvement in the management and monitoring of water.
- A desire for matauranga maori in relation to water resources to be appropriately acknowledged and utilised.
- Requests for regional and district plans and strategies to promote and provide incentives for the rehabilitation, enhancement and protection of river banks and riparian margins.

A range of successful projects have been undertaken previously in conjunction with local Maori, such as the provision of interpretation panels along the Hatea Loop (Figure 24) as well as the Parihaka lookout project, where a kohatu and information panels were installed (Figure 25). Maori are also already significantly involved in restoration and enhancement projects and cultural health monitoring in relation to many of our waterways.

Te Huinga (a forum of Whangarei hapu representatives) meet with Council on a monthly basis (via the Te Karearea Strategic Partnership). Through this forum hapu are able to advocate for their concerns at a policy-making, strategic level. Te Karearea has identified improving water

quality at Otuihau/Whangarei Falls as a priority focus for the health and well being of the local community swimming there, and because this area is a key tourism site and culturally significant to local iwi/hapu. As a result the Otuihau Water Quality Partnership was established in 2015.

Whangarei District Council, other agencies and iwi/hapu representatives from Pehiaweri Marae, Ngati Hau and Parawhau have since worked collaboratively to initiate water quality monitoring, education, advocacy, riparian planting and fencing initiatives above the Whangarei Falls.

Enable access to areas of cultural and spiritual value for tangata whenua

Many sites have yet to be formally identified by iwi/hapu for Whangarei. As part of the District Plan rolling review, draft plan change PC100 (in preparation in consultation with iwi/hapu) will address the identification and distribution of sites of significance to Maori. As work on specific projects and sections of shared use paths is undertaken prior to the completion of PC100, engagement with iwi/hapu will be critical to ensure that access is allowed for, or is restricted in the case of some wahi tapu sites. This exercise will also provide opportunities to encourage the practice and representation of Maori culture, for example through use of markers, symbols, names and design in public open space and the built environment when appropriate.

Assist in protecting and enhancing traditional resources

Currently some traditional resources are either inaccessible, contaminated or of insufficient quantity to be utilised by Maori. By achieving environmental goals, such as improving water quality, restoring riparian margins and increasing biodiversity, traditional resources will become more plentiful and food, rongoa (medical) and raranga (weaving) species could be utilised for customary harvest once again.



Figure 25 A kohatu carved to represent Papatuanuku sits at the peak of Mt Parihaka, a former Pa site

ENHANCING ECOSYSTEM SERVICES AND ECOLOGICAL CONNECTIVITY

Habitat loss and fragmentation are a major reason for biodiversity decline globally. When fauna cannot move between areas of habitat small populations are formed, which are vulnerable to local extinction through inbreeding effects, disease or catastrophic events. Creating 'stepping stones', or ecological corridors, between areas of quality habitat is therefore important in maintaining populations long term.

Habitat loss and fragmentation is not limited to the terrestrial environment. Many New Zealand native fish are diadromous, migrating between freshwater and the ocean as part of their life cycles. Man-made structures, such as culverts and weirs, can create barriers preventing fish migration. Removing these barriers will assist in re-establishing access to breeding sites in the upper reaches of the waterways and increase available habitat for all aquatic species.

Increasing greenspace in the City will provide more areas of habitat and will allow movement through urban areas to more suitable environments for mobile species. Increasing vegetation throughout the urban area will also provides additional food sources, which could lead to urban populations establishing. In addition to providing the opportunity for wildlife to flourish, attractive urban green corridors also encourage people to walk or cycle around the City, taking vehicles off the street and improving air quality.

Case Study: Singapore



Nature ways are urban biodiversity corridors providing ecological connections between parks and bringing biodiversity into the city. These are designed to mimic the structure of forests with tall emergent trees, canopy trees and understory trees and shrubs alternated along roads. This encourages forest species, such as butterflies and birds, to move through the city. The goal is to increase these from 43km to over 180km by 2030. Singapore's vision is to be a 'City in a Garden' and their future planning is heavily focused on becoming as sustainable as possible.

Case Study: Lodz, Poland



Lodz has a high level of impermeable surfaces. The majority of its urban streams were channelized or piped during the 19th century and the city has been subject to increased flooding and water pollution. The Sokolowka River project involved restoring the river to a more natural state and creating a combination of reservoirs and bioinfiltration sites to store water and reduce pollutants entering the river during flooding events.

Increasing vegetation also improves the level of ecosystem services to the City. Vegetation absorbs water and releases it back into the atmosphere through transpiration. This process has a cooling effect, reducing the urban heat island effect caused by large concreted surfaces. Whilst this is not a major issue for Whangarei, shading streets would provide an additional level of comfort for pedestrians. Water uptake by vegetation, bioretention systems and street trees also filters pollutants, including heavy metals and sediments, improving the water quality of stormwater run-off and groundwater infiltration.

Waterway corridors are often undeveloped and underutilised, providing a cost-effective opportunity to create additional habitat and provide ecosystem services through riparian planting and management. Creating a more natural stream channel, with vegetated banks and reduced channelization also creates a better environment for freshwater species. Freshwater species can be sensitive to changes in their environment, including temperature, pollutant levels and sedimentation. Shading from vegetation prevents the stream from becoming too warm, while eddies and areas of slower flow provide additional habitat for eels, fish and macroinvertebrate communities. In addition to habitat and shading, riparian vegetation provides water filtering effects. By filtering stormwater runoff, sediment is trapped and pollutants are reduced through vegetation uptake, improving the quality of water entering the streams.

Current State

The Pukenui Forest and the Parihaka Reserves, are large areas of bush separated by Whangarei City. There is little connectivity and habitat throughout the City, which restricts movement of species that do not fly long distances. Connecting the two areas of bush will assist in allowing our native wildlife to disperse and encourage use of urban areas for supplementary habitat or food sources for birds and insects. There is little biodiversity data available for Whangarei City, however inventories have been done as part of reserve management plans for Barge Park, Pukenui Forest Reserves and the Parihaka Reserves, which are adjacent to the City. The inventories are not exhaustive and are likely lacking in species present in these reserves. The inventories have been combined to produce lists of native flora and fauna and introduced and invasive species for the City (see Appendix 2).

Nationally, the majority of the indigenous flora is considered to be 'Not Threatened' by the Department of Conservation. Several species are considered 'At Risk' – the 'Declining' species Para (King Fern), and the 'Naturally Uncommon' species Kawaka, Kawakawa (Pepper Tree), Toropapa and the orchid *Caladenia bartletti*. The only species present that is 'Nationally Endangered' is the Tauhinu.

There are several species of fauna that are considered to be 'Threatened'. These are the 'Nationally Vulnerable' North Island Kaka, North Island Brown Kiwi, and Pekapeka (Long-tailed bat) and the 'Nationally Critical' Parera (Grey Duck). Fauna 'considered to be at risk are the 'Declining' Tuna (Long-finned Eel), the 'Relict' Kakariki (Red-crowned Parakeet) and Puweto (Spotless Crake) and the 'Naturally Uncommon' freshwater crab.

Surveys conducted by the Northland Regional Council have identified a number of barriers to fish passage in our urban streams. The barriers interrupt the migration patterns of many of our native freshwater species and prevent them from reaching suitable breeding and habitat sites upstream. During the summer of 2014/15, surveys were conducted in the Waiarohia, Otaika and Raumanga catchments (approximately 36 kms). A total of 28 barriers were observed, only one of which had fish passage remediation. Two barriers, one on the Waiarohia and one on the Kirikiri Stream, were of particular concern as they were low in the catchment and presented a significant barrier to migration for a number of species. A fish survey on the Waiarohia barrier revealed three species present upstream of the barrier, one of which was non migratory, and ten species (two unidentified) below the barrier (Northland Regional Council, unpublished data). This suggested that the barrier was preventing threatened and declining species from accessing suitable habitat and the barrier was removed in late 2015.



Figure 26 Fish passage barrier on the lower Waiarohia Stream prior to removal in 2015

The majority of urban streams in Whangarei do not have water quality data available. The exceptions are the Hatea River and Waiarohia Stream, where permanent water quality monitoring sites are located. There are three regular water quality sampling sites in Whangarei where bacteria, nitrogen and phosphorus levels, clarity and pH are measured. Two sites are on the Waiarohia Stream and one is on the Hatea River (Table 2). These sites provide us with information on current state as measured by comparing the median monitoring results over five years for the site, with those of all sites of similar land use and altitude (LAWA, accessed 10.02.2015). The current state results are expressed in quartiles:



Bacteria levels are high at all sites and, as these are indicators of faecal matter (human or otherwise) in the waterways, this could potentially mean illness for people coming into contact with the water. Recent attention has focused on the Whangarei Falls, a popular swimming site with local children, which is often recorded as unsafe to swim due to high *E. coli* levels.




























Macroinvertebrate Index (MCI) sampling, which is used as an indicator of water quality and ecosystem health, has been completed for these waterways (Table 1), with two sites on the Waiarohia Stream, one on the Raumanga Stream and one on the Hatea River. All of the sites have MCI scores indicating that the stream is moderately impacted by pollution. Lower EPT percentages suggest the stream is affected by organic pollution.

Table 1 MCI Sampling at four sites in Whangarei (2015)

	Hatea at Mair Park	Raumanga at Bernard Street	Waiarohia at Second Ave Bridge	Waiarohia at Whau Valley
Taxonomic richness ¹	27	21	25	22
Northland Regional Council MCI value ²	101	111	94	108
EPT count ³	6	3	6	4
%EPT ⁴	22.2	14.3	24.0	18.2

¹ Taxonomic Count is the number of macroinvertebrate species present.
² MCI scores are based on the presence of macroinvertebrate taxa, which are each assigned scores, which reflect their tolerance to environmental changes/extremes. The final score for each stream incorporates the sum of the MCI scores for each taxon with one or more individuals. A score of 120 or greater indicates a stream in pristine condition, a score between 80 and 120 indicate a moderately impacted stream, and a score lower than 80 indicate a severely polluted stream.
³ EPT count is the number of species of the macroinvertebrate community that belong to the mayfly, stonefly and caddisfly orders. Two caddisflies *Oxyethira* and *Paraoxyethira* are excluded as they are considered relatively tolerant to organic pollution
⁴ %EPT* is the percentage of the total macroinvertebrate community that belong to the mayfly, stonefly and caddisfly orders. These are considered more sensitive to organic pollution, with higher

Table 2 Current state of water quality at monitored sites, compared to similar New Zealand sites

		Waiarohia Stream at Second Ave Footbridge	Waiarohia Stream at Whau Valley	Hatea River at Mair Park Footbridge
Bacteria ⁵	<i>E. coli</i>	 339 n/100ml	 445 n/100ml	 298 n/100ml
Clarity ⁶	Black Disc	 2.1m	 1.7m	 1.7m
	Turbidity	 2.4 NTU	 4.2 NTU	 4.04 NTU
Nitrogen ⁷	Total Nitrogen	 0.41 g/m ³	 0.7 g/m ³	 0.64 g/m ³
	Total Oxidised Nitrogen	 0.3 g/m ³	 0.41 g/m ³	 0.375 g/m ³
	Ammoniacal Nitrogen	 0.01 g/m ³	 0.01 g/m ³	 0.012 g/m ³
Phosphorus ⁸	Dissolved Reactive Phosphorous	 0.008 g/m ³	 0.009 g/m ³	 0.003 g/m ³
	Total Phosphorous	 0.015 g/m ³	 0.0235 g/m ³	 0.018 g/m ³
Other	pH	 7.5 pH	 7.3 pH	 7.7pH

proportions indicating a healthier waterway. Two caddisflies *Oxyethira* and *Paraoxyethira* are excluded as they are considered relatively tolerant to organic pollution
⁵ An indicator of faecal contamination, which can be harmful to humans
⁶ A measure of light penetration and suspended sediment
⁷ High levels of Nitrogen can cause algal growth. Total Oxidised Nitrogen is a measure of inorganic nitrogen; Ammoniacal Nitrogen a measure of organic nitrogen, which can be toxic at high levels.
⁸ High levels of Phosphorus can cause algal growth. Dissolved Reactive Phosphorus measures soluble phosphorus that is available for uptake by plants and algae.

Enhancing Ecosystem Services and Ecological Connectivity

GOALS

Improve ecosystem services

Increase stormwater filtration

Education campaigns and school programs on stormwater

Increase air filtration through use of street trees

Restore the riparian ecosystem

Landscape cycleways appropriately

Re-vegetate lower slopes of the riverbank to provide habitat for fish species

Create ecological corridors

Connect riparian zones to neighbouring forested areas and urban greenspace

Remove barriers to fish passage

Increase urban biodiversity

Increase use of trees throughout urban area

Increase use of food sources for bird species within landscaping

Improve Ecosystem Services

Increase stormwater filtration

A number of pollutants enter the waterways and Harbour via stormwater runoff directly into the waterways or entering via the piped system. Different types of pollutants require different treatment options, which means that multiple filtration elements will be needed to improve water quality as a whole. There are a number of green and grey infrastructure solutions that assist with filtering stormwater to improve the overall quality of water entering the waterways and Harbour and a combination of these will offer the best results.

Green infrastructure elements can improve water quality through increased filtration and water uptake by vegetation and entrapment of sediments and pollutants from stormwater before it enters the piped system or waterway. Bioinfiltration elements, such as swales (gutters), bump-outs (curb extension) street trees, rain gardens and planters (footpaths) are all vegetated features which are set at a lower-than-street level with infiltration ramps to guide water into the feature and overflow into the piped system. The plants are placed in a filtering media, which assists in removing pollutants and increases groundwater infiltration. When placed and planted appropriately they can assist in the uptake of a variety of pollutants.

Small wetlands can be used to filter stormwater before it enters waterways or harbours. They are effective at breaking down nitrogen and trapping sediment. There are several of these located around the City, but they are not currently maintained on a regular basis. Wetland establishment is generally restricted to locations where a large amount of land can be converted and is not suitable in many areas in the City. Other

cities have had success with incorporating wetlands into waterfront parks (Figure 27), providing a high level of amenity, while improving water quality.

Riparian vegetation can also assist with filtration of stormwater. Dense plants are good at filtering runoff and also assist with bank stabilisation. Our native sedges and rushes are hardy and tolerant of flooding and can be planted right down to the waterline to increase the filtration zone. These species do not impede water flow in a flood situation and, unlike grass, are low maintenance. In addition to filtering water they also provide habitat and shading for fish species and so are ideal lower bank riparian vegetation throughout an urban environment.



Figure 27 Waitangi Park, Wellington, has a number of small wetlands to filter stormwater prior to entering the harbour

There are a number of newer treatment devices designed to be incorporated into the piped system. Grey infrastructure is becoming increasingly complex, with multiple in-system devices able to filter a range of pollutants from stormwater available. Gross pollutant traps remove larger sediment particles, leaf litter and rubbish and can be simple in-grate systems, such as the enviropod (Figure 28) which require a lot of maintenance, or large in-line treatment devices, such as the Vortcapture device installed in Banff Street, which are lower maintenance. Additional treatment devices are available that remove finer sediment particles and remove oil and grease from stormwater.



Figure 28 Enviropod, used to filter rubbish coming through stormwater grates, prior to installation

These devices can be expensive, require regular maintenance to remain effective, and the majority are not easy to retrofit. When undertaking roadworks or new developments, consideration should be given to whether one of these devices is appropriate. Of particular concern is large areas of concrete, such as carparks and main roads, where residue from vehicles, including heavy metals, oil and grease, enter the stormwater system or, if adjacent to a waterway, directly into the streams. Carparks adjacent to waterways should be set back from the waterway with a riparian buffer separating the two.

Education campaigns and school programs on stormwater

Whangarei District Council currently supports the 'Drains to Harbour' education program in schools. This project educates children on the differences between stormwater and wastewater and how they can help prevent rubbish getting into the stormwater system. More work is needed to educate adults on the impacts of pollutants on the waterways and Harbour. A community education day was held in June 2015 at the Town Basin. From October-December 2015 Seacleaners, an organisation that provides education on the effects of rubbish on the marine environment and coordinates volunteers to remove rubbish from coastlines and rivers, removed 32,650 litres (measured by 50L bags) of rubbish from the Hatea River (Seacleaners, 2015). Ideally, a stormwater campaign, including media releases, educational displays and clean up events, should be run each year to remind people of the effects they can have on the waterways and coast. This should be held during the summer months, when people are more likely to see the direct effects of pollution.

Increase air filtration through use of street trees

Emissions from industry, vehicles and residential fires create air pollution, which has negative impacts on human health. Increasing the reach of shared use paths will assist in reducing the number of vehicles on the roads, but emissions will still be present in the airshed. In addition to emission reduction, increasing the vegetation available for air filtration will assist in improving air quality in the City. Street trees can provide filtration of air pollutants and have the additional benefits of providing shading and cooling through transpiration in a predominantly concrete urban area. Riparian margins and pocket parks can also be used as locations for larger trees, which are less suitable for use in a streetscape.



Figure 29 A vision of the future - Cafier Park - Lovers Lane Bridge to Rust Ave

Restore the Riparian Ecosystem

Landscape cycleways appropriately

All waterways should have riparian planting, however this will differ depending on the location and use of the waterway. Cycleways need to be landscaped in a way that does not reduce safety or impede movement. CPTED principles will need to be considered. At the same time, the integrity of the riparian zone needs to be maintained to achieve biodiversity and water quality outcomes. As the majority of cycleways are only on one side of the waterway it will be more practical to divide the waterway into a recreational corridor, where planting is primarily for amenity and shading, and an ecological corridor, where the entire bank is planted to enhance biodiversity and increase ecological connectivity.

Vegetation within the recreational corridor will need to be considered carefully to ensure that sightlines are maintained and there is no vegetation overflow onto the walkway/cycleway/shared use path that could impede movement or lead to accidents. Vegetation within the ecological corridor will need to be based on ecological principles. The plant species in this corridor will need to provide shade for the waterway and habitat and food sources for bird, fish and invertebrate species.

Re-vegetate lower slopes of the riverbank to provide habitat for fish species

The lower banks of the waterways will need to be vegetated appropriately to ensure that habitat and shading is provided for freshwater species, while not impeding the flow of water in high flow conditions or expected 1 in 10 year flood levels. Shading is of particular importance as eggs will not be viable and breeding unsuccessful if water temperatures are too high.

ECOLOGICAL CORRIDOR

Lower Bank:

Pukio (*Carex secta*)
 Cutty grass (*Carex maorica*)
 Giant umbrella sedge (*Cyperus ustulatus*)
 Flax/harakeke (*Phormium tenax*)
 Jointed wire rush/oioi (*Apodisma similis*)
 Kiokio (*Blechnum novae-zelandiae*)

Upper Bank:

Cabbage tree (*Cordyline australis*)
 Flax/harakeke (*Phormium tenax*)
 Mingimingi (*Coprosma propinqua*)
 Karamu (*Coprosma robusta*)
 Kohuhu/kohukohu/black matipo - (*Pittosporum tenuifolium*)
 Koromiko (*Hebe stricta*)
 Red matipo (*Myrsine australis*)
 Mahoe (*Melicytus ramiflorus*)
 Putaputaweta (*Carpodetus serratus*)
 Ribbonwood (lowland)/manatu (*Plagianthus regius*)
 Titoki (*Alectryon excelsus*)
 Kowhai (*Sophora microphylla*)
 Manuka (*Leptospermum scoparium*)
 Kanuka (*Kunzea ericoides*)
 Mamaku/black tree fern (*Cyathea medullaris*)
 Wheki (*Dicksonia squarrosa*)

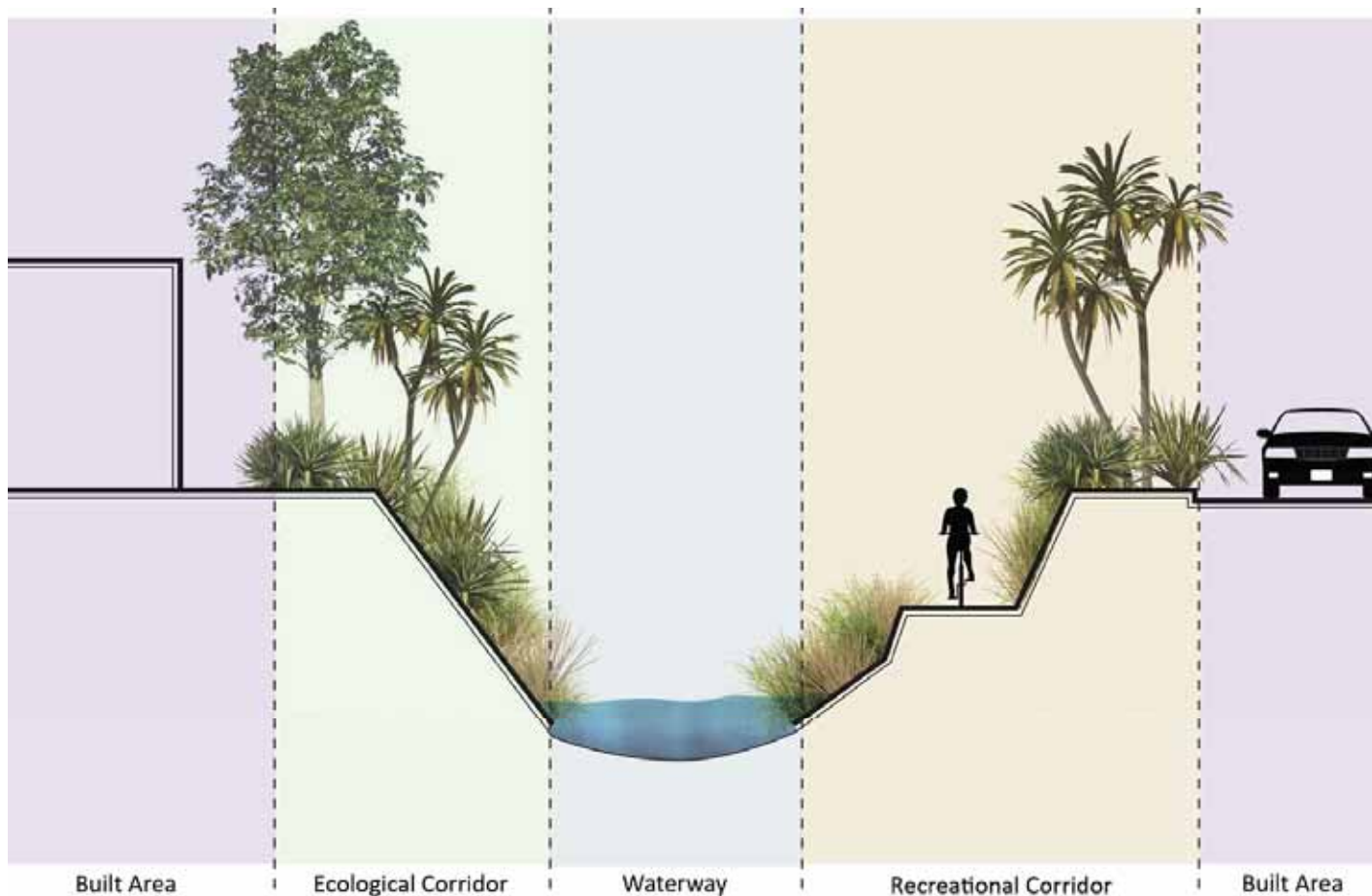
RECREATIONAL CORRIDOR

Lower and Upper Banks:

Pukio (*Carex secta*)
 Giant umbrella sedge (*Cyperus ustulatus*)
 Jointed wire rush/ oioi (*Apodisma similis*)
 Kiokio (*Blechnum novae-zelandiae*)

Top of the Bank:

Cabbage tree (*Cordyline australis*)
 Flax/harakeke (*Phormium tenax*)
 Mingimingi (*Coprosma propinqua*)
 Karamu (*Coprosma robusta*)
 Kohuhu/kohukohu / black matipo (*Pittosporum tenuifolium*)
 Koromiko (*Hebe stricta*)
 Red matipo (*Myrsine australis*)
 Manuka (*Leptospermum scoparium*)
 Kanuka (*Kunzea ericoides*)
 Mahoe (*Melicytus ramiflorus*)
 Ribbonwood (lowland)/manatu (*Plagianthus regius*)
 Putaputaweta (*Carpodetus serratus*)
 Titoki (*Alectryon excelsus*)
 Kowhai (*Sophora microphylla*)
 Mamaku/black tree fern (*Cyathea medullaris*)
 Wheki (*Dicksonia squarrosa*)



- BUILT AREA**
- Pukio (*Carex secta*)
 - Giant umbrella sedge (*Cypruss ustulatus*)
 - Jointed wire rush/oioi (*Apodisma similis*)
 - Cabbage tree (*Cordyline australis*)

Riparian planting extends along all waterways to provide corridors across the City for our flora and fauna.

Planting will enhance ecological function and connectivity.

Lower bank prone to flooding.

Upper bank to provide food and shading.

Planting will enhance amenity and provide water quality enhancement.

Lower bank prone to flooding.

Planting the banks must not impede walkway/cycleway/shared use path users.

Planting will be for landscaping or as part of green infrastructure element.

Create Ecological Corridors

Connect riparian zones to neighbouring forested areas and urban greenspace

Where there are no walkways/cycleways/shared use paths, for example on the smaller streams, creating an ecologically functional riparian corridor will be the priority. These smaller streams are flood prone and tend to have weedy vegetation on their banks. Access to these streams is limited, as they often lie at the bottom of gullies or behind rows of properties. As such they are unsuitable for community planting efforts and would need to be planted and maintained by professionals.



Figure 30 Example of a type of fish ladder, catering to weaker swimmers such as inanga.

Remove barriers to fish passage

While there are several natural barriers (waterfalls) located on our urban streams there are also a number of culverts and in stream structures that are preventing movement of freshwater species upstream. This interrupts the migration patterns for a number of native species, including those whose juveniles make up the 'whitebait' and native eel species.

In conjunction with NorthTec students, several barriers to fish passage were identified by Northland Regional Council on the Waiarohia and Raumanga Streams in early 2015. Additional barriers in the Upper Hatea catchment were identified mid 2015 as part of a study by Northland Regional Council into water issues upstream of the Whangarei Falls. However the Falls are a strong natural barrier and upstream restoration will have a lesser impact than on some of the smaller, urban streams. Ground-truthing to identify potential barriers in the smaller streams will be necessary and could be undertaken by NorthTec students.

Removal of these barriers will take time and will need to be considered carefully whether the obstruction is removed entirely or a fish ladder is installed to assist fish species to get past the obstruction. Due to the different ways species move against the current, including jumping, wriggling and climbing, there are many different kinds of fish ladders. Generally, by catering to the weakest swimming species, such as inanga, and installing a ladder (e.g. Figure 30) the majority of species will be able to pass. For higher barriers further inland, where weaker swimmers would not be expected to reach, catering to only climbing species may be a more economical option.

Increase Urban Biodiversity

Increase use of trees throughout urban area

Street trees have the additional beneficial effects of reducing the urban heat island through transpiration, and providing shade along pedestrian corridors. These trees need to have a deeper root system that will not warp, or interfere with, the surrounding footpath, roading or nearby buildings. Street trees can be part of general landscaping or they be used as part of green infrastructure elements, to filter pollutants and enhance groundwater infiltration.

Any new park design should consider planting trees in addition to general landscaping, which is often low to the ground to ensure public safety. Trees in pocket parks, recreational parks and along waterways will encourage native species to use the urban area to feed and rest and will act as 'stepping stones' between larger areas of habitat and the ecological corridors bordering the waterways. Trees will also provide shading in parks, and provide additional options for passive recreation.

Increase use of food sources for bird species within landscaping

There are a number of native and exotic species that can be used to provide food sources for our native birds (Figure 31). In order to encourage species to move through the City, away from the ecological corridors provided along the waterways, additional food sources should be considered when landscaping new project sites or parks. Large native trees, such as the Puriri or Taraire, provide a year round food source, as well as providing shading for park users. Smaller plants, such as flax, provide a lower profile option that can be more easily integrated into landscaping.



Figure 31 Kukupa (native Wood Pigeon) in a Taraire tree

*Landscaping along walkways/cycleways
and parks are designed to encourage
native birds to travel through the City.*

PROVIDING OPPORTUNITIES FOR ECONOMIC DEVELOPMENT

Properties with water views have traditionally attracted higher prices. In the Netherlands they have been quantified as attracting prices up to 10% higher than those without a water view (Luttik, 2000). However the views must be attractive, and degraded water features are seen as less desirable. By enhancing the waterways there will be opportunities for landowners to capitalise on increased land value through development.

Mixed use neighbourhoods, such as those proposed for the Hihiaua Precinct, allow residents to live in close proximity to facilities, services and businesses. Low-maintenance medium density housing in an attractive, accessible setting will appeal to the retired sector, which currently makes up 17% of the District's population (2013 census) and will continue to grow as the nation ages. Mixed use development has increased potential over single use development to improve the vitality and attractiveness of an area.

Revitalising urban areas to increase opportunities for economic development is occurring globally. Urban renewal involves taking disused, degraded or underutilised land and infrastructure and revitalising the area to create new mixed use commercial, residential and recreational areas. Urban renewal projects generally result in increased land values and economic activity. Traditionally based around grey infrastructure, urban renewal projects are increasingly incorporating blue/green features.

Case Study: New York High Line



Opened in 2009, the High Line is a green walkway and public park built on an old elevated railway line on Manhattan's West Side. The aim was to preserve the historical values of the site while bringing more greenspace into the city. The project attracts around five million visitors a year and is host to temporary art installations, urban theatre and over 450 community programmes, activities and festivals each year. Seasonal food vendors are present during the warmer months to cater to the tourist market, and spaces along the High Line are rented out for marketing promotions and events. The project also offers paid job opportunities for local teenagers in event production, horticulture, informal education, and civic participation.

Current State

Whangarei has largely ignored the urban streams as an economic asset. The majority of buildings bordering the urban streams face away from the water, and there are few residential developments taking advantage of the amenity values living next to a waterway provides.

The Town Basin area is the exception to this, being the only combined commercial/recreational space facing the water, where the Hatea River joins the Harbour. An information centre (the Hub), marina facilities, motor home parking and a long distance/tourist bus stop at the Town Basin provide easy access for tourists, and businesses in this area cater predominantly to this market. There are a number of general souvenir shops and cafes as well as artisan stores, including a glassworks and kauri carver's store. A regular artisans market is held on the Canopy Bridge during the summer, adding to the number of businesses in the area during peak tourist season.

In addition to commercial operations a number of tourist attractions are located at the Town Basin, including Claphams National Clock Museum, Whangarei Art Museum Te Manawa Toi and the historic Reyburn House, which also hosts an art collection. Future development in this area will include the iconic Hundertwasser and Wairau Maori Arts Centre (HWMAC), adjacent to the Canopy Bridge (Figure 32). It is anticipated that this development will further enhance tourism in Whangarei, particularly around the Town Basin area. These attractions/facilities are connected by the Hatea Loop Walkway, which is a 4.2km shared use path along the lower Hatea River and connects to the Basin to Falls walkway.



Figure 32 Proposed Hundertwasser and Wairau Maori Arts Centre at the Town Basin

The development of the Town Basin area provides a starting point for tourism in Whangarei. The challenge will be to encourage tourism to expand outwards from the Town Basin area. By connecting the tourist attractions at the Town Basin with accommodation, natural features, restaurants and bars tourists will be able to access attractions without needing to use a vehicle.

Increasing the reach of walkways/cycleways/shared use paths throughout the City will enable tourism to develop further, with opportunities for businesses to establish around the waterways and shared use walkways/cycleways/shared use paths. For example there is potential for a Raumanga Falls to Whangarei Falls tourist trail as paths connect these attractions across the City.

Case Study: Seoul, Korea



Cheonggyecheon, an urban drain in central Seoul, Korea, was covered by an elevated freeway in the late 1960s. In 2003 it was decided to pull down the aging freeway, which needed to be repaired or removed for safety reasons, and restore the stream. The freeway separated the north and south districts of Seoul and the surrounding area was degraded. The aims of the project were to improve connectivity between the two halves of the city, create a catalyst for urban development, bring nature into the city and restore historical and cultural values of the site. The project was completed in 2005 and has had a number of benefits for the area. Economic benefits since the projects completion include an increase in businesses adjacent to the stream, land values of adjacent properties increasing up to 50% and increased tourist numbers, both domestic and international. A reduction in the urban heat island effect of up to 6° C and a reduction in air pollution levels has been measured within several blocks of the stream. Traffic flow has also improved.

Retail and hospitality premises or pop-up stalls along the enhanced waterways can capitalise on the increased foot traffic, with the potential to develop an attractive outdoor dining experience facing onto the waterways. This has been achieved to some extent along the Town Basin, but could continue throughout the City.

There is significant potential for mixed use residential development along the waterways, utilising the benefits of the waterside location close to amenities and facilities. The Hihiaua Precinct Plan (2015) provides a blueprint for the future development of inner city living at Hihiaua Peninsula, capitalising on the amenity values of the Hatea River and Waiarohia Stream. Inner city living could be expanded further up the Hatea River and Waiarohia Streams and potentially central areas of the Raumanga Stream. Development of these areas will require careful consideration of flooding effects. Responses to this could include prohibiting basements and underground carparking or prescribing ground floors as non-habitable areas that could be easily cleared following a flood.

The City is attractive and vibrant with people living, working and engaging in activities along the waterways and in our urban parks.

Providing Opportunities for Economic Development

GOALS

Raise the profile of the waterways

Identify opportunities to improve the perception of the waterways

Promote activities along the waterways

Add artistic gateways and associated signage to draw people into the area

Increase tourism development along waterways

Identify opportunities for the development of tourist infrastructure

Provide incentives for tourism investment

Increase commercial/retail and residential development along waterways

Identify opportunities for development of small businesses

Provide incentives for mixed use residential development

Change zoning to ensure that the right land uses are clustered together

Increase interaction between development and the waterways

Encourage active frontages onto the recreational corridor

Improve connections between commercial/retail/residential/recreational space and waterways

Ensure that quality design enhances the waterfront experience

Raise the Profile of the Waterways

Identify opportunities to improve the perception of the waterways

Negative perceptions of the waterways discourage people from accessing adjacent paths, streets and businesses, due to an impression of reduced safety and neglect. This can have a real impact on foot traffic through an area and reduce the appeal of having a waterside business. As impressions of an area improve, the number of people accessing the waterfront and associated businesses will increase, as evidenced by the success of the Hatea Loop, where foot traffic has increased dramatically (Whangarei District Council 2015b; Whangarei District Council 2016b).

There are several key areas along the waterways where people already gather to participate in existing activities. These areas should be enhanced to encourage people to continue along the recreational corridor and increase foot traffic through waterfront businesses outside of existing areas of use. Key areas include the local market spaces (Canopy Bridge and Water Street carpark), youth space (Cafler Park), tourist attractions (Town Basin, Whangarei Falls) and popular recreation areas (Hatea Loop Walkway, Pohe Island). By making these areas more attractive and inviting, people will look at the waterways in a more positive light, reducing the impression of neglect and improving perceptions of safety. Enhancements will need to be physical, focusing on amenity, planting, walkways/cycleways/shared use paths, facilities and rubbish removal.

Improving the perception and foot traffic along the waterways will allow a greater vibrancy to develop in the inner city, enhancing the identity of Whangarei as a destination and a place to live. The tourism industry will be able to use water views and waterfront activities as a marketing tool

for the inner city. Attractive connections along waterways between tourism sites will assist in spreading the benefits from tourism across the City.

Promote activities along the waterways

Whangarei plays host to a number of regional events, which already use parts of the waterway network and recreation corridors. Regular events such as the Sport Northland run/walk series, the International Rally and a number of festivals (Endless Summer, Artbeat, Fritter Festival, Matariki etc.) are a good opportunity to promote the recreation corridors and connect people with the waterways and adjacent businesses.

On a local scale, locating community gardens, fruit trees, fitness stations and play equipment next to the waterways provides active recreation spaces (Figure 33). Pocket parks along the river corridors could provide attractive locations for passive recreation, such as picnics.



Figure 33 Intergenerational fitness station along the Hatea Loop Walkway

Add artistic gateways and associated signage to draw people into the area

Gateways are visual elements highlighting access points and significant features (Figure 34). Gateways are suitable for a variety of areas, but should focus on access points. Gateways to the four main entrances to the City are already in development, and will concentrate on the roading corridor. These will be large scale features, whereas local connections can be smaller in size and more specific to the community they are in.

Local gateways are designed to draw attention to the waterway or cycleway and encourage members of the public or tourists to enter the recreational corridors. They can include artistic features, natural features and amenities or facilities, such as lighting and seating. They will be most effective in tourist hotspots and marking suburban routes to encourage people to access the recreational corridors. Gateways should be meaningful and relate to the social and cultural profile of the geographic area. For example, entry to a waterside park or playground will have bright colours and be attractive to children, whereas those marking access to a nature walk should feature a design reflecting the natural history of that area. Other designs could be utilized as a tool to recognise and provide for the relationship of tangata whenua to a particular site.



Figure 34 Examples of a variety of different gateways drawing attention to walkways and parks

It is important that gateways enhance the identity of a location and are striking enough to draw people's attention. Gateways should contain signage to highlight connections and features within a short distance. This can be used to promote business and tourist attractions and assist tourists with wayfinding.

Increase Tourism Development Along Waterways

Identify opportunities for the development of tourist infrastructure

In addition to private enterprise, Council is able to influence the development of tourism infrastructure and attractions. Upgrades to local public infrastructure can be used to create identifying landmarks and enhance the tourist experience, whilst providing amenities and facilities for use by locals. When upgrading existing infrastructure, or designing new projects, such as bridges, buildings and facilities, which are primarily for local use, projects can be designed to be architecturally striking, providing an iconic image or attraction for the tourism market, while providing necessary functions. For example the Te Matau a Pohe Bridge (Figure 35) is an award-winning, iconic design in addition to being an important roading link for local commuters.



Figure 35 Te Matau a Pohe Bridge



Figure 36 Concept image of Hihiaua Cultural Centre

Council owned land that is currently underutilised, or aging buildings that need to be updated, could be redeveloped to provide tourist infrastructure or attractions, where appropriate. The City is currently lacking in accommodation facilities that can house a number of people, which means that the City currently cannot tap into the conference market. An increase in high quality hotel accommodation with a large number of rooms would enable the City to host larger and more lucrative conferences. Increasing the number or size of current conference facilities to host larger events will also assist in attracting conferences to the District. Council can identify where public land could be used for the development of these facilities, some of which have been identified in the Whangarei 20/20 Momentum document.

Provide incentives for tourism investment

Where private enterprise is interested in developing tourist attractions and opportunities, Council should encourage this interest and facilitate their development where appropriate. Financial incentive options on private land could involve reducing development contributions or rates relief during the build phase. Private developments could take place on council land, as is the case with the proposed HWMAC and Hihaua Maori Cultural Centre (Figure 36). Grants could be provided for community led developments and options such as lower lease rates could be considered.

Increase Commercial/Retail and Residential Development along Waterways

Identify opportunities for development of small businesses

Where Council owns land, the best use of that land needs to be considered. Carparks, parks, reserves and disused plots of land can all be

used for multiple purposes, including small business operations. By identifying places where small businesses could develop on council land, and the type of business appropriate for the area, Council can then seek interested parties to develop these opportunities further.

For example, Council is currently seeking suggestions from the public and interested parties on business ideas for particular sites on the Hatea Loop Walkway. Bascule Park, a combined carpark and rest stop on the Walkway, was identified as an appropriate location for a pop-up type cafe, due to its fit with the other facilities proposed to be located in the park, and position on the Hatea Loop Walkway away from similar businesses. Pohe Island, the site of a former landfill and currently largely open space, has been identified as a recreational space, with tourism and recreational activity businesses identified as appropriate for the location.

Provide incentives for mixed use residential development

Council has identified areas where inner city living is desirable through the Hihiaua Precinct Plan and the draft Inner City Development Plan. Much of this land is owned by Council or the Northland Regional Council, although the buildings and leases are privately owned. Incentives for development could include sale of underlying council land on completion of a mixed use or residential development or long term leases with low land lease rates. Other areas adjacent to restored waterways may become more suitable for mixed use residential development over time as amenity values improve and demand for inner city living increases. As waterways have been restored in overseas cities and amenity increased, demand for adjacent high-quality housing has often increased. By increasing amenity and kickstarting mixed use residential development in the urban area on its own properties, Council can encourage adjacent landowners to follow suit as demand increases.

Change zoning to ensure that the right land uses are clustered together

Zoning will need to be considered as part of the District Plan review to ensure that mixed use developments in the inner city are possible. A number of light industrial and trade services premises are currently occupying prime waterside locations, which could be better served as mixed use neighbourhoods. The Town Basin and Hihiaua Peninsula are one of the few areas in the City where quality medium density, mixed use development can be accommodated. Desirable waterfront accommodation is lacking and bringing this into the City will revitalise the inner city and support new retail and commercial activities. Reverse sensitivity, urban design and land use will need to be considered when re-zoning the inner city. Council's long term planning initiatives, such as the Inner City Development Plan (under development), need to make provision for mixed use residential development to occur along waterway corridors as demand arises.

Increased Interaction between Development and the Waterways

Encourage active frontages onto the recreational corridor

Active frontages are those that encourage activity and allow passive surveillance of the public area. From a commercial point of view this includes commercial activity at street level, interaction with public space through outdoor seating areas (particularly for cafés), window displays and entrances. For residential buildings this includes entrances fronting onto public space, balconies and windows providing surveillance and permeable fencing adjacent to the public space to increase sight lines.

Improve connections between existing commercial/retail/residential/recreational space and waterways

Increasing connectivity between commercial zones and the recreational corridors will increase foot traffic to businesses. Since the Hatea Loop Walkway was established usage of the space around the loop went up 132% (Whangarei District Council, 2015b) and door counts into Claphams Clock museum and the HUB a year after the loop was opened increased by 11% and 26% respectively (Whangarei District Council, unpublished data). The second year after opening saw a 15% increase in users on the previous year (Whangarei District Council, 2016a). Increasing access to premises further away from the recreational corridor will encourage people to visit businesses and attractions. Increased connectivity will assist with raising awareness of where businesses, attractions and facilities are and what services are available.

Off road paths along the waterways will also increase awareness of distance between locations and provide alternative routes away from traffic. There is less than 1km between the three central shopping areas of Okara Park, the Town Basin and the CBD. This equates to approximately 10 minutes or less of walking time. Pedestrian routes away from the recreational corridors can be established by creating streetscapes with high amenity and attractive viewshafts, which encourage pedestrian movement. Increased connectivity along the waterways between attractions will assist in spreading the economic benefits of tourism across the City, rather than concentrating activity in a few zones.

Ensure that quality design enhances the waterfront experience

Quality design is needed when creating new developments or repurposing land to ensure that amenity is high. Buildings adjacent to the

recreational corridors need to enhance and promote the waterways as a destination for living, working and relaxing. Active frontages are important in maintaining vibrancy and activity along the waterways, which increases the perception of safety. Urban design guidelines are being formulated for the Hihiau Plan Change and the Inner City Development Plan. These will include guidance on interaction between buildings, particularly mixed use residential developments, and public space along the waterways.

Quality landscape design is also required when implementing physical improvements, such as flood protection measures or infrastructure projects. These features should enhance the amenity of the area, creating an aesthetic experience serving functional purposes.

Commercial

Commercial premises should interact with the recreational corridor via access, outdoor seating and window displays. Street fronting businesses should provide either entrances or large windows which front onto the waterway and recreational corridor. Large impermeable walls close to the recreational corridor should be avoided.

Mixed-Use Residential

Commercial areas on ground floors interact with public spaces, residential units overlook the public space. Permeable fencing assists with maintaining sight lines, whilst separating the private and public spaces. Ground level dwellings have separate entrances.

Recreational/Tourist

Recreational activities and tourist sites fronting onto the street should have additional entrances and ticketing sites fronting the public space along the waterways. Seating should be provided along the recreational corridor outside of sites to encourage activity and surveillance.

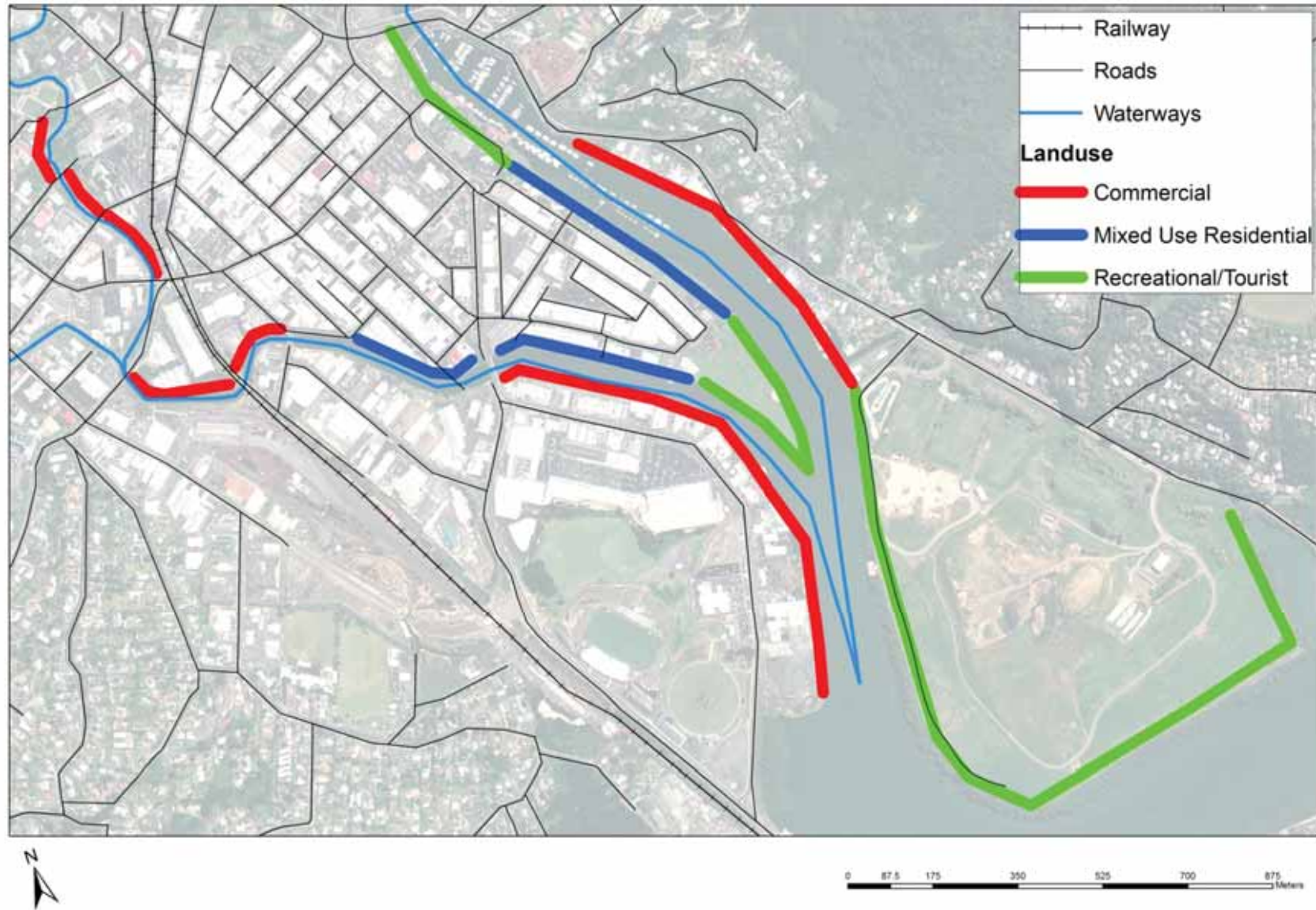


Figure 37 Land use activity along waterfront where active frontage and interaction is needed



Figure 38 A vision of the future - residential units along the Waiarohia Stream at Hihiaua

PROTECTING OUR COMMUNITIES FROM NATURAL HAZARDS

Case Study: Isar River, Munich, Germany



The Isar River was dechannelized to provide improved flood protection with additional recreation benefits for citizens. The channel has been widened and a more natural shape has been established. The project included increasing flood protection, creating a public beach, bank re-grading, weir removal, river bank planting and installing water disinfection systems to improve quality.

Recently, flood control internationally is moving away from highly channelized systems to a more natural approach to stormwater control and flood corridors. Contouring the land around waterways and coastal areas is a well established form of combating flood risk. Wider channels and naturally sloping banks increase the capacity of rivers to carry flood water. Previously channelized and piped waterways are being returned to a more natural state to combat flooding, heat island effects and low water quality, whilst providing enhanced amenity, recreational opportunities and improved biodiversity.

As most urban areas have a high level of impermeable surfaces (roads, roofs, car parks etc.) short term flooding events are common. Traditionally flood protection and stormwater infrastructure has involved grey infrastructure – piping and channelizing waterways to increase the flow speed and get the water through as quickly as possible.

Green infrastructure is increasingly being used over traditional grey infrastructure (pipes etc.) for the multiple benefits they offer. For stormwater this means combining runoff control and improving water quality through increased infiltration and removal of sediments and pollutants from stormwater before it enters watercourses. This is usually through planted features or increasing permeable surfaces. Wetlands (natural and created) have a dual use in managing stormwater and providing protection from coastal inundations. Mangroves are also beneficial in reducing the height of storm surges.

Current State

Whangarei City centre has a history of flooding. The construction of the Hopua te Nihotetea Dam alleviates some of the flooding risk for the city centre for up to a 50 year event, with the exception of Commerce Street and the junction of the Raumanga and Waiarohia Streams. The suburb of Morningside is also at risk. For a more extreme event, such as a 1 in 100 year event, the city centre is still at high risk of flooding (Figure 39). The modelling around this only reflects waterways overtopping their banks and does not take into account overland flow from stormwater or coastal surges. When these are considered, it is clear that further measures to address both waterway capacity and stormwater issues need to be taken. While insurance can cover flood damage to property, the impact on businesses and communities will need to be considered when investigating options.

The Waiarohia Stream presents an opportunity to develop flood protection around the Harbour area and through the CBD. A 'greenway' concept was originally proposed in 2006 (URS, 2007). This would involve widening the channel of the stream and creating sloping, staged banks. The concept originally included the Waiarohia and Raumanga Streams, with a channel width of up to 37m. With the construction of the dam this can be refocused to the Waiarohia Stream from the Intermediate School to the Harbour, with reduced widths. Higher flood berms or walls could be constructed in coastal zones to account for coastal surges. The stormwater network throughout the city centre will need to be investigated and upgraded where appropriate to ensure that stormwater and overland flow do not contribute to additional surface flooding.

Climate change will create additional challenges globally for the management of natural hazard events. By the end of the century it is

predicted that in Whangarei we will be living in a warmer, drier city. However, an increase in the frequency of high intensity rainfall events may increase flood risk, through both waterway capacity and overland flow. A predicted sea level rise of approximately 1m may exacerbate the issue by creating an additional risk of storm surge and coastal inundation. A king tide combined with a high intensity rainfall event could cause major flooding and therefore further flood prevention strategies are required in the long term.

Case Study: Dryline, Manhattan



Originally unveiled as "The Big U" concept in June 2014 to protect Lower Manhattan from the effects of climate change, the Dryline is currently in the planning process, with construction due to start in 2017. As part of the original concept, a berm was proposed which would raise the bank height along the East River by 9 feet, increasing the capacity for storm surges to levels above what was experienced with Hurricane Sandy. The berm would be used as a public park with good amenity and connection to other parts of the city. Additional options, including deployable flood walls, are also being considered in places.

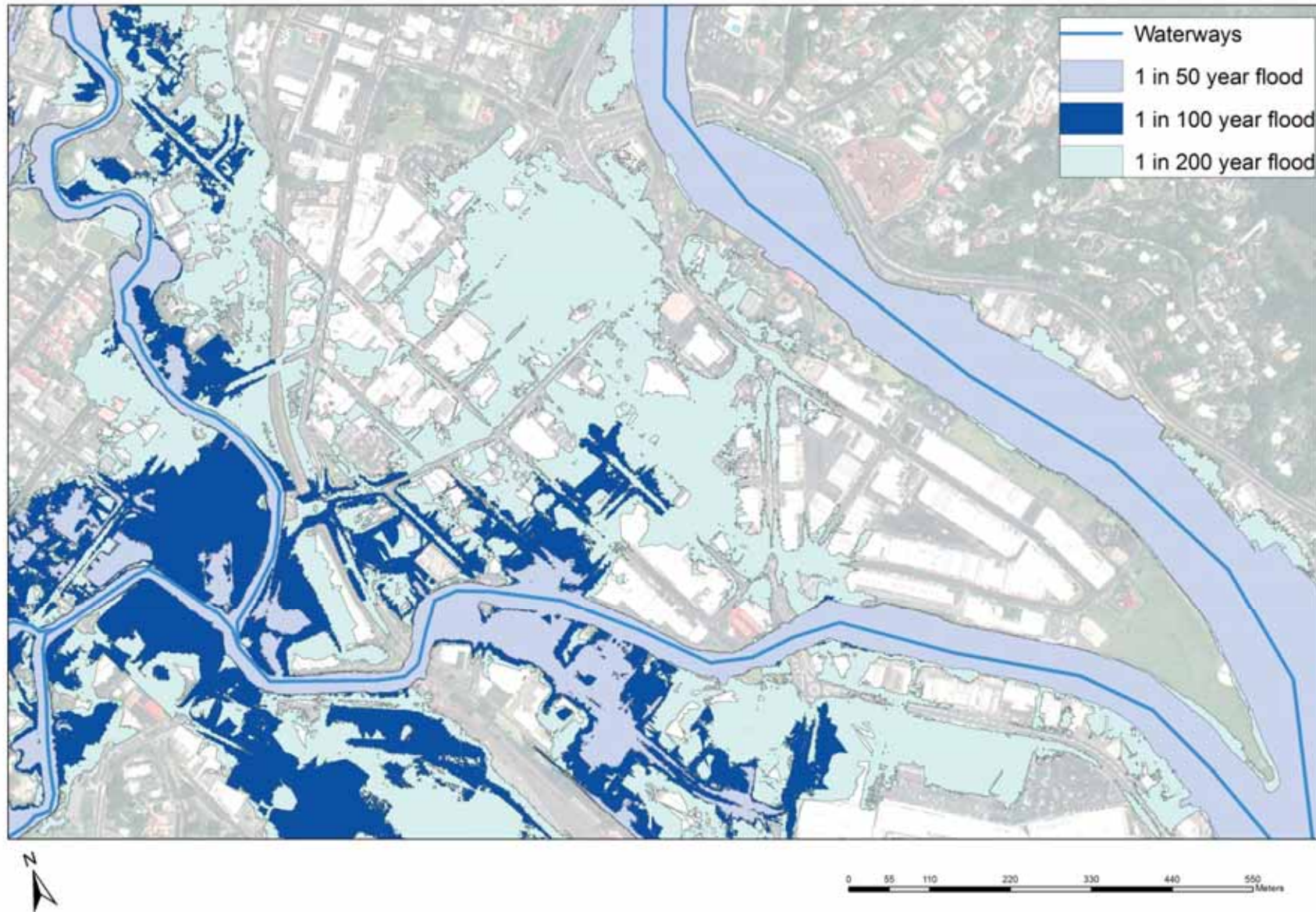


Figure 39 Flooding extent by return period for the City, post completion of the Hopua te Nihotetea Dam. Note this does not include inputs from runoff or coastal surges



Figure 40 A vision of the future – Waiarohia Stream downstream from Woods Rd Bridge - Flood protection measures are integrated with shared use paths

Protecting our Communities from Natural Hazards

GOALS

Enhance waterway flood capacity

Identify areas where increasing channel capacity is desirable

Identify opportunities to acquire land to undertake flood protection works in future

Protect against climate change and sea level rise

Identify areas under additional pressure from climate change predictions

Take into account predicted sea level rise in hazard assessment and mitigation

Reduce overland flow/surface flooding from stormwater

Identify areas where green infrastructure could reduce stormwater loading

Improve stormwater network capacity in areas where green infrastructure is inappropriate

Enable safe public access

Ensure that flood protection structures do not inhibit access to the waterway or prevent fast exit should the need arise

Ensure that entries/exits to the cycleway/walkway are safe and located at regular intervals to increase accessibility

Establish a warning system to let users of waterways and adjacent walkways/cycleways/shared use paths know when it is unsafe to use those areas

Enhance Waterway Flood Capacity

Identify areas where increasing channel capacity is desirable

Wider channels allow rivers to resume a more natural meander and allow additional capacity for water during floods. Widening channels in urban areas is often not an option for increasing flood capacity due to the proximity of structures, buildings and businesses on adjacent land. Channel widening should focus on areas where waterways are constricted and few properties are directly affected (Figure 41).

In addition to directly widening streams, sloped banks with stages can also provide additional capacity for flood waters and coastal inundations from storm surges. When not in flood the intermediate platform can be used to accommodate shared use paths, vegetation or access for maintenance. Creating additional staged platforms is often easier to undertake in a built up environment as it generally involves flattening out a portion of the existing sloped section of the stream bank. When the waterway edge has been modified to create a hard edge, more modification will be required and land will be lost in the creation of the additional stage. This option provides multiple use platforms, and costs of creating the additional flood capacity can be offset by building cycleways and infrastructure at the same time.

Higher berms, or hard floodwalls, can be created to provide additional protection against high water levels. This option will need to be considered where constraints, such as location of the roading network, limit horizontal capacity creation options. Flood walls can be permanent structures or deployable during likely flood events and high intensity storm events. They can be retrofitted to existing infrastructure if required and are likely to be needed in the coastal environment.

Identify opportunities to acquire land to undertake flood protection works in future

Flood protection often requires widening channels or building structures on occupied land. Identifying future risk areas and locations where flood protection works will become necessary provides agencies with sufficient time to acquire appropriate land resources as required. Where multiple properties are required it is an expensive undertaking. This will need to be done when considering design options for the identified capacity increase projects.

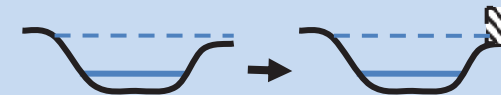
Channel Widening

This area is where excavation is required to extend the width of the river corridor, down to the water level. Widening will allow additional channel capacity through horizontal expansion. Properties may need to be purchased or removed to facilitate widening.



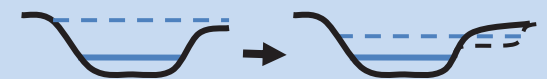
Flood Wall/Stopbank

These areas are where flood protection structures are needed to raise the bank height. These structures will be added to the existing bank and will increase flood capacity through additional vertical height of the channel.



Staged with Pathway

These areas are where the upper bank will be benched down to create a middle stage, which can be used for walking and cycling infrastructure and maintenance access. This increases capacity through horizontal expansion.



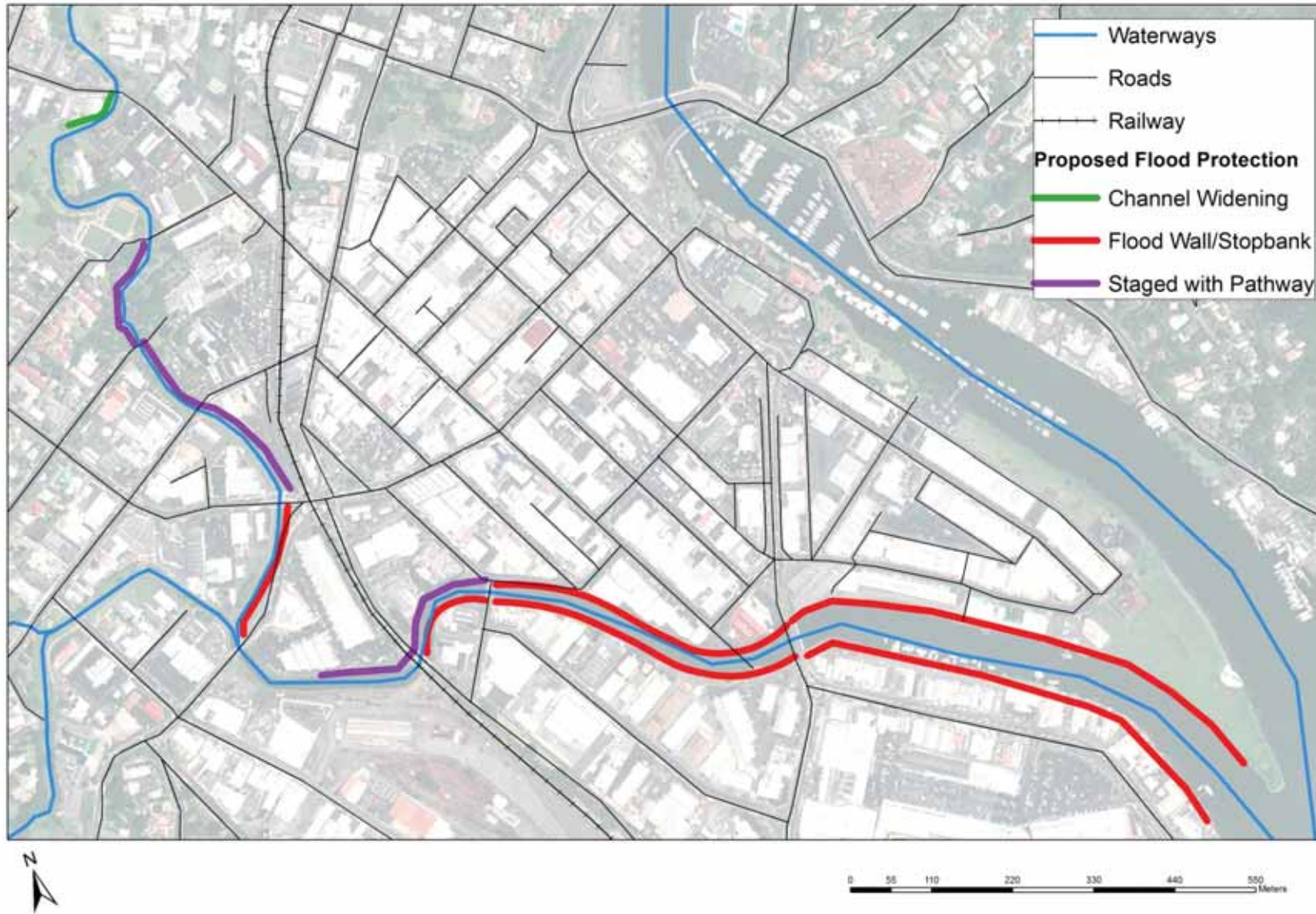


Figure 41 Areas where future flood protection is required and potential options for remediation subject to investigation

Protect Against Climate Change

Identify areas under additional pressure from climate change predictions

Climate change predictions for Whangarei include sea level rise of 1m by the end of this century and an increase in high intensity rainfall events. With this comes an increased risk of flooding, through overtopped waterways and stormwater runoff, throughout the inner city and coastal storm surges up the lower Hatea River and the Waiarohia Stream.



Figure 42 Lower Waiarohia Stream at Woods Rd Bridge

Much of the land adjacent to the lower Waiarohia Stream below the confluence with the Raumanga Stream is under 2.5m above sea level (Figure 42), and already at risk of storm surge damage (Northland Regional Council, unpublished data). The properties on the true right bank adjacent to the Waiarohia Stream along Woods Road, Commerce Street, Port Road and Okara Drive will be particularly vulnerable to the effects of climate change under the potential 1m sea level rise by the end of the century. Parts of Albert Street and a service lane parallel to Herekino Street on the true left bank are also at risk, and breaches of

floodwater through these areas would likely lead to further flooding inland. A high intensity storm event combining floodwaters with a storm surge could lead to increased widespread flooding through this commercial and light industrial area in the future, resulting in economic loss and detrimental environmental effects. The nature of the businesses in these areas means that any flooding will flush a number of pollutants, including heavy metals, oils and grease, into the upper Harbour.

Take into account predicted sea level rise in hazard assessment and mitigation

Further investigation into the likely risk areas will need to be undertaken. The Northland Regional Council is undertaking coastal hazard mapping, which will identify areas under threat from climate change sea level rise predictions. There are a number of flood and storm surge protection options that could be considered. Flood walls or berms are likely to be required in some places due to the constraints of land use in the area. In addition to hard structures, mangroves and wetlands can provide some protection from storm surges and coastal inundation. However, for mangroves to be effective they need to occupy a large, continuous area, but are often removed to improve views and enhance the amenity of an area. This is unlikely to be appropriate in the urbanised Waiarohia Stream, but may be an option in the lower Hatea River, which is not as low lying. In some cases adequate flood protection may not be possible and it may be preferable to encourage businesses to move to new sites and retire the land to a park or floodwater/stormwater retention area. It will also be necessary to consider restrictions on buildings and land use in these areas to reduce the effects that storm surges and flooding will have on the City and upper Harbour. This can be done through the District Plan review.

Reduce Overland Flow/Surface Flooding From Stormwater

Identify areas where green infrastructure could reduce stormwater loading

Traditionally, flood protection and stormwater infrastructure has involved grey infrastructure – piping and channelizing waterways to increase the flow speed and get the water through as quickly as possible. Overland flow from roads and carparks can cause surface flooding in high rainfall events, where the piped network becomes blocked or overloaded. Increasing the permeable surface area, or infiltration zone, allows for water drainage outside of the piped system. There are a number of green infrastructure features that can be used to assist in infiltration and retention of stormwater. These features increase the permeable surface available and infiltration space and are positioned to intercept stormwater coming off impermeable surface such as roads, carparks and buildings. They can be used in isolation or combined to form a sequence of features to increase infiltration and reduce overflow (Figure 43).

Bioinfiltration elements, such as swales (gutters), bump-outs (curb extension) street trees, rain gardens and planters (footpaths) are all vegetated features which are set at a lower-than-street level with infiltration ramps to guide water into the feature and overflow into the piped system. Planting is done into a shallow layer of soil with porous material underneath to absorb and filter water into the ground. Green roofs can also be used to reduce the stormwater loading coming off buildings by as much as 80%.

Retention ponds or wetlands, which require a large amount of space, are another option for retaining additional water before it enters the piped

system, however these are difficult to implement within an urban area. Water retention cells or water holding chambers, which are open to the ground, can also be used to assist infiltration. These structures can be placed under concreted areas to further increase the infiltration zone.

Pervious pavement, roading or walkways/cycleways/shared use paths are paved area that are either constructed of a porous substance or have gaps between pavers. This allows for water to infiltrate through the surface or between pavers and absorb into the ground, reducing overland flow into the stormwater system. An additional porous stone layer below the paving helps retain structure and store stormwater. The downside to these products is that they have a high whole of life cost, and where there is a sediment issue, they tend to block up and need to be replaced on a frequent basis.

Areas that would benefit from green infrastructure elements to reduce stormwater loading are those with high levels of impervious surfaces, such as carparks, areas that are prone to surface flooding away from the waterways, and areas where stormwater runs directly into the waterway through overland flow.



Figure 43 Series of stormwater planters, Portland, Oregon

Improve stormwater network capacity in areas where green infrastructure is inappropriate

Where additional infiltration is not possible through green infrastructure, the piped network will need to be looked at to ensure there is enough capacity to cope with high intensity rainfall events and potential inundation due to rising sea levels and storm surges. Stormwater pumping may need to be considered in tidal areas. While installing larger pipes is an option, this is expensive and involves digging up existing assets to upgrade them. Ensuring that the existing network does not get blocked and runs efficiently should be a priority. Gross pollutant traps can assist with this throughout the catchment, however during high intensity events the majority of in-line systems will be bypassed due to high flow rates.

Another option is to increase stormwater retention areas. These are areas that act as temporary reservoirs in flood conditions. Internationally, it has been recognised that these reservoirs can be used for additional purposes, such as amphitheatres or skate parks (Figure 44).



Figure 44 Stormwater retention ponds double as a skatepark, Roskilde, Denmark

Ensure Safe Public Access

Ensure that flood protection structures do not inhibit access to the waterway or prevent fast exit should the need arise

Ideally, flood protection structures should not impede access to the waterway. In some areas, higher berms or barriers may be needed to combat the predicted effects of climate change and it is in these areas where innovative design will be needed to ensure accessibility requirements are still met.

Ensure that entries/exits to the cycleway/walkway are safe and located at regular intervals to increase accessibility

Access points to the waterway paths should be located near key community features (schools, parks, services, retail etc.) and at regular intervals to ensure that access to the recreational corridor is maintained.

To ensure that accessibility needs are met, low gradient entryways of less than 5% will be required on major routes deemed accessible for mobility impaired users. For routes with a lower level of accessibility, e.g. walkways, a steeper gradient can be used.

Establish a warning system to let users of waterways and adjacent walkways/cycleways/shared use paths know when it is unsafe to use those areas

Some walkways/cycleways/shared use paths will sit in the flood corridor and will need to be signposted as potential risk areas. These could be as part of permanent signage or temporary signage when expecting a flooding event. This is particularly important for tourist routes, as locals are less likely to use the walkways/cycleways/shared use paths in adverse weather.

BLUE/GREEN NETWORK PLANS



Figure 45 Whangarei City as viewed from Mt Parihaka

THE NETWORK

This section contains a map of the overall future network (Figure 46) and information on individual sections of the waterways, associated major pathways and major non-riparian pathways, broken down into the following:

- Major Waterways
 - Hatea River
 - Upper Hatea Link
 - Hatea Recreation Corridor
 - Hatea Loop
 - Raumanga Stream
 - Raumanga Recreation Corridor
 - Waiarohia Stream
 - Upper Waiarohia Stream
 - Waiarohia Recreation Corridor
- Minor Waterways
 - Te Hihi Stream
 - Kirikiri Stream
 - Otangarei Stream
 - Otangarei Link
 - Waikoromiko Stream
- Cross-City Connections
 - Kamo Route
 - City Link
 - Maunu Connection
 - Hopua te Nihotetea Dam Loop

Each section will cover elements of the four themes that need to be considered for that waterway or route (illustrated adjacent) and an

associated map. Waterway profiles will give an indication of what proposed sections could look like in cross section (Figure 47, Figure 48, Figure 49). Additional pathways (identified in theme one) will create minor connections and will not be addressed in detail.



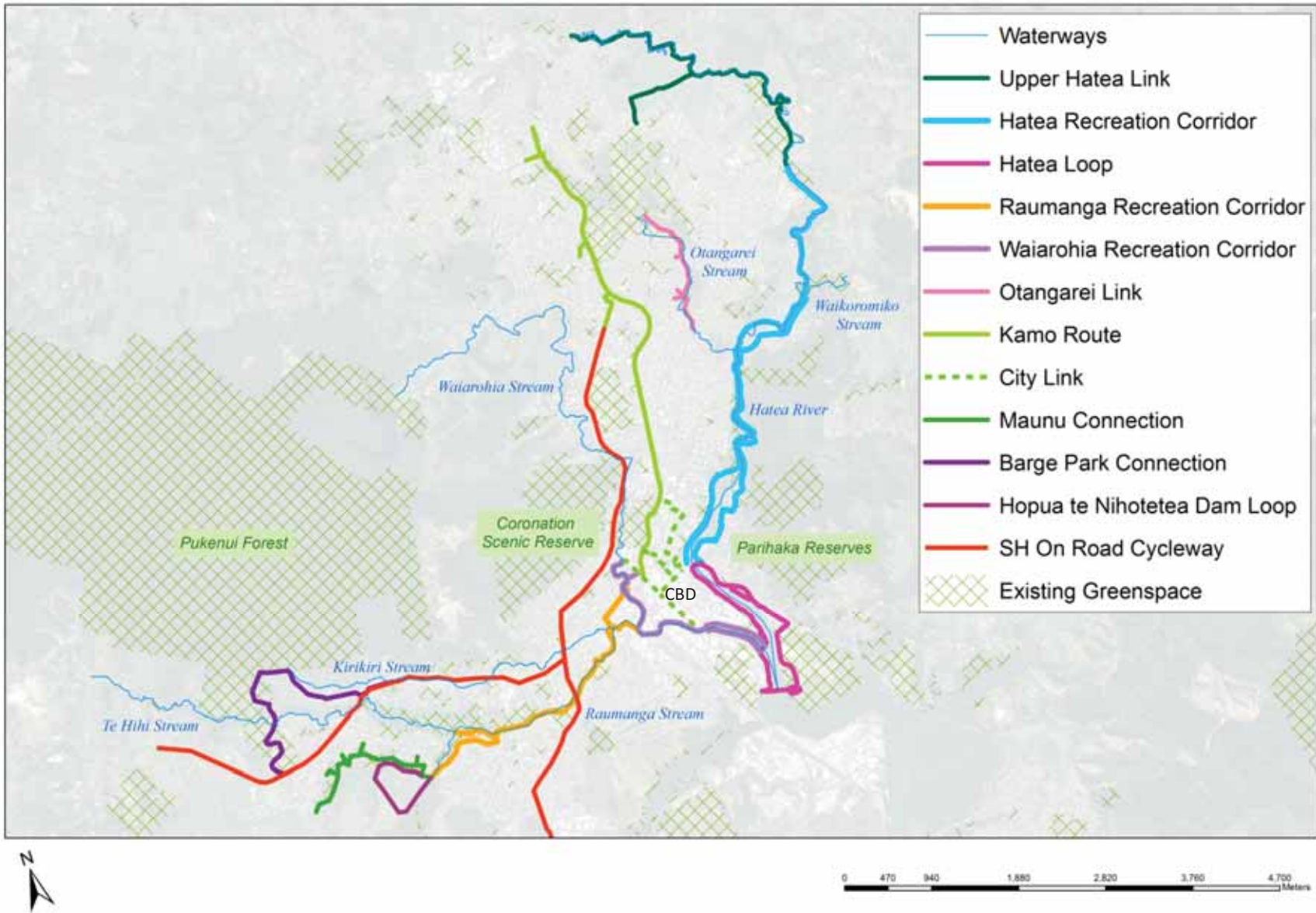


Figure 46 Blue/Green Network - waterways and pathways

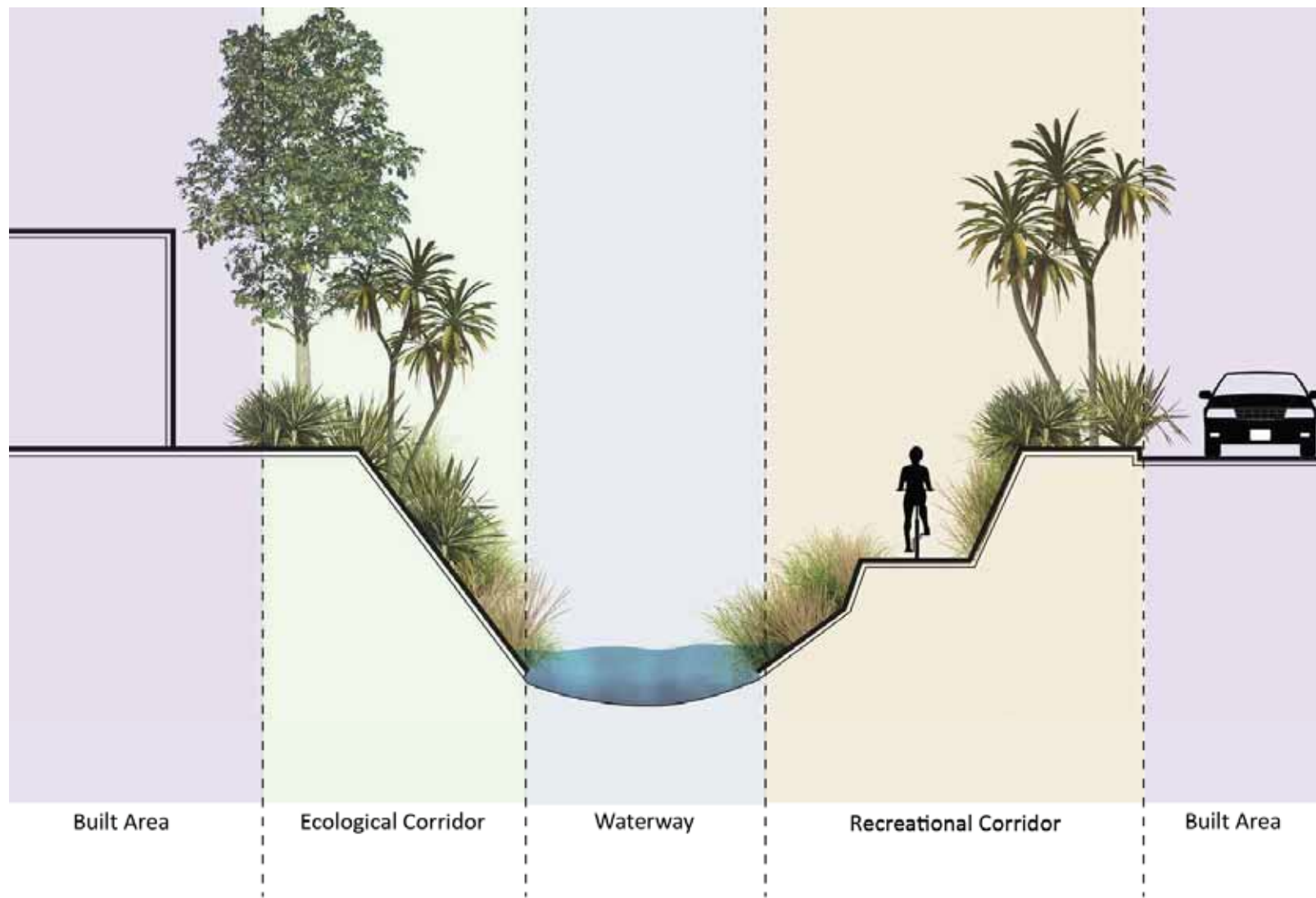


Figure 47 Waterway Profile 1 - Staged Pathway

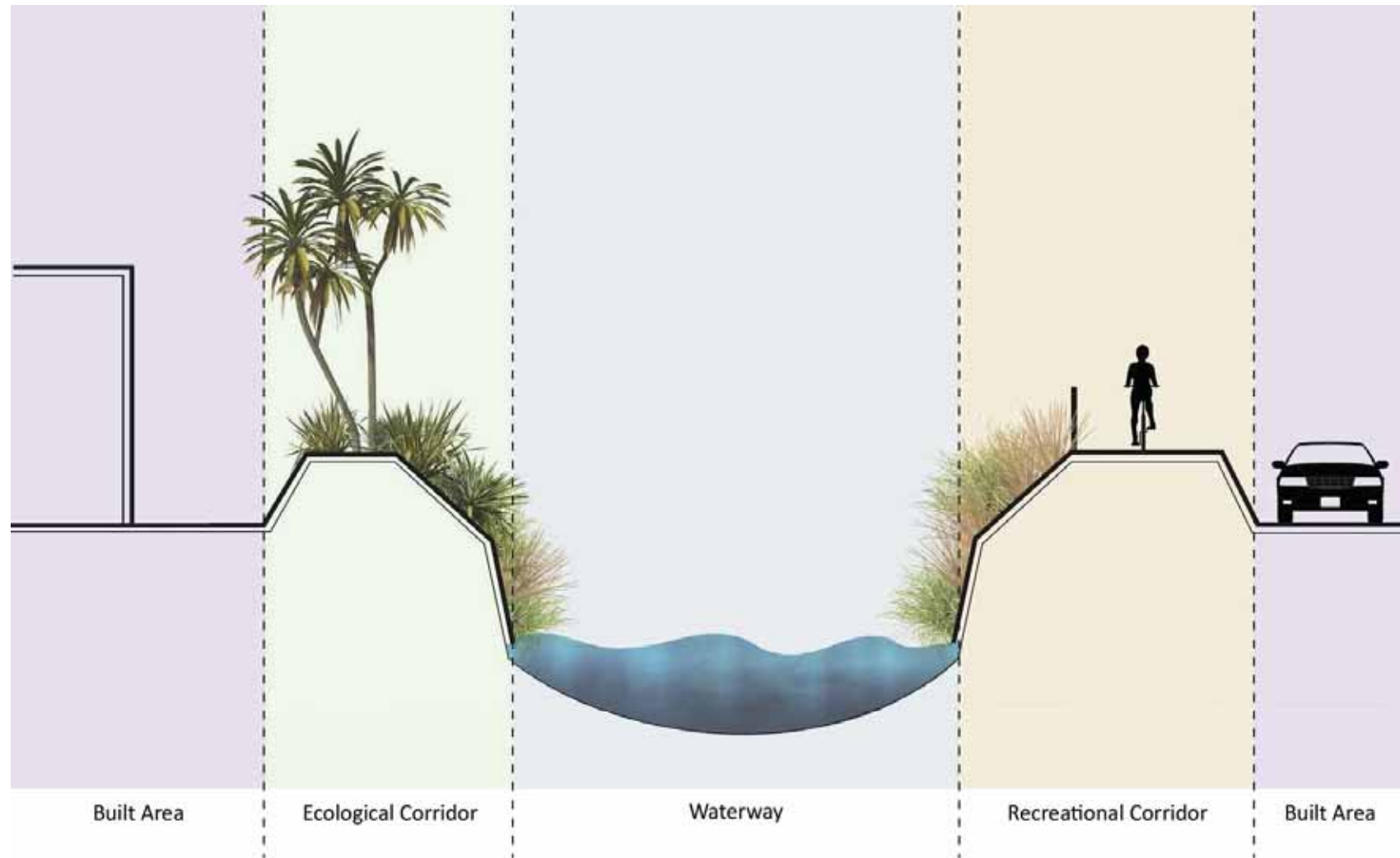


Figure 48 Waterway Profile 2 - Flood Wall/Stopbank

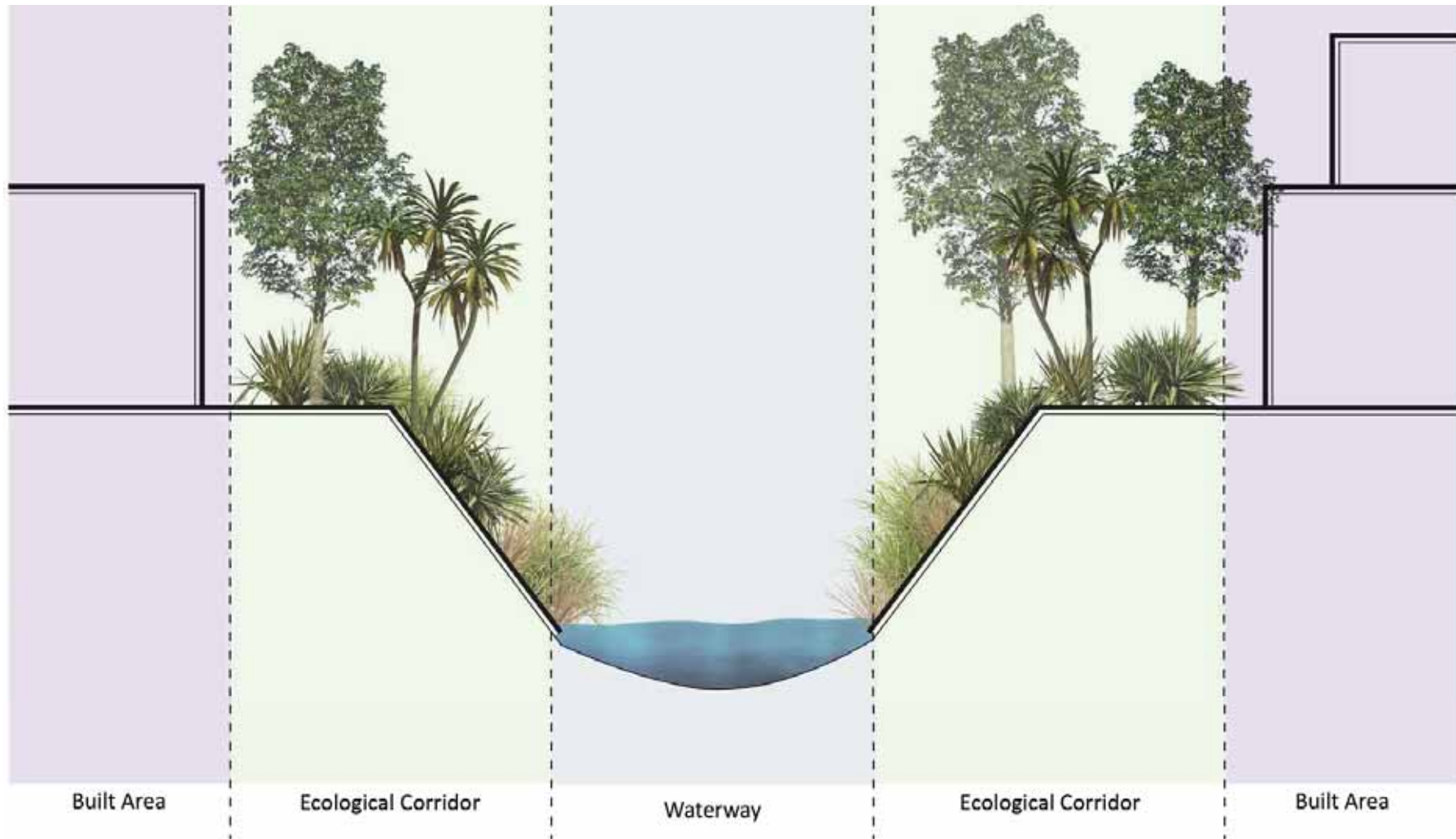


Figure 49 Waterway Profile 3 - Riparian Vegetation

MAJOR WATERWAYS

The Hatea River, Raumanga Stream and Waiarohia Stream are the major arterial waterways flowing into the Harbour. They have a lot of potential to become ecologically functioning, recreational corridors to move people and fauna through the City.

Three recreational corridors have been identified along each of the waterways. These will be primary routes for commuting and recreation with a good level of service.



Figure 50 Hatea River



Figure 51 Raumanga Stream



Figure 52 Waiarohia Stream

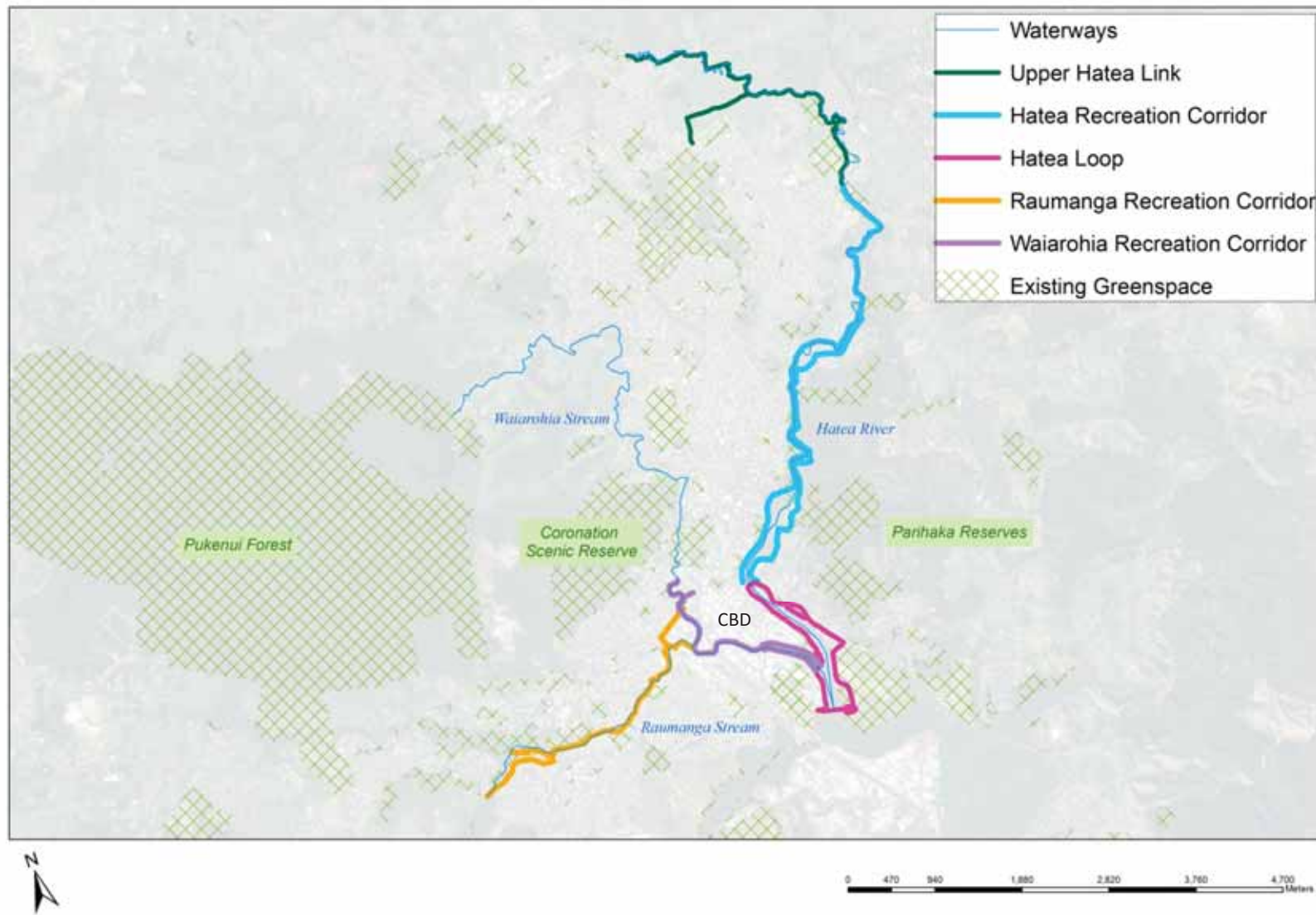


Figure 53 Major waterways and associated pathways

Hatea River

The Hatea River begins as the Waitaua Stream in Kamo, skirting the edge of residential and lifestyle blocks. Below the Whangarei Falls is a large area of forested reserve land on the slopes of Mt Parihaka. The river enters the Harbour at the Town Basin.

Upper Hatea Link

This section of the river runs between Gillingham Road and Kiripaka Road above the Whangarei Falls. The area is currently semi-rural, however as the Totara Parklands real estate development progresses, this will become a suburban area with a need for additional facilities. The reserve land at Gillingham Road is large enough to accommodate additional facilities such as a picnic area, children's playground, community gardens or fitness stations.

A pathway is proposed to run along the waterway on the true right bank from Gillingham Road to the Whangarei Falls, connecting to the Totara Parklands development. This is largely council reserve land, with the exception of the section owned by Totara Parklands. The proposed pathway will connect residents with schools, sportsgrounds and existing walkway infrastructure below the Whangarei Falls.

Community planting has finished at Balmoral Reserve along the proposed route (Figure 55) and planting will commence at the new site at Gillingham Road in 2016 (Figure 56). The waterway profile will likely be Profile 3 (Figure 49), with a pathway set back from the planted riparian zone. A small wetland will be located adjacent to Gillingham Road.

There are currently few residential properties in the area, the majority of which are some distance from the waterway. However, the Totara Parklands residential development is under construction adjacent to the waterway and an increase in the number of dwellings is expected over the next 5-10 years.

Flood protection is not currently an issue for this section of the river, however there are opportunities for small wetlands to be located along the waterway, which could increase the capacity of the stream to hold water, while improving water quality.



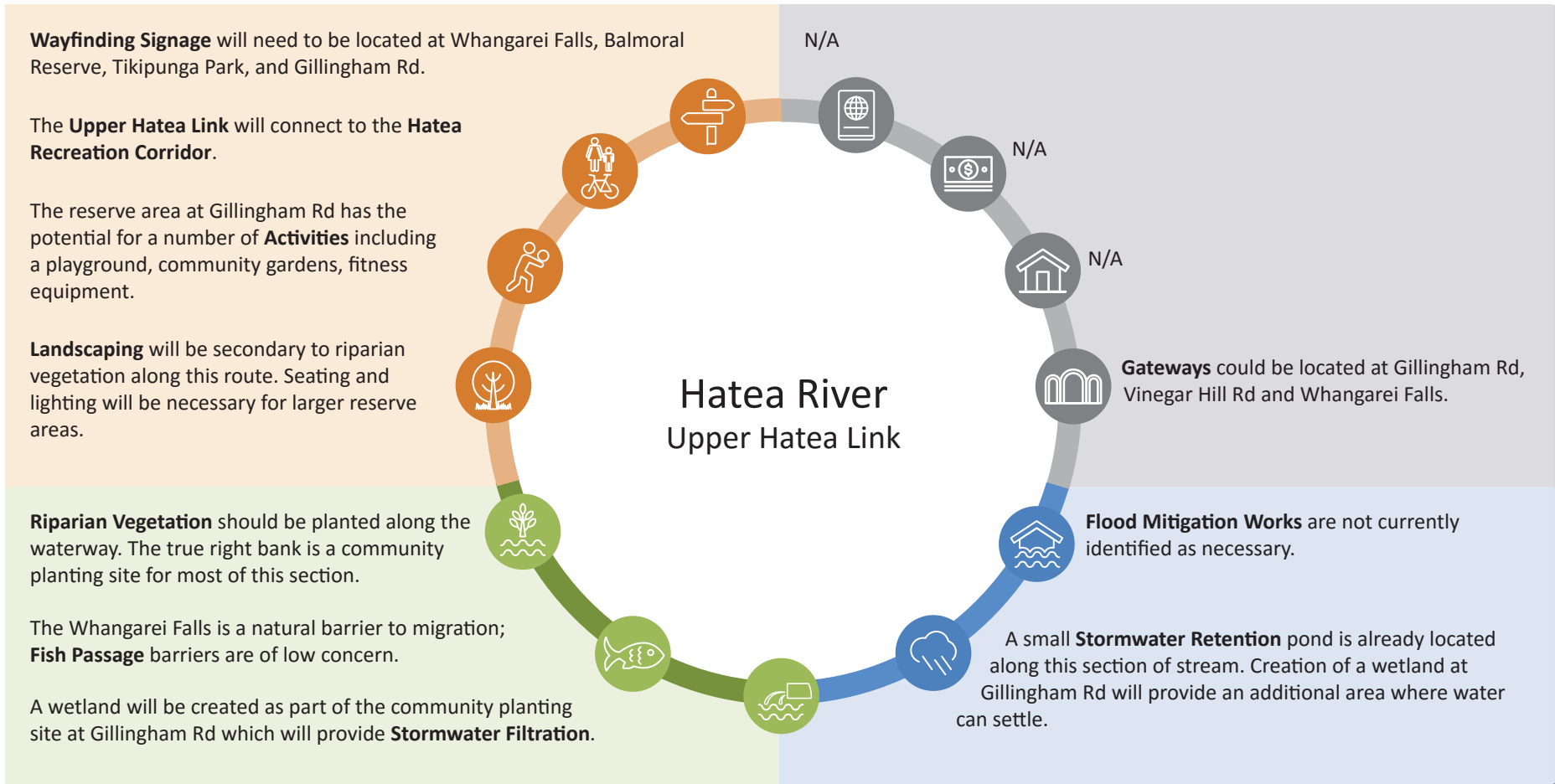
Figure 54 Whangarei Falls



Figure 55 Planting at Balmoral Reserve - 2011 (prior to planting), 2013 and 2015



Figure 56 Community planting site at Gillingham Rd 2016 prior to planting



EXISTING FEATURES



Education

- Totara Grove Primary School
- Te Kura Kaupapa Maori O Te Rawhiti Roa
- Tikipunga High School



Greenspace

- Whangarei Falls Scenic Reserve
- Balmoral Reserve
- Beazley Park
- Tikipunga Park
- Reserve land at Gillingham Rd



Sites of Interest

- Whangarei Falls

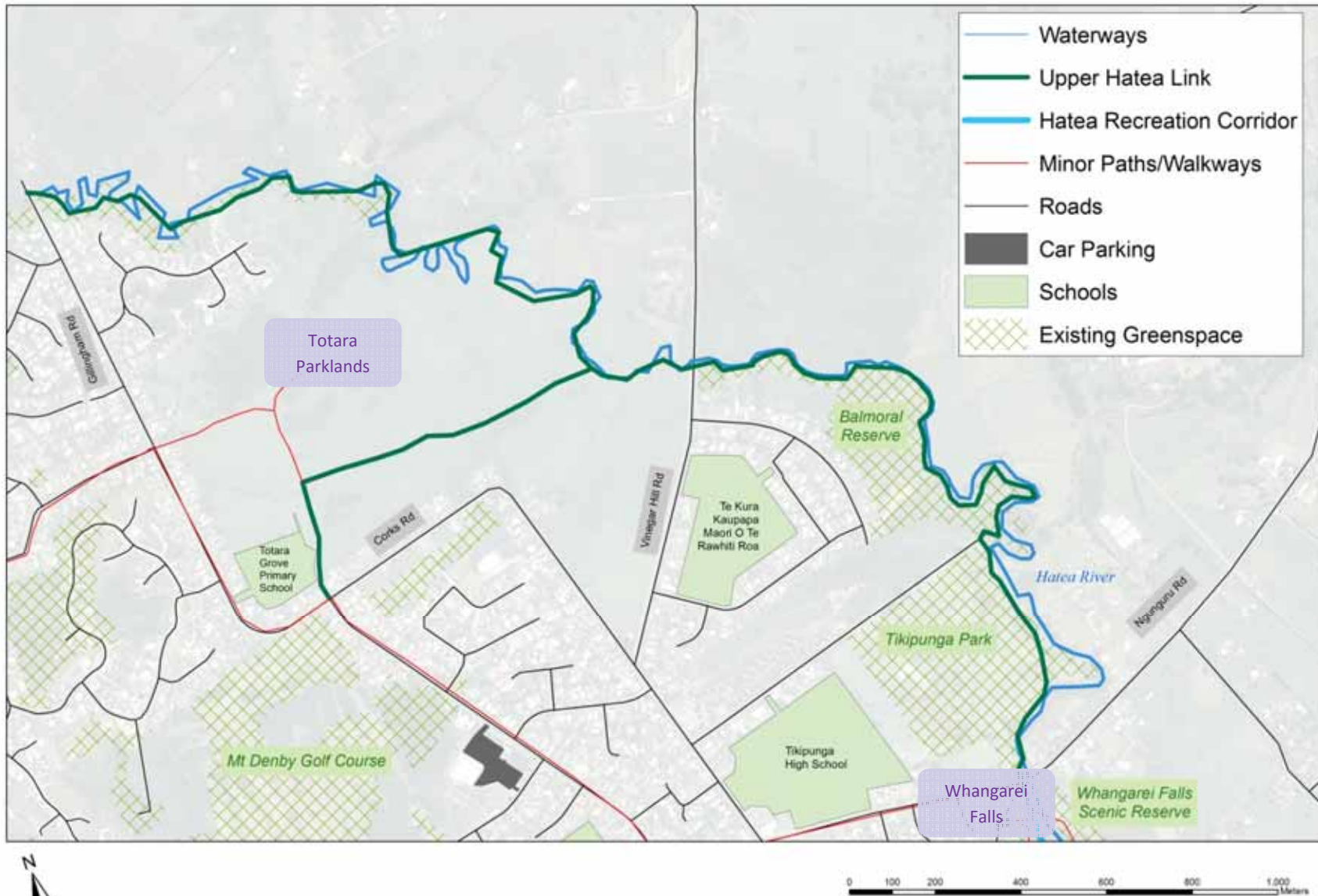


Figure 57 The Hatea River – Upper Hatea Link

Hatea Recreation Corridor

The section of the river below the Whangarei Falls is predominantly through forest and farmland, with a small section of urban area at the Town Basin before entering the Harbour.

There is a popular walking track on the true left bank of the river between the Falls and the Town Basin, which links into the Hatea Loop shared use path. A proposed shared use path along the opposite bank would allow additional users, such as cyclists and the mobility impaired, to move between Tikipunga and the Town Basin. Where it is not possible to do this, upgrading the existing walking track should be considered as an option.

The current walking track is generally in good condition with the exception of two sections. Currently there is a section where the path exits the Parihaka Reserves and users are required to travel along Whareora Road to reach AH Reed Memorial Park. The footpath is narrow, overgrown in places and the route is poorly signposted. Upgrading and maintaining the footpath, or preferably creating a separate path along the river, and adding signage should address these issues.

Between AH Reed Memorial Park and the Whangarei Falls the route is in poor condition and is more of a dirt track than a proper pathway in places. Consideration should be given to upgrading this section to a higher standard to improve accessibility and amenity regardless of whether additional provisions for cyclists are made. Improved wayfinding signage would also be beneficial here.

Consideration of creating several loops using the two sides of the river would provide additional opportunities for people to access the

waterway. There is potential to use the existing facilities, parking and bridges at Mair Park and AH Reed Memorial Park to create recreational loops of approximately 5km.

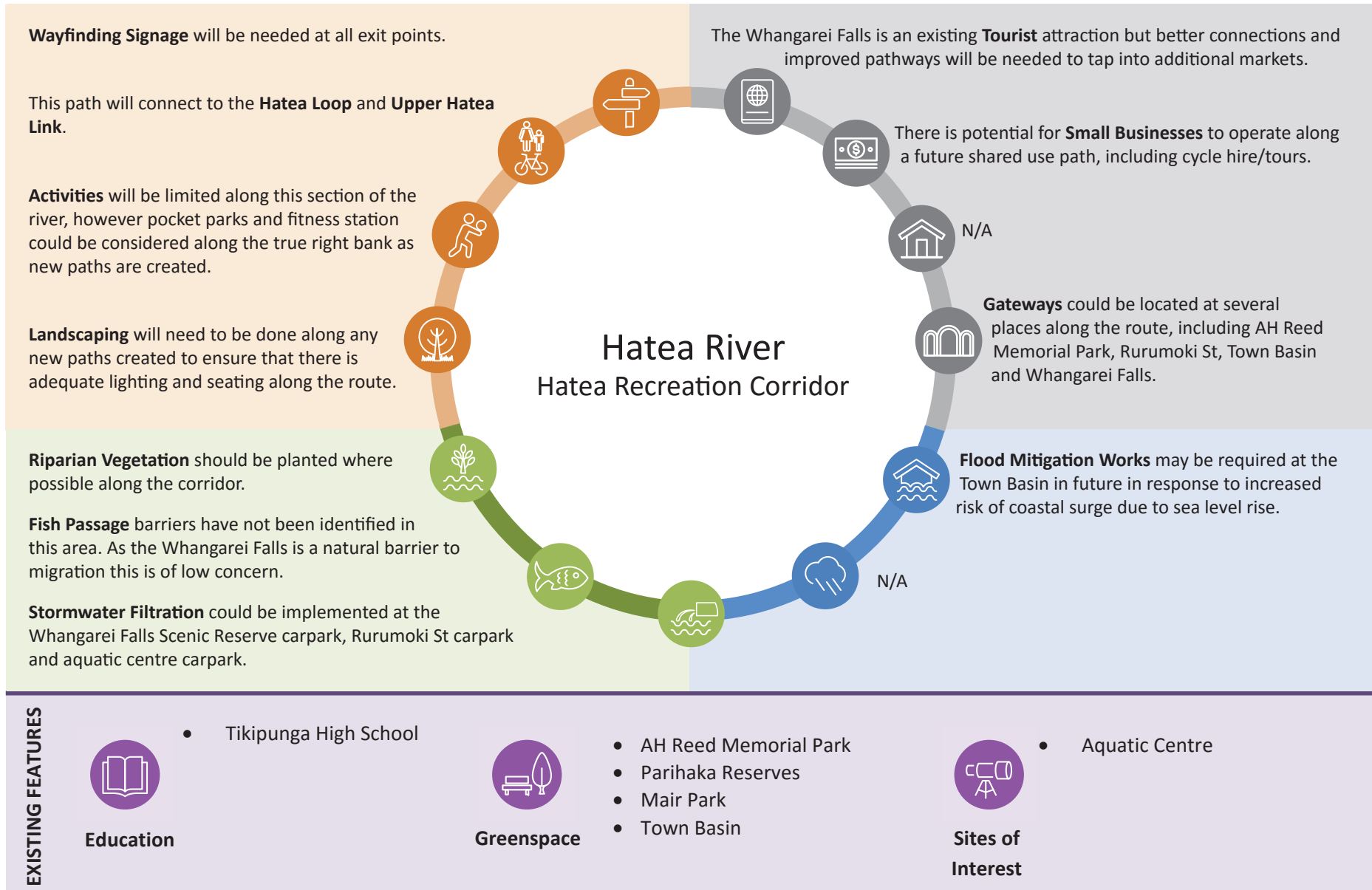
Some riparian planting would be beneficial along the corridor, connecting the forested areas. Weed control will be necessary to ensure ecological integrity. As this section borders the Parihaka Reserves, any planting or weed control in this area will benefit local biodiversity.

Tourism opportunities exist along this stretch, with possibilities for a Raumanga Falls to Whangarei Falls tourist trail. As the existing track is approximately 6km from the Town Basin to the Whangarei Falls, connectivity is an issue for those not wishing to make the return journey on foot. Current public transport scheduling does not allow for return journeys on weekends, when the route is most likely to be used. Implementing a shuttle service from the Whangarei Falls to the city centre will assist with encouraging tourists without vehicles to visit this attraction.

Flood control is not considered necessary along this stretch of the river, however, there may be some areas closer to the Harbour that are affected by high coastal surges from sea level rise in future. This should be considered by policy and decision makers when considering new developments along this stretch of river.



Figure 58 The walkway from the Town Basin to the Whangarei Falls is popular with tourists and residents



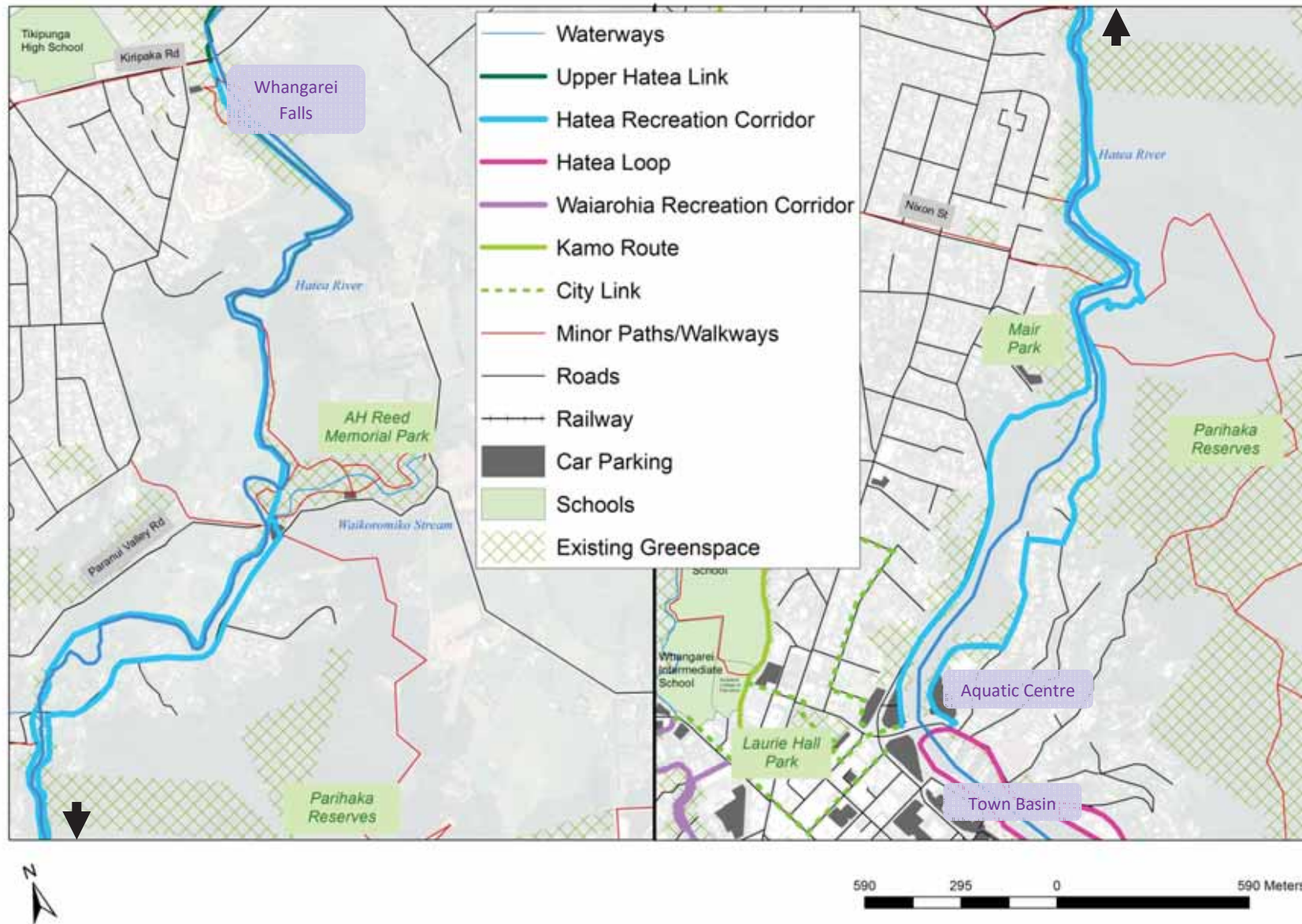


Figure 59 The Hatea River – Hatea Recreation Corridor

Hatea Loop

This area of the river at the edge of the Upper Harbour is host to the popular Hatea Loop Walkway – a shared use path used by cyclists, runners, families and dog walkers for recreation purposes. This recreational loop has been popular with locals and tourists alike and connects a number of facilities, tourist attractions and businesses. Improvements to the Loop are ongoing, with fitness stations, additional toilets and seating added in 2015.

A number of economic development opportunities exist in this area. Mixed use residential opportunities exist on the Hihiaua Peninsula and the Town Basin area. Business expansion could occur from the Town Basin along the Hatea Loop, with potential for shopping, eateries and services as part of any development at Hihiaua.

In 2015 Council requested ideas from the public on what activities they would like to see on Pohe Island. Through this consultation, a number of suggestions were presented by the community, including opportunities for commercial activities such as cafes and recreational equipment hire. Opportunities to incorporate these activities will be investigated and progressed in accordance with the Reserve Management Plan for Pohe Island as the reserve is further developed as a recreational area.

Landscaping is needed on Pohe Island and this should include planting for food sources for bird species. Some flood protection may be needed around the Town Basin area to account for coastal intrusion from rising sea levels and king tides.



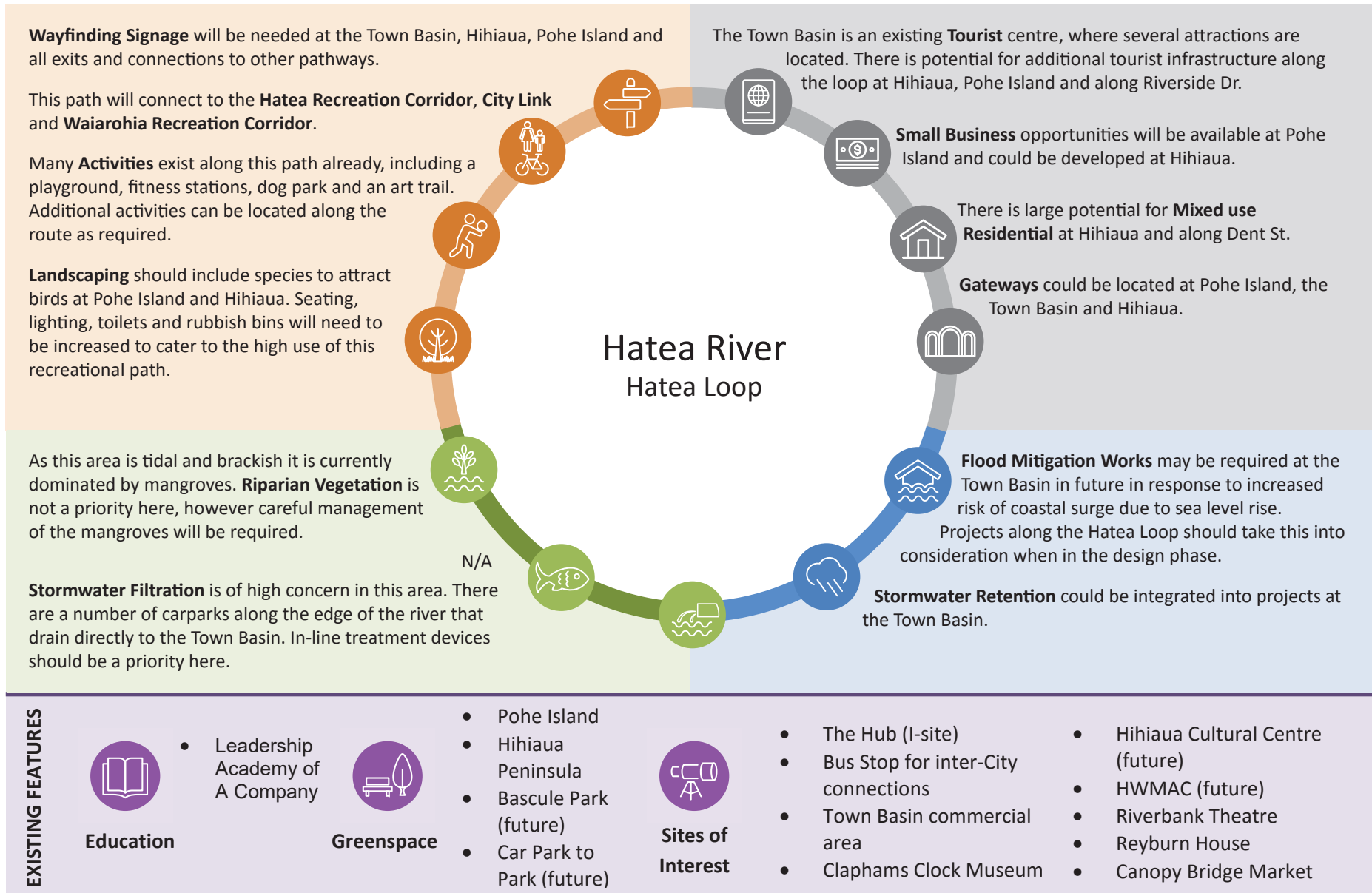
Figure 60 The Canopy Bridge at the Town Basin hosts weekly markets in summer



Figure 61 Artistic seating provides amenity and functionality



Figure 62 Hatea Loop Walkway



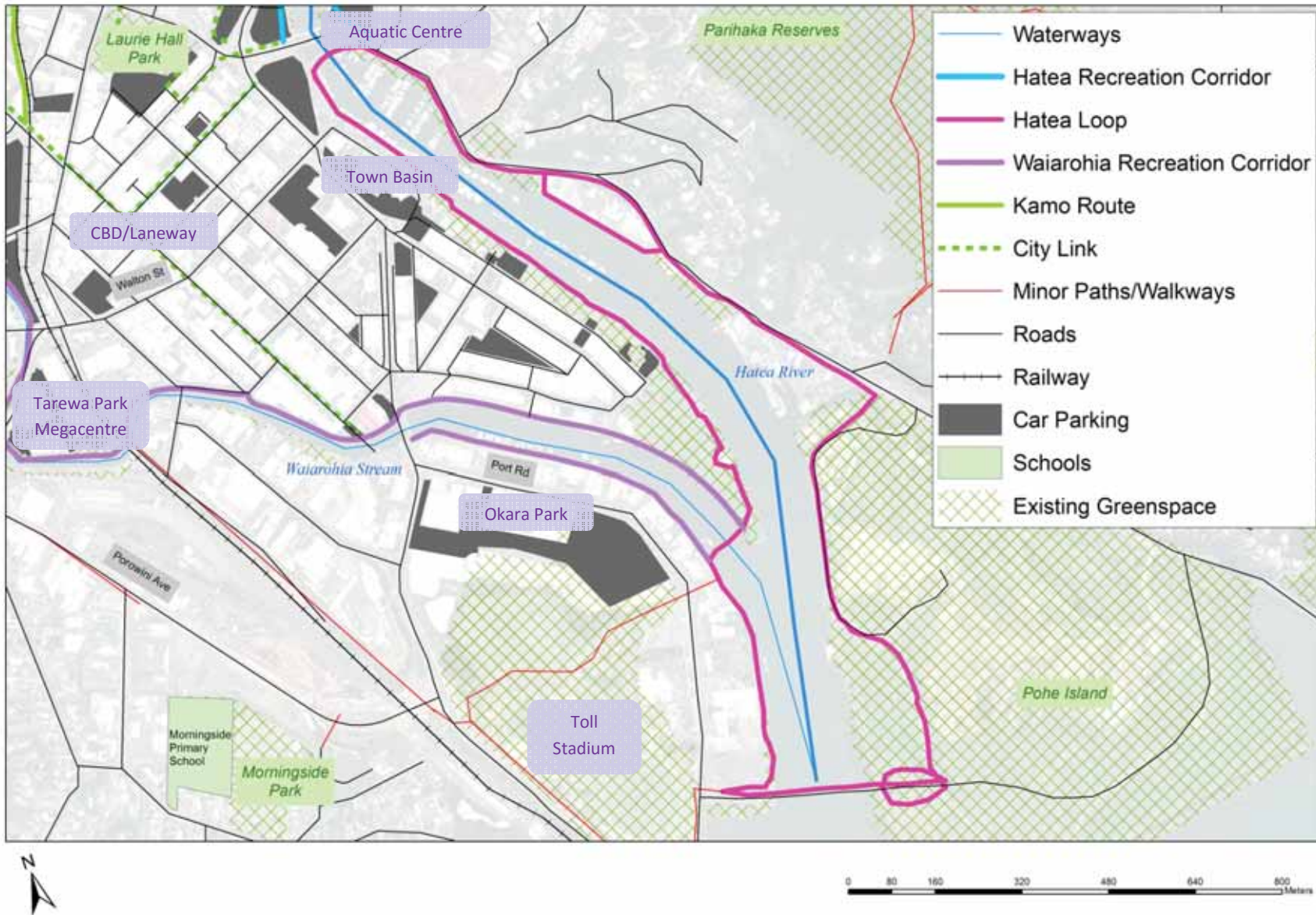


Figure 63 Hatea River – Hatea Loop

Raumanga Stream

The Raumanga Stream has a largely rural catchment, before entering the residential area below the Hopua te Nihotetea Dam.

Raumanga Recreation Corridor

The stream runs predominantly through an urban residential environment with several open space areas. An existing shared use pathway currently runs from Bernard Street to the Raumanga Valley Reserve. Additional pathways need to be considered to connect through the reserve to the Raumanga Falls, through to the Hopua te Nihotetea Dam and to connect from Bernard Street through to the city centre and additional pathways in the network.

There are a number of ecological benefits that could be achieved in this area, including riparian planting and weed control. The Raumanga Falls acts as a natural barrier to fish migration so fish passage barriers should be removed or mitigated with fish ladders up to this point.

The location of the I-Site along this route provides access for tourists to engage with the recreation corridor. The Raumanga Falls provides an opportunity for increased tourist infrastructure. Currently there is no access to the base of the Falls and no clear view shafts of the Falls from the side or base. Access is not currently provided, as it is for the Whangarei Falls. Providing additional pathways, a viewing platform and select removal of vegetation would enhance the value of this natural asset. Small tourist operations, such as a Raumanga Falls to Whangarei Falls tourist trail or guided tours, could be offered however larger scale economic development opportunities are low. There are several places on the route where pocket parks or additional facilities could be added. Additional flood mitigation along this route is not required.

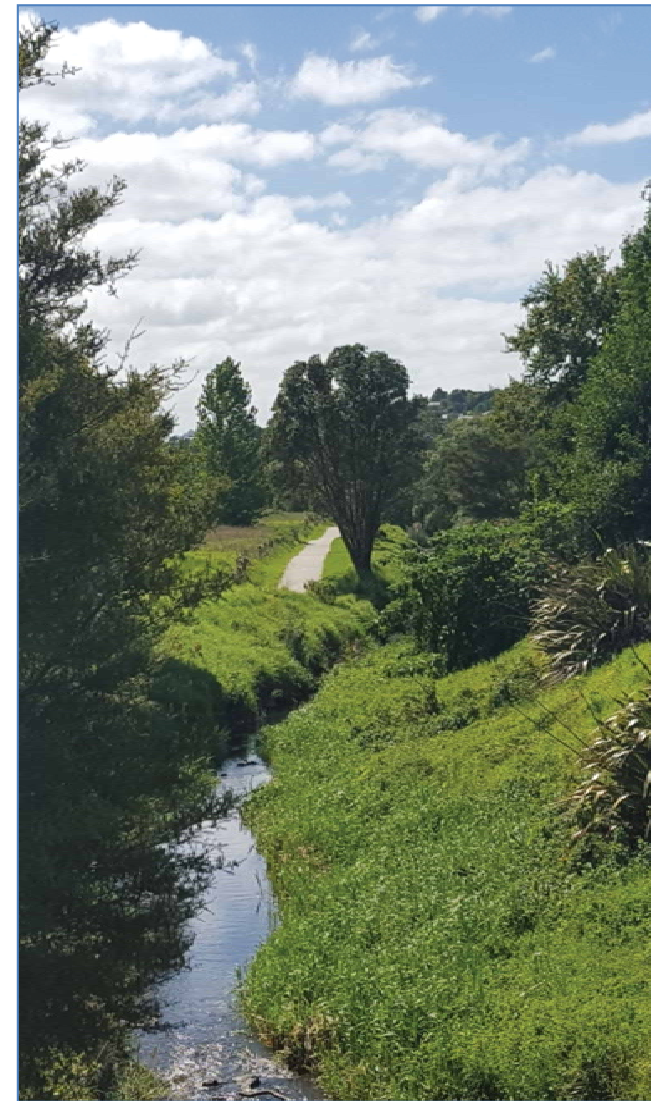


Figure 64 Raumanga Stream with adjacent shared use path



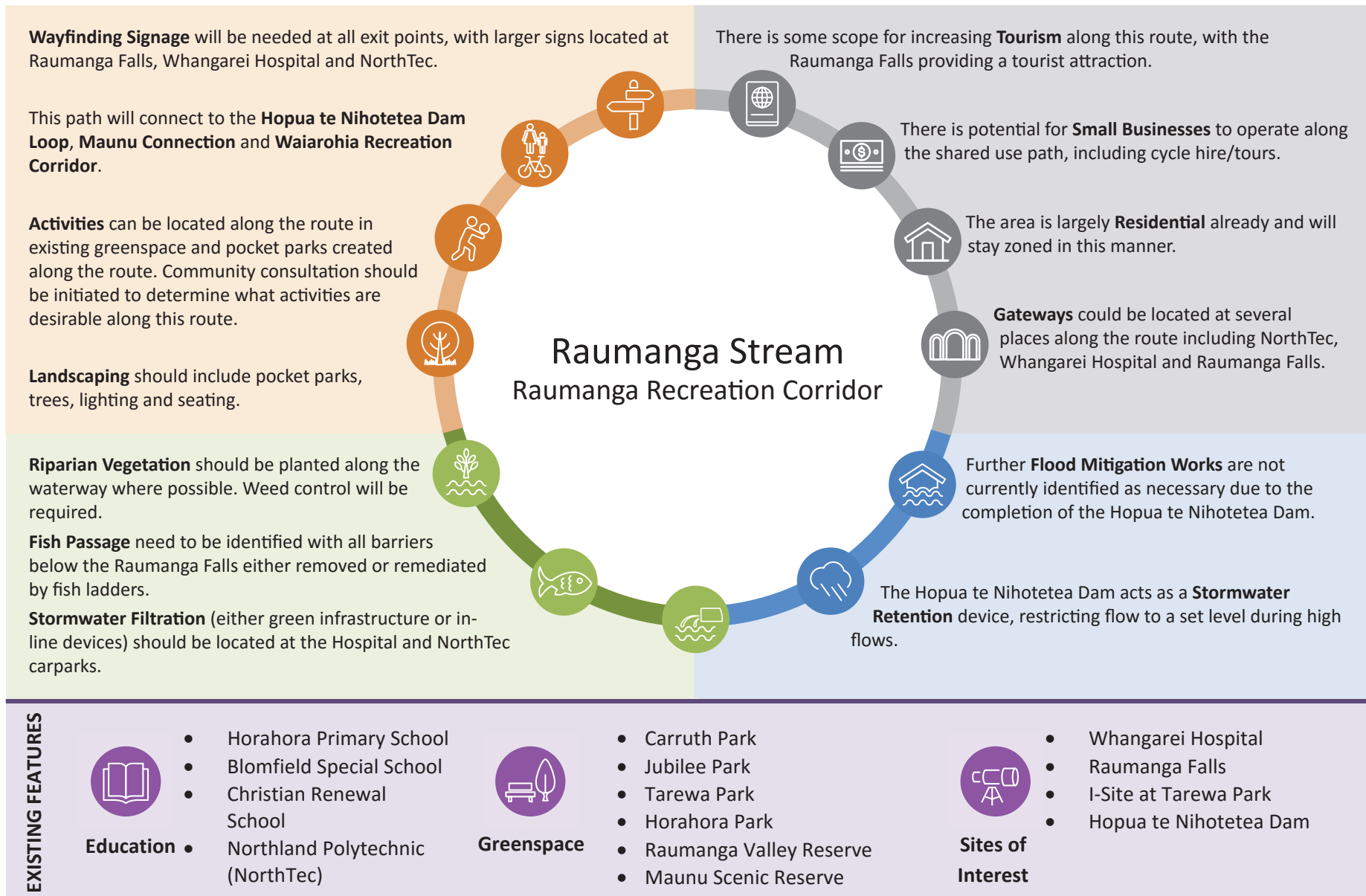
Figure 65 Viewshafts are needed for the Raumanga Falls



Figure 66 Raumanga Falls at the top of the waterfall



Figure 67 Raumanga Recreation Corridor - the existing shared use path



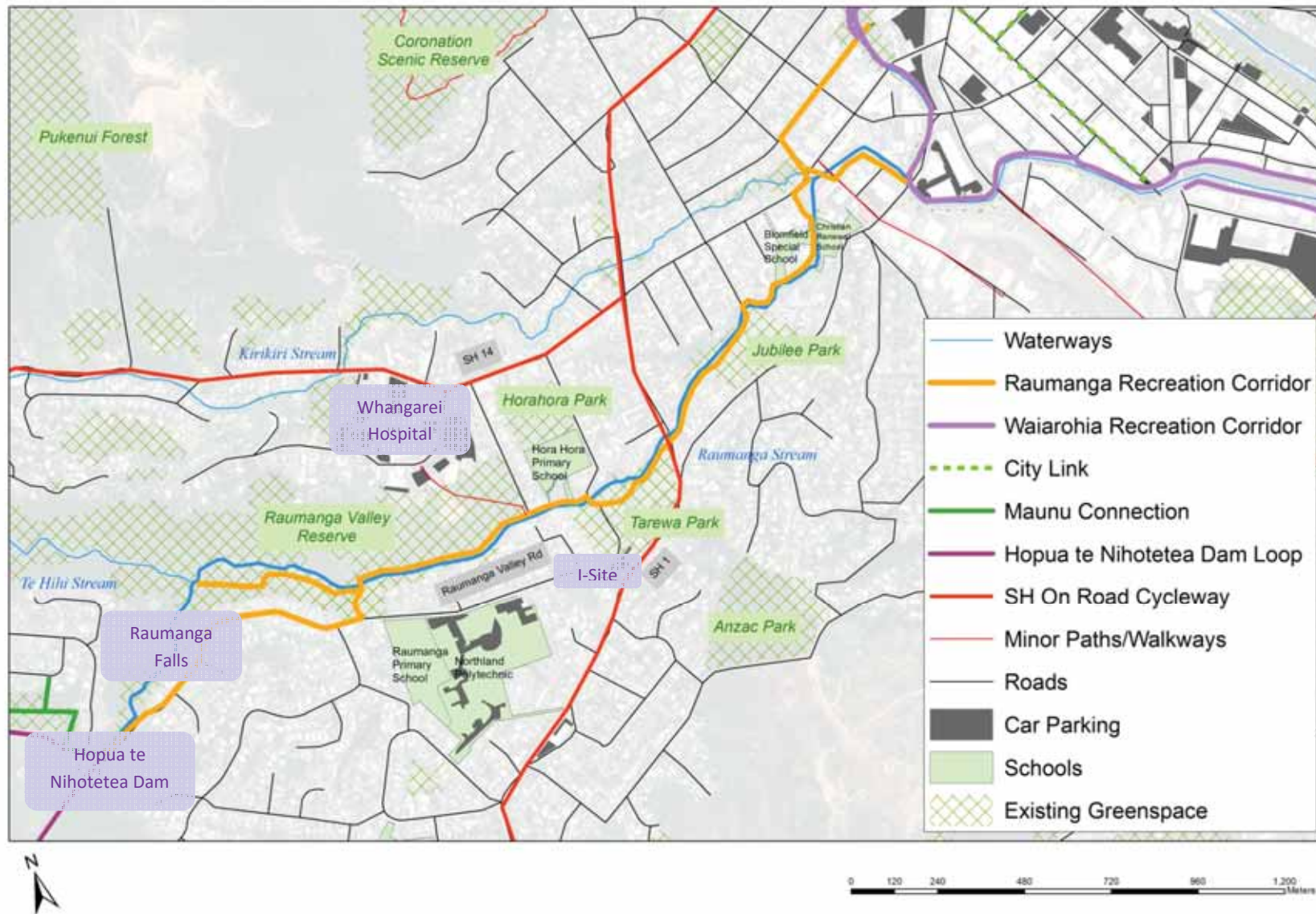


Figure 68 Raumanga Stream - Raumanga Recreation Corridor

Waiarohia Stream

The Waiarohia Stream flows through a small area of lifestyle blocks, skirting suburban residential properties before reaching the urban area.

Upper Waiarohia Stream

This section skirts the urban area, running through a semi-rural setting, and along Western Hills Drive. An existing footpath runs between Manse Street and the intersection of Western Hills Drive with Rust Avenue. Western Hills Drive presents a barrier to connecting this area with Russell Road, which would need to be solved before additional pathways are considered. However there is potential for a pathway between Russell Road and Whau Valley Road in the future if demand arises.

Stormwater filtration of runoff from Western Hills Drive should be considered due to the number of vehicles travelling this route and the likelihood of oils, heavy metals and sediments entering the waterway. Whangarei Intermediate School and Whangarei Boys High School border the stream. Enviro-school programs are running within the schools and the section of the stream between Manse Street and Rust Avenue could be planted to create a good ecological corridor, connecting across the Rust Avenue Bridge into the Waiarohia Recreation Corridor and Cafler Park. Restoration of riparian vegetation and weed control upstream of Russell Road should also be undertaken.

This area is not suitable for economic development. Flood protection structure and contouring are also unlikely to be necessary in this section of the stream. However the possibility of an additional flood water storage area, previously considered at Whangarei Intermediate School, will need to be investigated further if required.



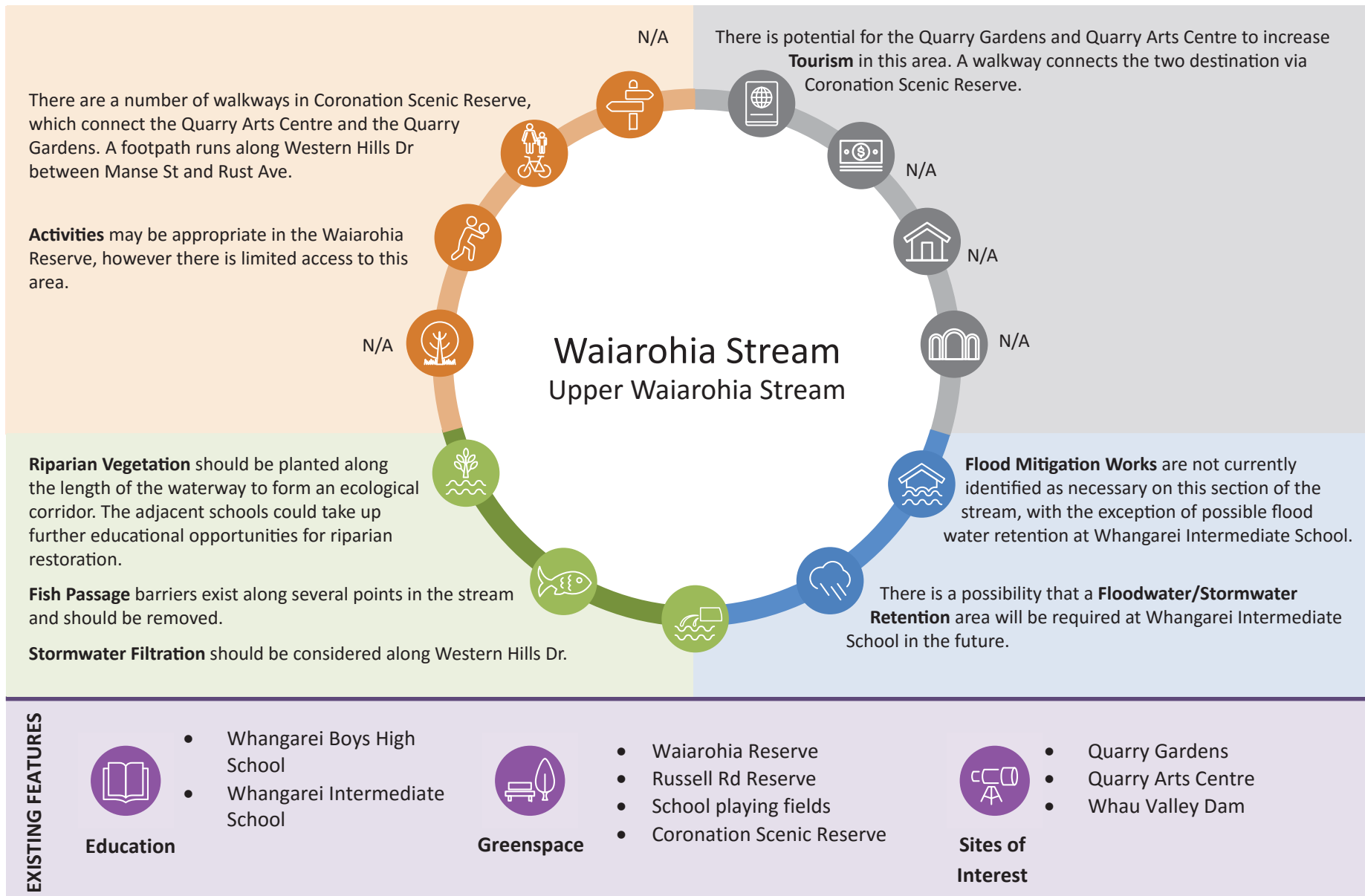
Figure 69 Coronation Scenic Reserve



Figure 70 Whangarei Quarry Gardens



Figure 71 Waiarohia Stream at Russell Rd



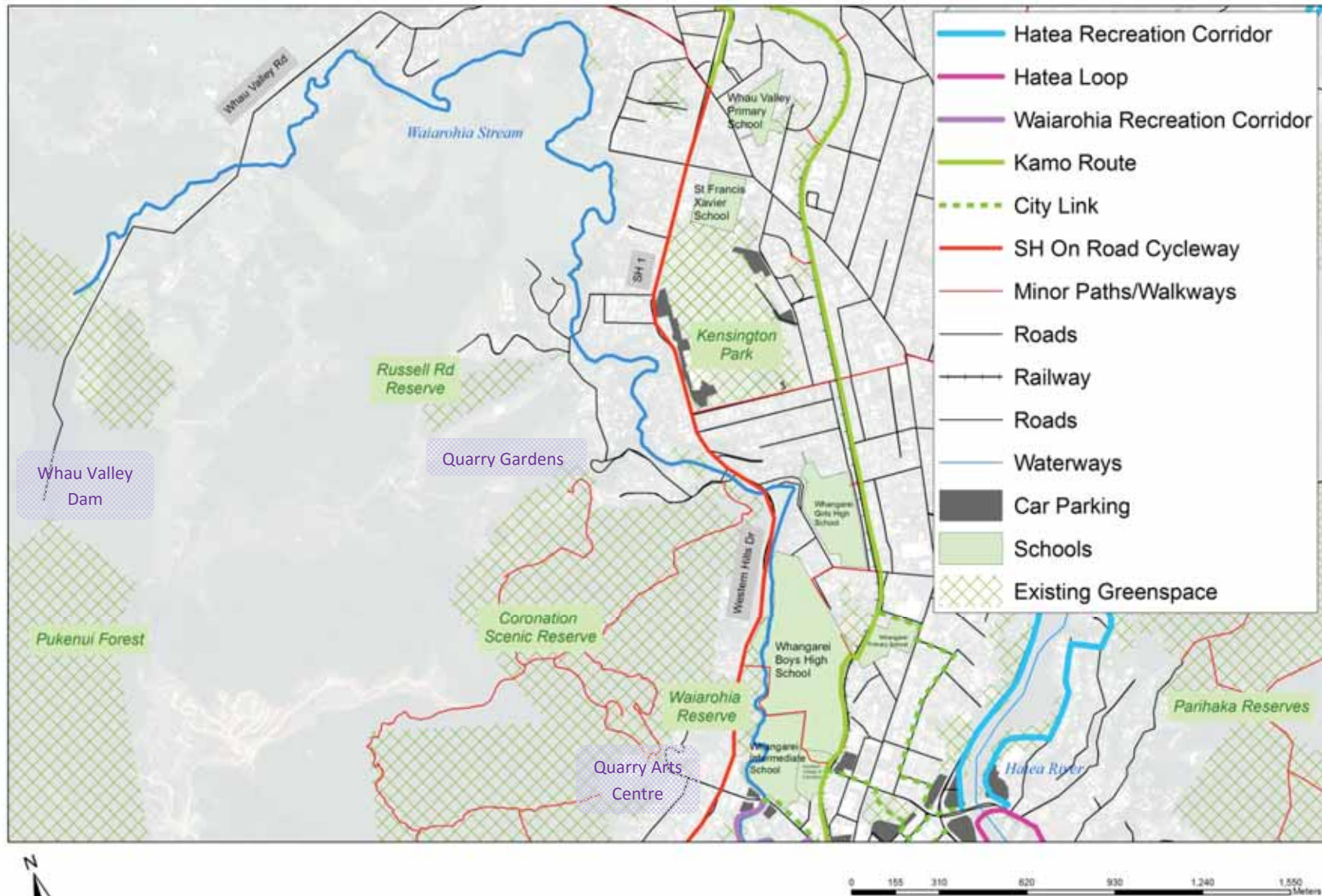


Figure 72 Upper Waiarohia Stream

Waiarohia Recreation Corridor

This section of the stream, from Rust Avenue Bridge to the Harbour, is identified in the Whangarei 20/20 Momentum document as part of the “Emerald Necklace” and the “Expanded Growers Market” projects. The stream runs behind a number of commercial properties and has been encroached on in places. The exception to this is where the stream runs through Cafler Park, an open space area with gardens and existing pathways. Extending the pathways beyond Cafler Park will enhance the amenity of this area of the City and provide an alternative route to the Hatea Loop for those wishing to use it for recreation purposes. The proposed pathway will connect into the Hatea Loop at Kotuitui Whitinga on the Hihiaua Peninsula, and with the Kamo Route, making it desirable for commuter travel as well as recreation purposes. Mixed use residential opportunities exist at Hihiaua Peninsula, along with business and tourism opportunities along the expanded pathway network.

Riparian planting should be undertaken along this section of the stream, with the profile of the waterway likely to resemble Profile 1 (Figure 47) upstream of Railway Road and Profile 2 (Figure 48) downstream. A number of flood protection measures will need to be put in place along this section of the waterway. Initial work suggests that staged pathways and flood walls will be needed to increase capacity of the waterway and allow for coastal inundation and the expected future impacts of climate change. Detailed engineering investigations and analysis will need to be undertaken to ensure the right measures are taken before the shared use pathway is constructed. It is essential that ecological corridors, economic opportunities and historical and cultural enhancements are considered when flood control works are planned and implemented. This may result in a higher cost but will provide multiple benefits to the community.



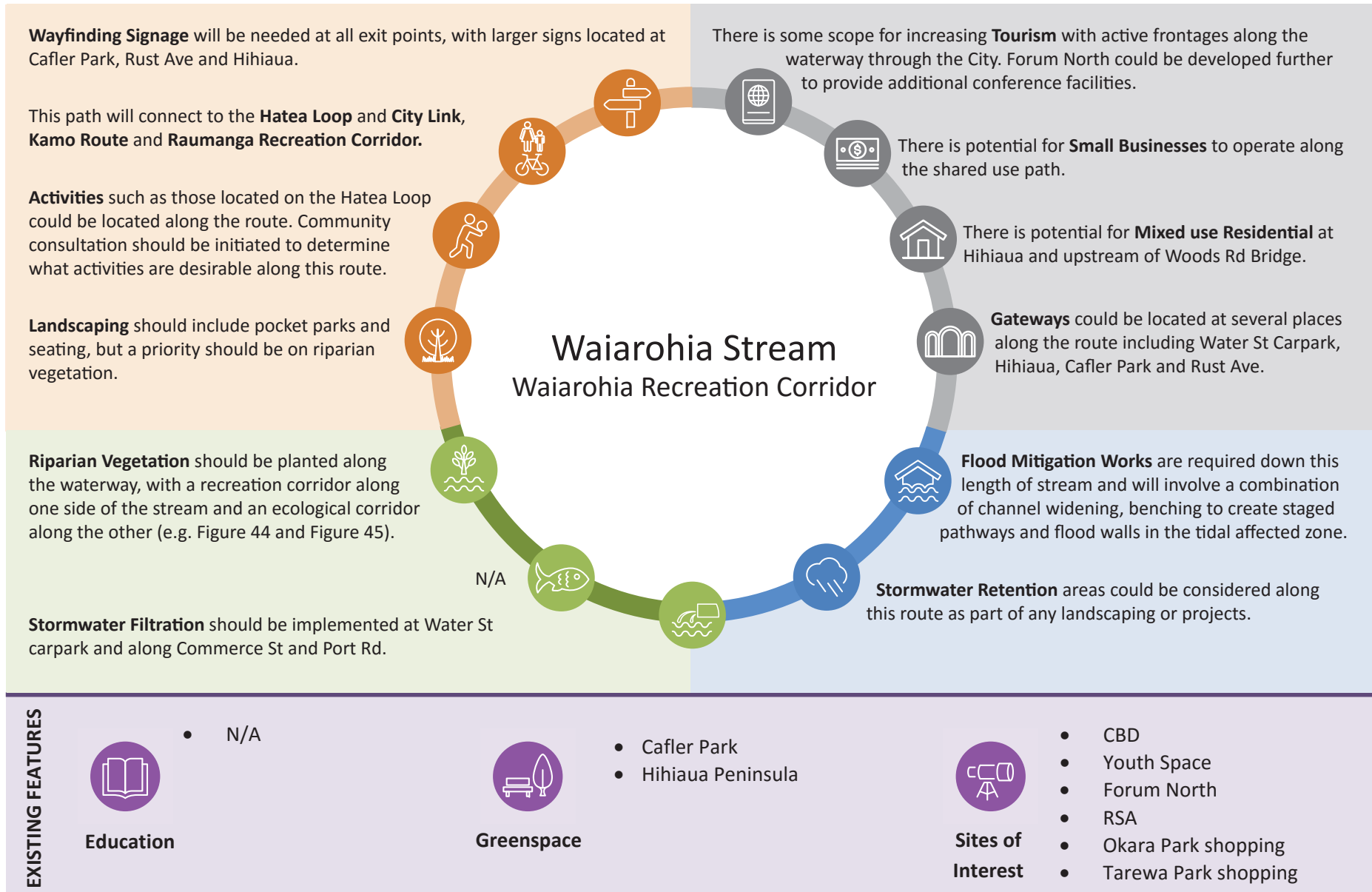
Figure 73 Growers Market at Water St carpark



Figure 74 Kotuitui Whitinga – the footbridge over the lower Waiarohia Stream



Figure 75 Waiarohia Stream at Cafler Park



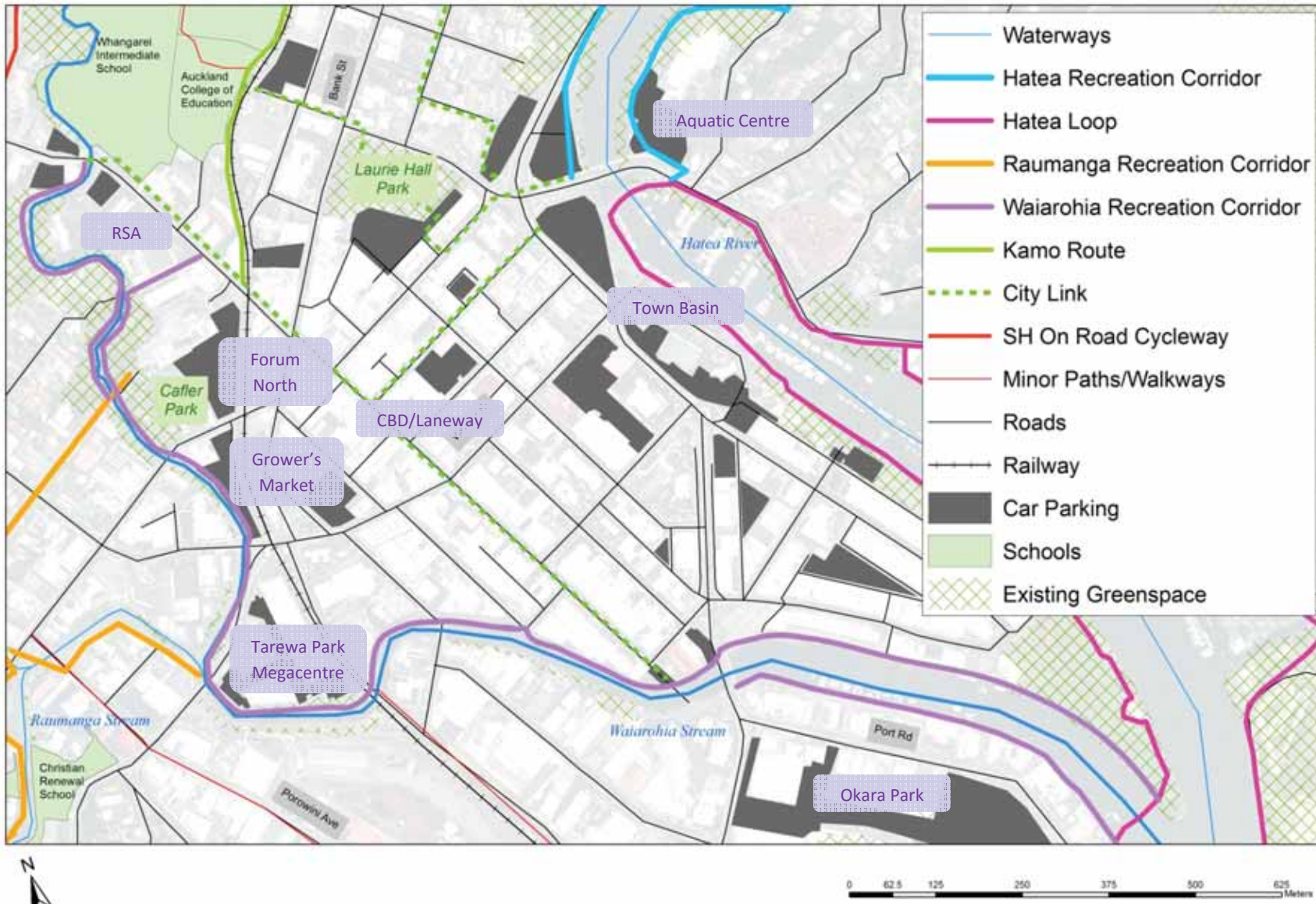


Figure 76 Waiarohia Stream - Waiarohia Recreation Corridor

MINOR WATERWAYS

These waterways are smaller and predominantly run behind residential properties or through gullies between suburbs. Opportunities for economic, residential and tourism development are minimal and flood mitigation works are unnecessary on these smaller streams. Ecological restoration and fish passage remediation would be beneficial.



Figure 77 The Waikoromiko Stream shows what our waterways could be like in the future

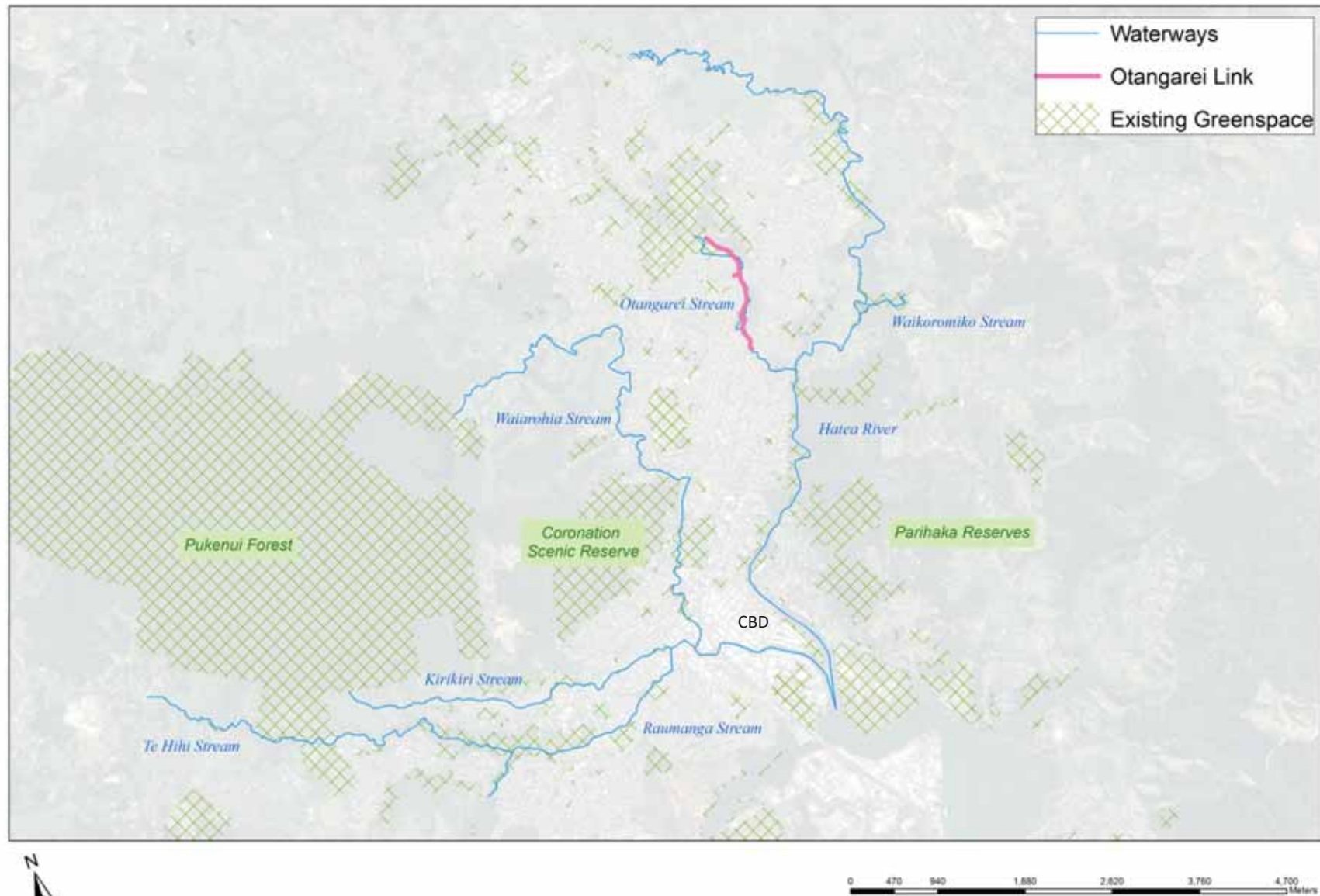


Figure 78 Minor waterways and associated pathways

Te Hihi Stream

Te Hihi Stream originates in the Pukenui Forest and runs along a gully between the suburbs of Maunu and Horahora before connecting to the Raumanga Stream.

The stream connects two popular reserves – Barge Park and Raumanga Valley Reserve. Due to the steep topography of the area a complete pathway along the stream is not recommended. There are a number of walking tracks commencing in the Barge Showgrounds, which are popular with dog walkers, and some of these could be upgraded to create shared use paths. Linkages could be enhanced with the Kiwi North grounds and back through the park to Pukenui Forest.

Restoration of the stream is currently being planned at the Barge Showgrounds, led by Biodiversity Northland as an educational site. Riparian planting will be difficult along much of the stream outside of the Showgrounds, due to the topography of the area. There are a number of weed species to be removed and riparian planting could be improved along the whole stream. Fish passage barriers need to be identified and removed. Additional wetlands or green infrastructure could be considered in the Barge Showgrounds to filter stormwater from car parking areas.



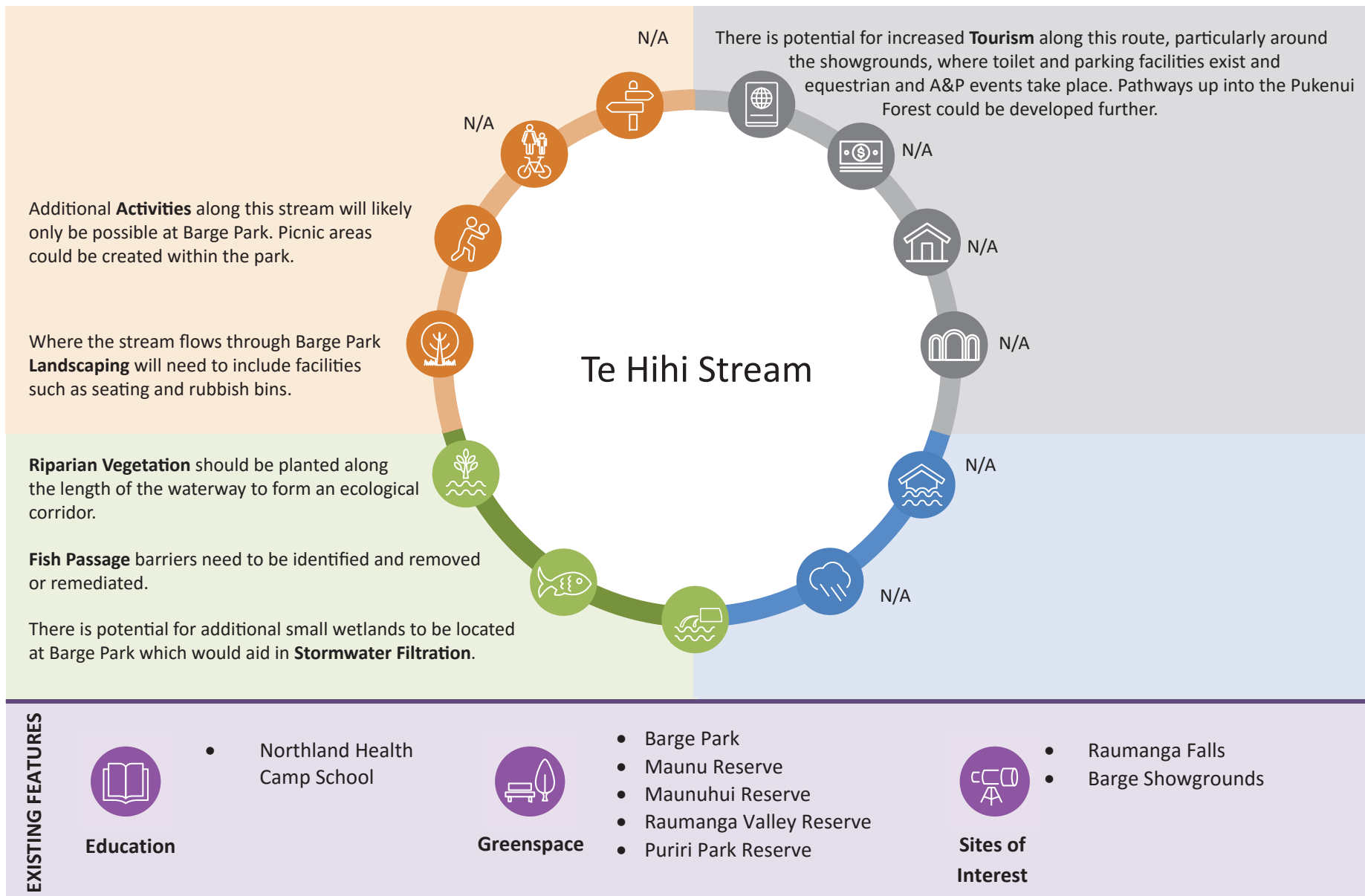
Figure 79 Te Hihi Stream at Barge Park



Figure 80 Ponds and wetland connect to Te Hihi Stream in the lower Barge Showgrounds



Figure 81 The confluence of Raumanga Stream (left) and Te Hihi Stream (right) at Raumanga Valley Reserve



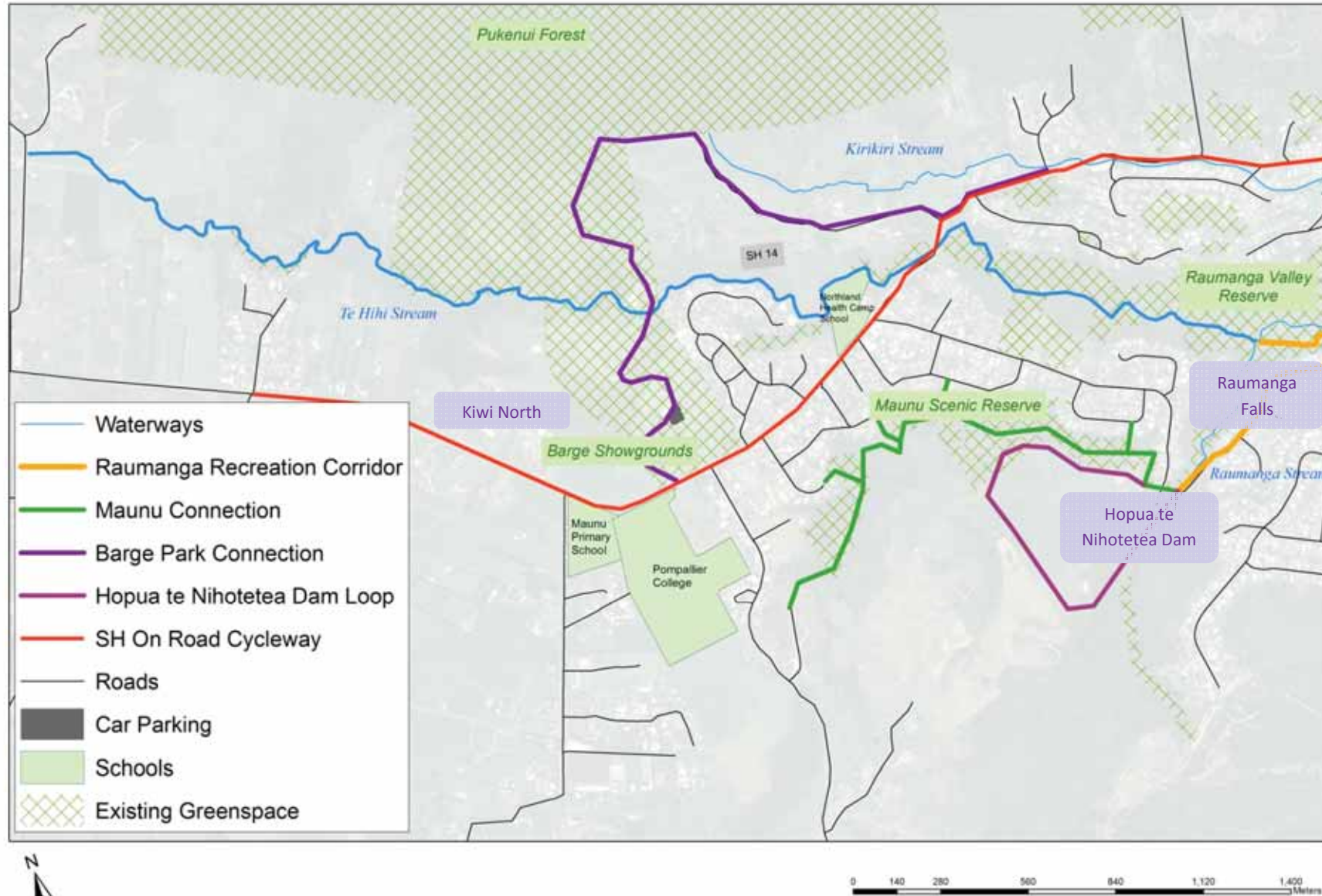


Figure 82 Te Hahi Stream

Kirikiri Stream

Kirikiri Stream originates in the Pukenui Forest and runs between the suburb of Horahora and the Pukenui Forest before entering the urban area and connecting into the Raumanga Stream at Porowini Avenue.

A shared use path along the stream has not been recommended due to topography, the difficulties in crossing SH 1 and SH14 where the stream flows, proximity to the Raumanga Recreation Corridor and limited connectivity with residential areas. It is possible in the future that sections of the stream could be provided with a walkway, however this would be beyond the time scope of the Strategy. The Raumanga Route will provide an alternative recreation path nearby.

There is a lot of scope for riparian planting on this stream. Weeds and grassed banks are common and this could be remedied. A number of barriers to fish passage were identified by Northland Regional Council in 2015 and these could be remediated.

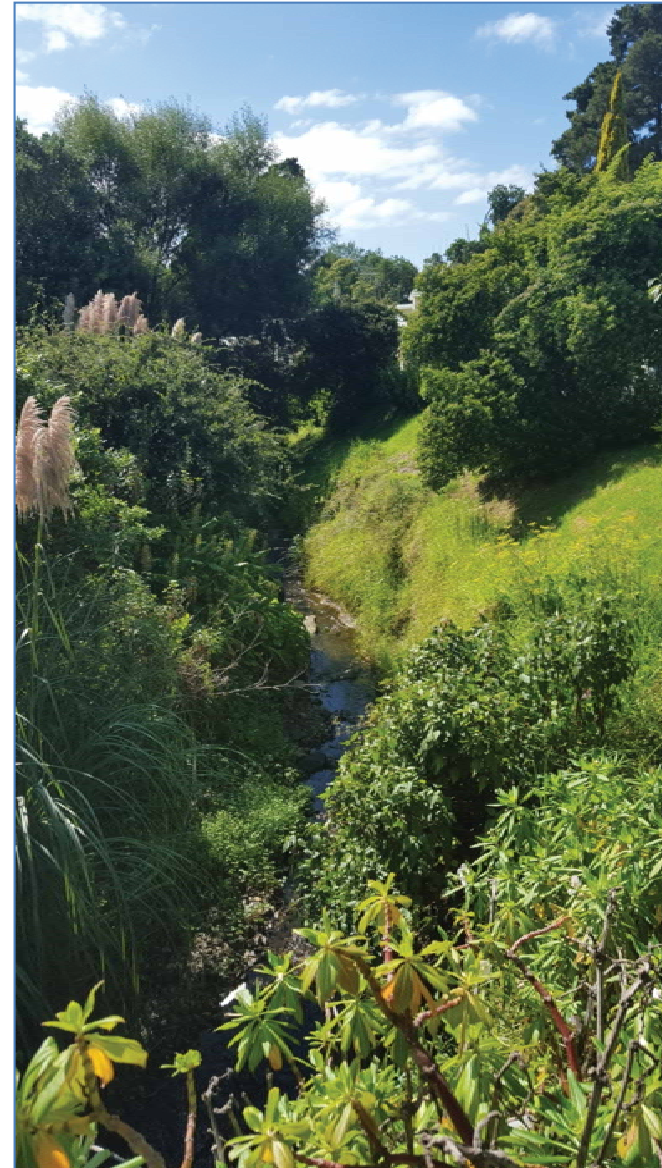


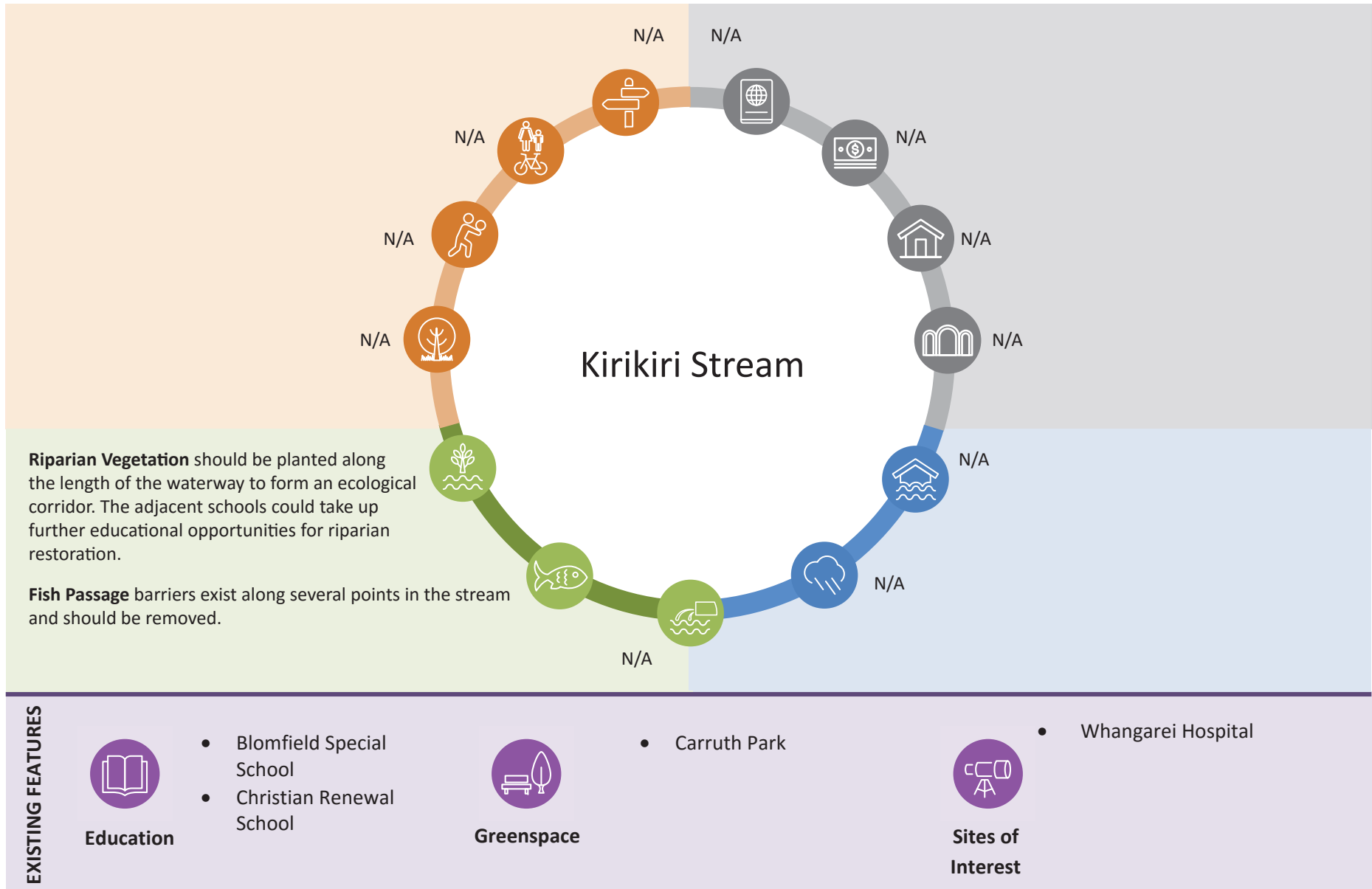
Figure 83 Kirikiri Stream at Maunu Rd



Figure 84 Kirikiri Stream at Maunu Rd



Figure 85 Kirikiri Stream at Silverstream Rd



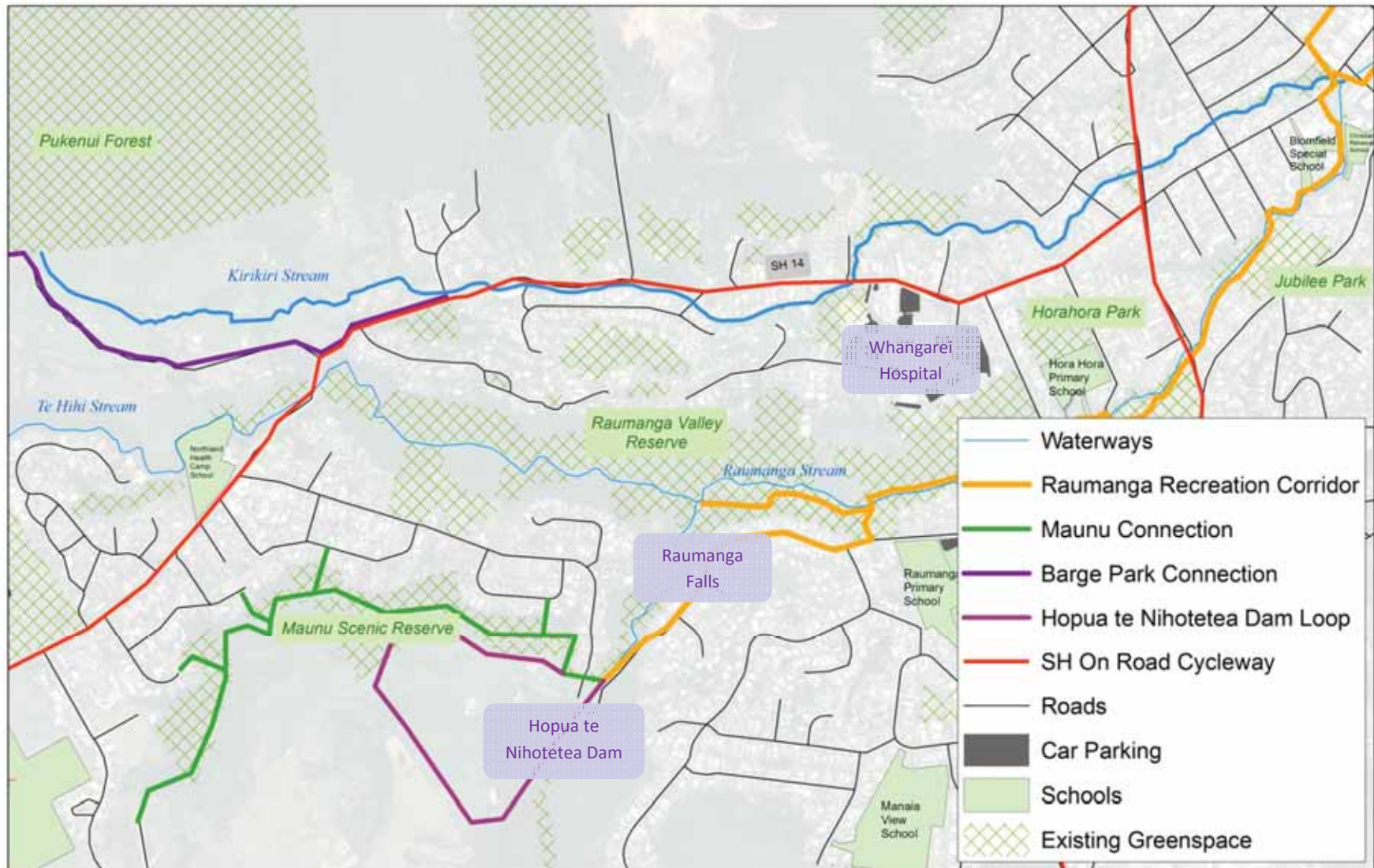


Figure 86 Kirikiri Stream

Otangarei Stream

Otangarei Link

The stream skirts the edge of the urban area down a gully and runs through predominantly native vegetation and suburban areas before joining the Hatea River.

There is a walkway at the Otangarei Sportsgrounds, which links to Punarere Drive. This was a project driven by the community through Whangarei District Council's Village Plan program, which aims to deliver meaningful improvements to a local area whilst achieving community ownership. The Village Plan for Otangarei was drafted by a residents group in 2014 following extensive community engagement. It identified a number of issues to be address including improving the connectivity between Otangarei and the surrounding neighbourhoods and enhancing the water quality and biodiversity of the stream.

To address these issues, the community identified a new walkway connecting Puna Rere Drive to William Jones Drive via the rugby fields and the Otangarei Stream. Whangarei District Council then assisted the community to draw plans and hire the contractors. The build was undertaken by contractors with volunteers from the community. A second stage of the walkway was identified continuing the walkway to Kiripaka Road. There is an opportunity to link this path with the Hatea River trail, via Whareora Road. This track would be primarily recreational and provide an additional link for the local Otangarei community, which would benefit from additional transport links.

The walkway was opened in 2015 and has been well used by the community, but also by people from surrounding neighbourhoods. The

success of the walkway has inspired the community to look at further enhancements such as more native planting, picnic tables and signage. There is a lot of potential to develop more activities at the Otangarei Sportsgrounds and along the stream corridor. Fitness stations, improved sports facilities and seating would allow people to engage with the waterway and improve community ownership of the space.

Opportunities exist for community led ecological restoration along and in the stream. Previously, plantings along the stream in the Otangarei Sportsgrounds have been vandalised or pulled out and only flax remains. Away from the reserve the stream banks are dominated by a number of weeds and long grass, preventing access and engagement with the waterway. The stream channel is clogged with oxygen weed and some minor barriers to fish passage have been identified. In stream restoration may be needed once a riparian corridor has been established.

The Otangarei Village Plan walkway project is an excellent example of how important connectivity is to communities, particularly one that is relatively isolated. The Village Plan program aligns well with the Blue/Green Network Strategy and could be a mechanism of delivery for many of the Strategy's recommendations. Currently Otangarei is the only suburb within the Strategy's focus that is part of this program.



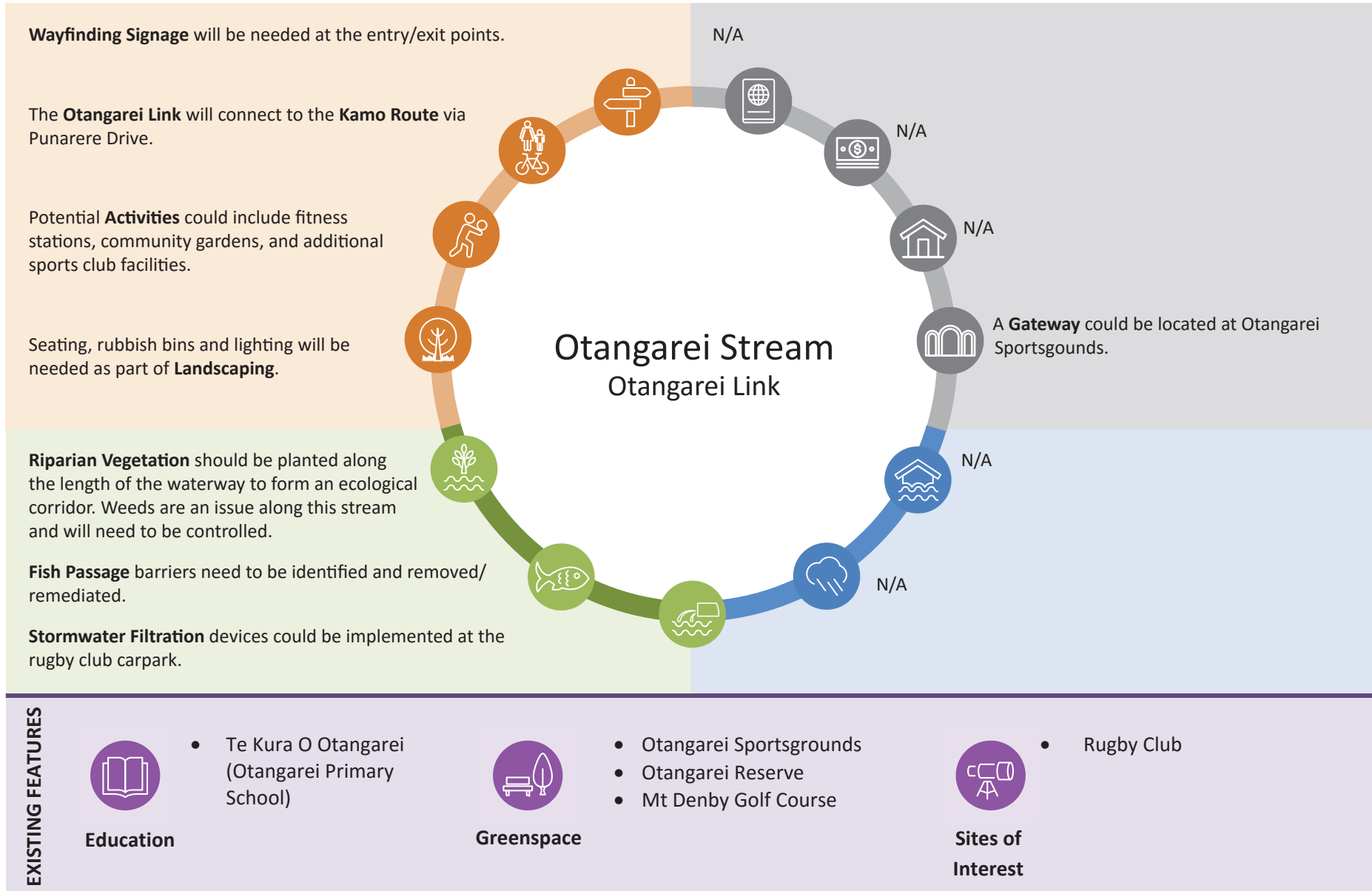
Figure 87 Otangarei Stream



Figure 88 The walkway at the Otangarei Sportsgrounds adjacent to the stream



Figure 89 Otangarei Stream at the Otangarei Sportsgrounds



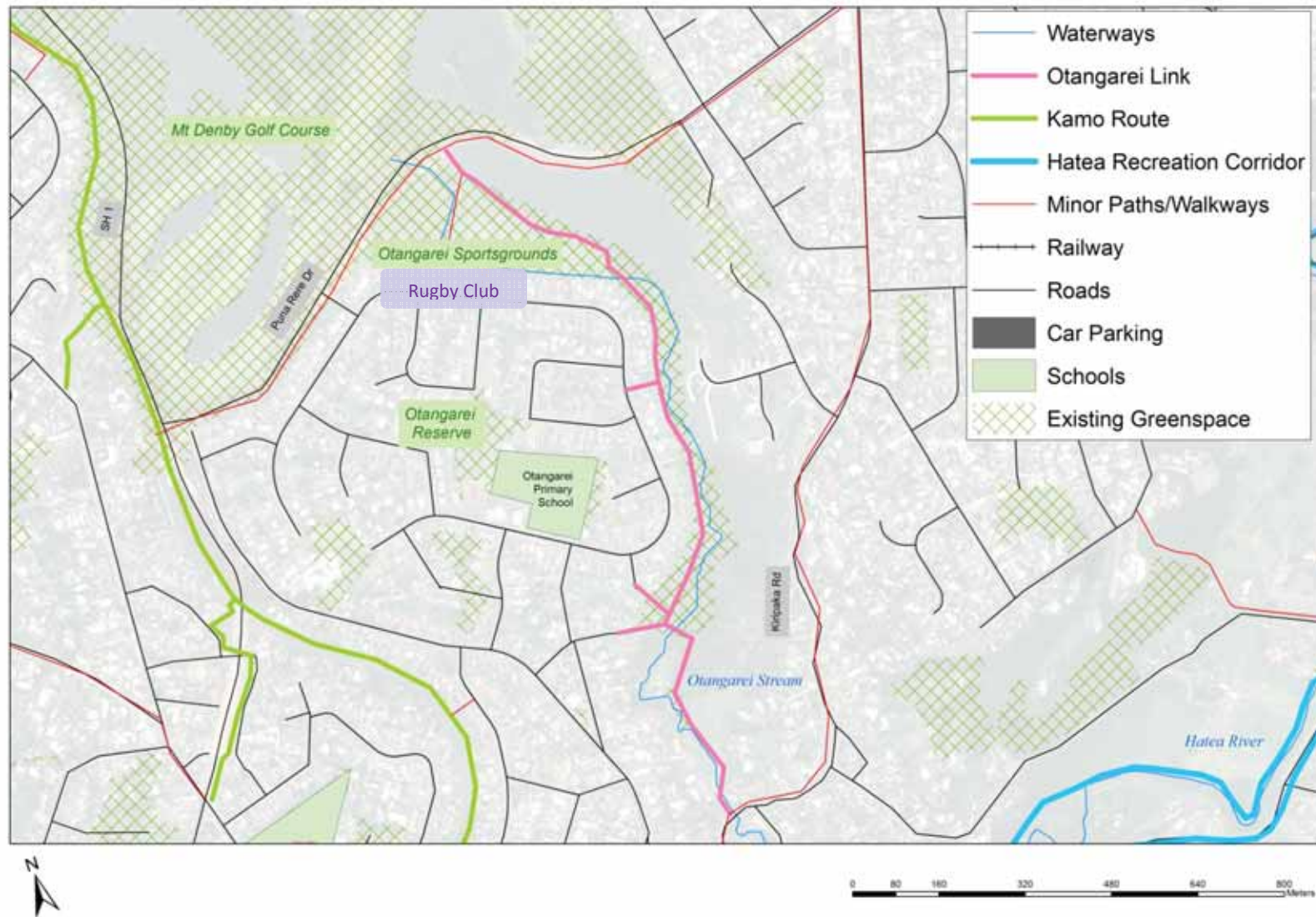


Figure 90 Otangarei Stream – Otangarei Link

Waikoromiko Stream

This section of the stream runs through the A H Reed Memorial Park, a well maintained forested reserve, with several large Kauri trees and the Paranui Falls. The stream is not channelized and maintains a meander throughout the park.

Overall, the quality of the environment is high and there are a number of walkways through the park along the stream. The park would benefit from weed control along the stream margins, particularly where it joins the Hatea River. Stormwater filtration at the adjacent car parks would further enhance the quality of the water at this site.



Figure 91 The Waikoromiko Stream has high ecological and amenity values

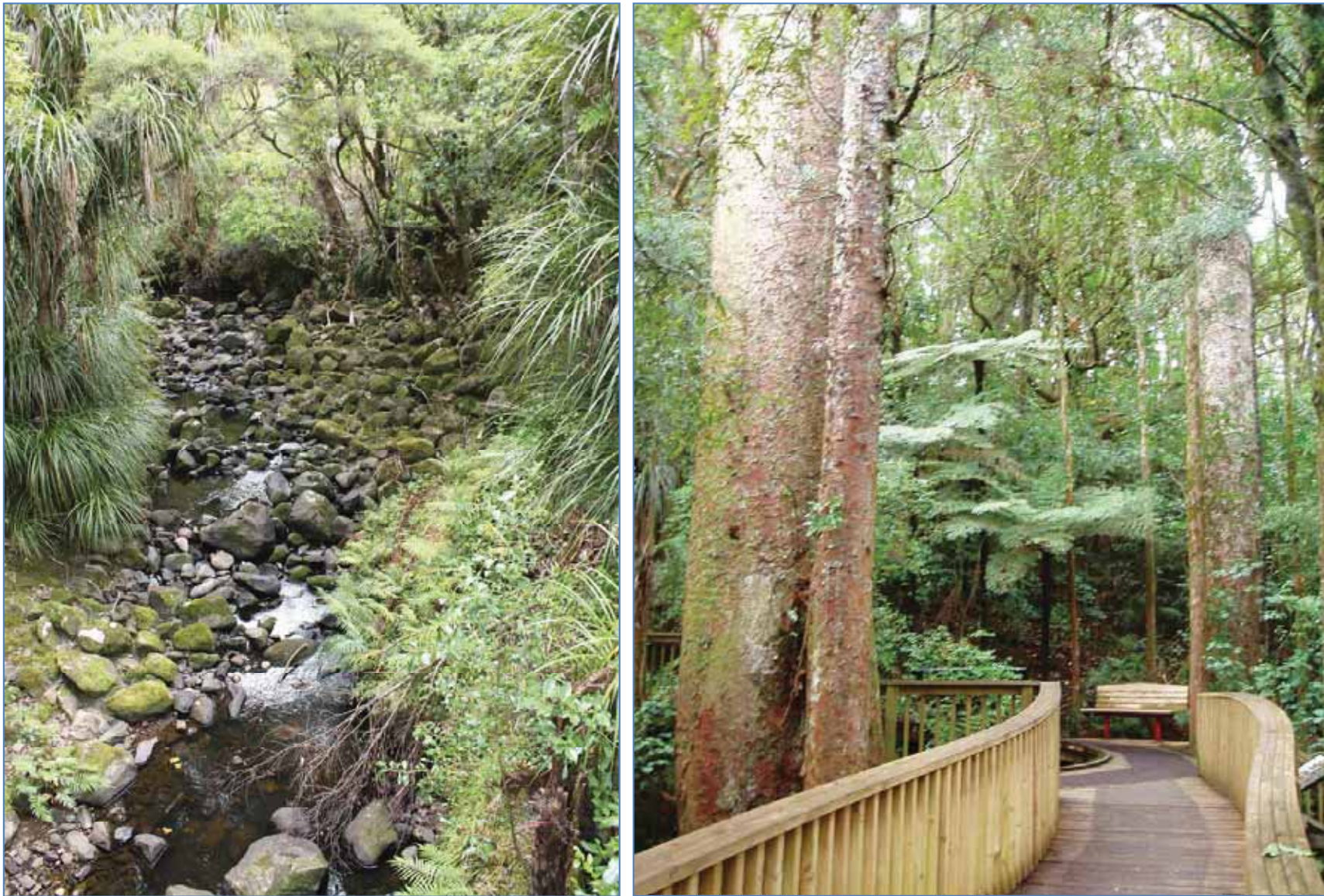
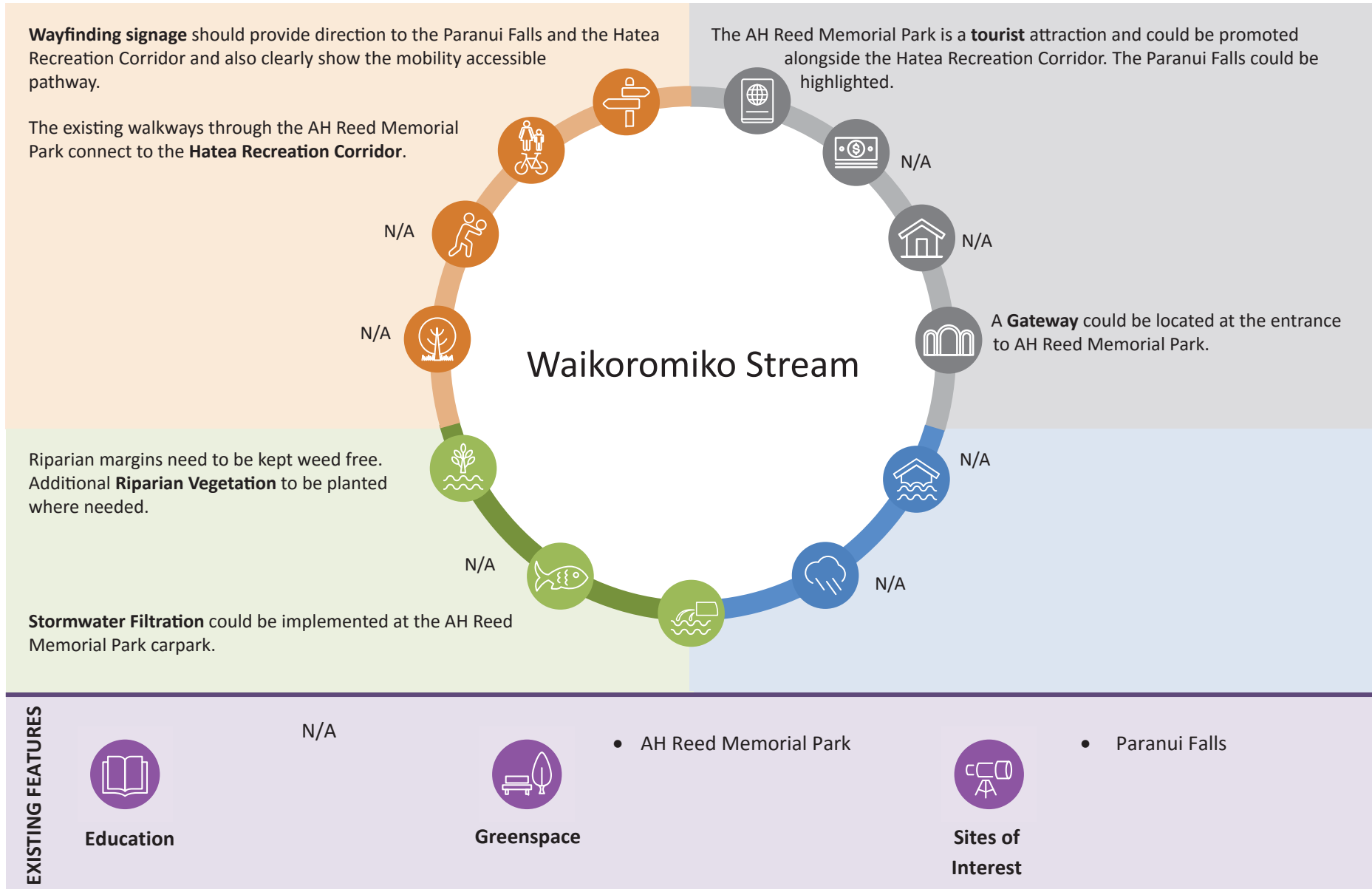


Figure 92 Native bush and Kauri trees surround the Waikoromiko Stream at AH Reed Memorial Park



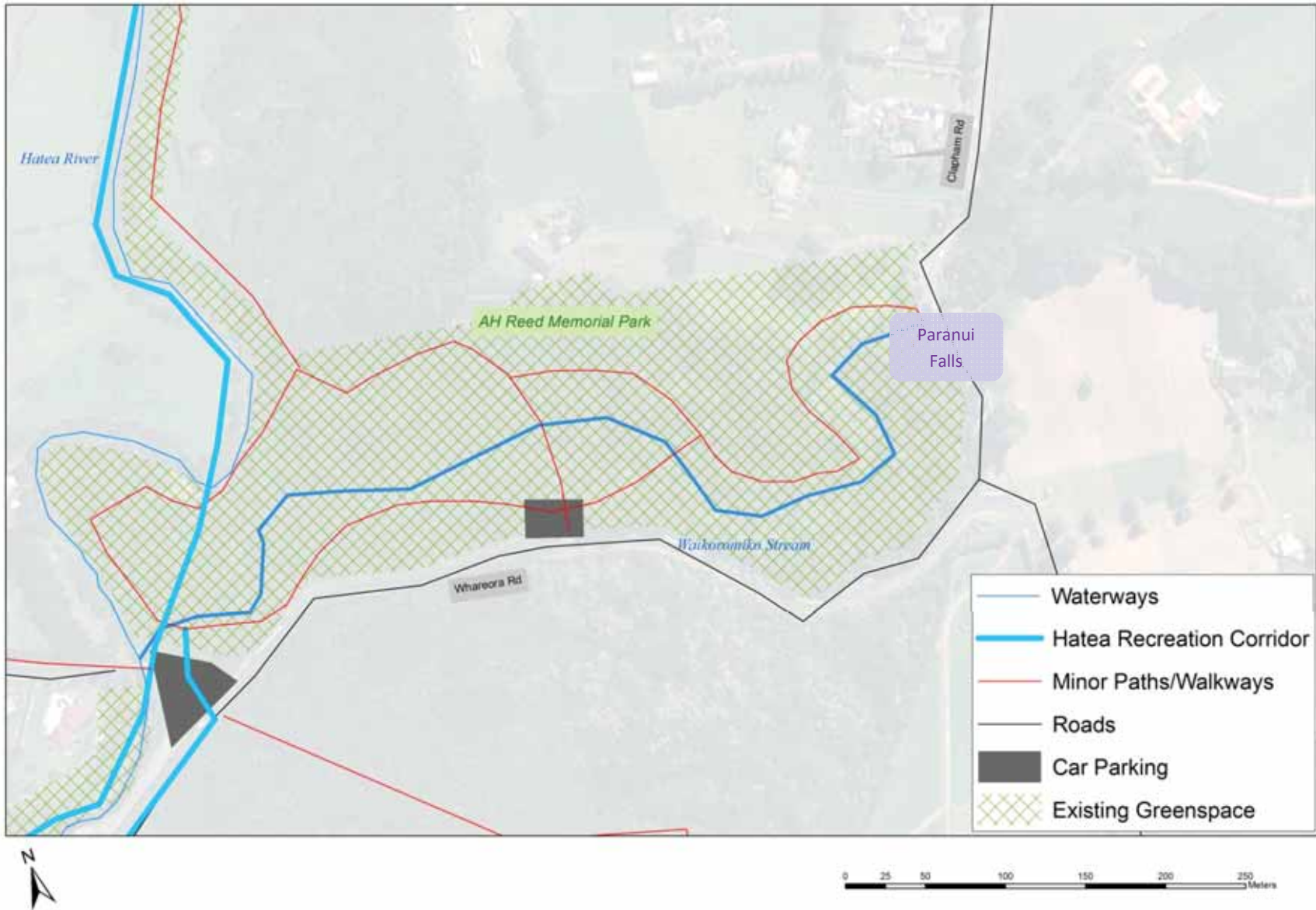


Figure 93 Waikoromiko Stream

CROSS CITY CONNECTIONS

These are shared use paths connecting neighbourhoods and areas of greenspace, including parks, reserves, school fields and playgrounds, which are not adjacent to the waterways, with the facilities and amenities found along the waterway recreational corridors. Minor paths and local connections will tie into these in the future to allow transition across the City.



Figure 94 The Hopua te Nihotetea Dam has created an opportunity to connect Maunu and Raumanga – a view from the Dam over Raumanga Valley Rd

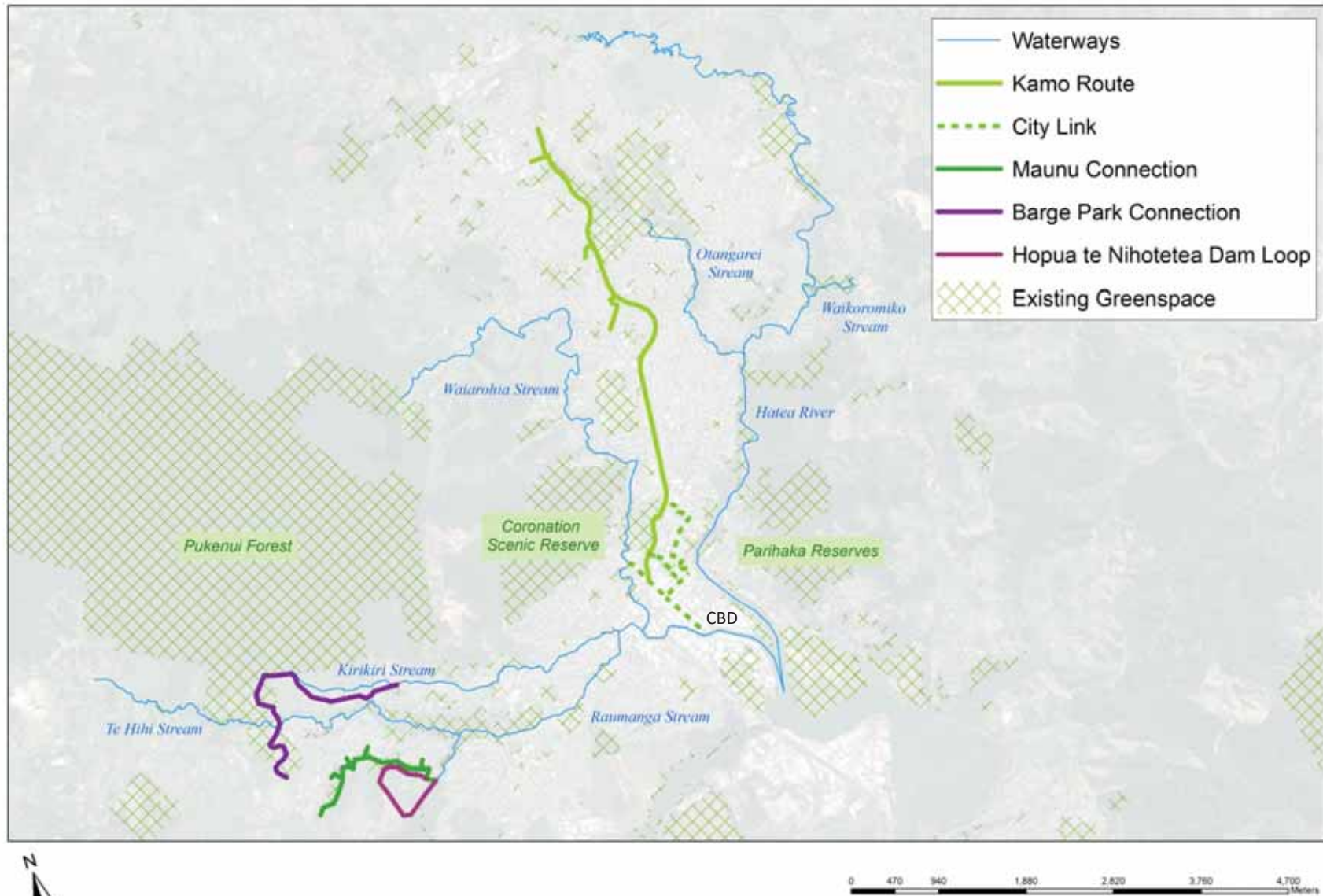


Figure 95 Cross City Connections

Kamo Route

This shared use path runs between Station Road in Kamo and Rust Avenue in the City centre. The shared use path originates from a co-funding initiative between Central Government and councils across the country to increase the number of commuter cycleways. The route is therefore primarily intended for commuter use for workers and school children, but will likely also see recreational use in the weekends.

The pathway runs adjacent to the railway line behind a number of residential neighbourhoods and connects to a number of schools at primary and secondary level. Connections off the route into individual schools will need to be added over time, once the route is completed. By providing better and safer access to schools, it is expected that more children will cycle to school.

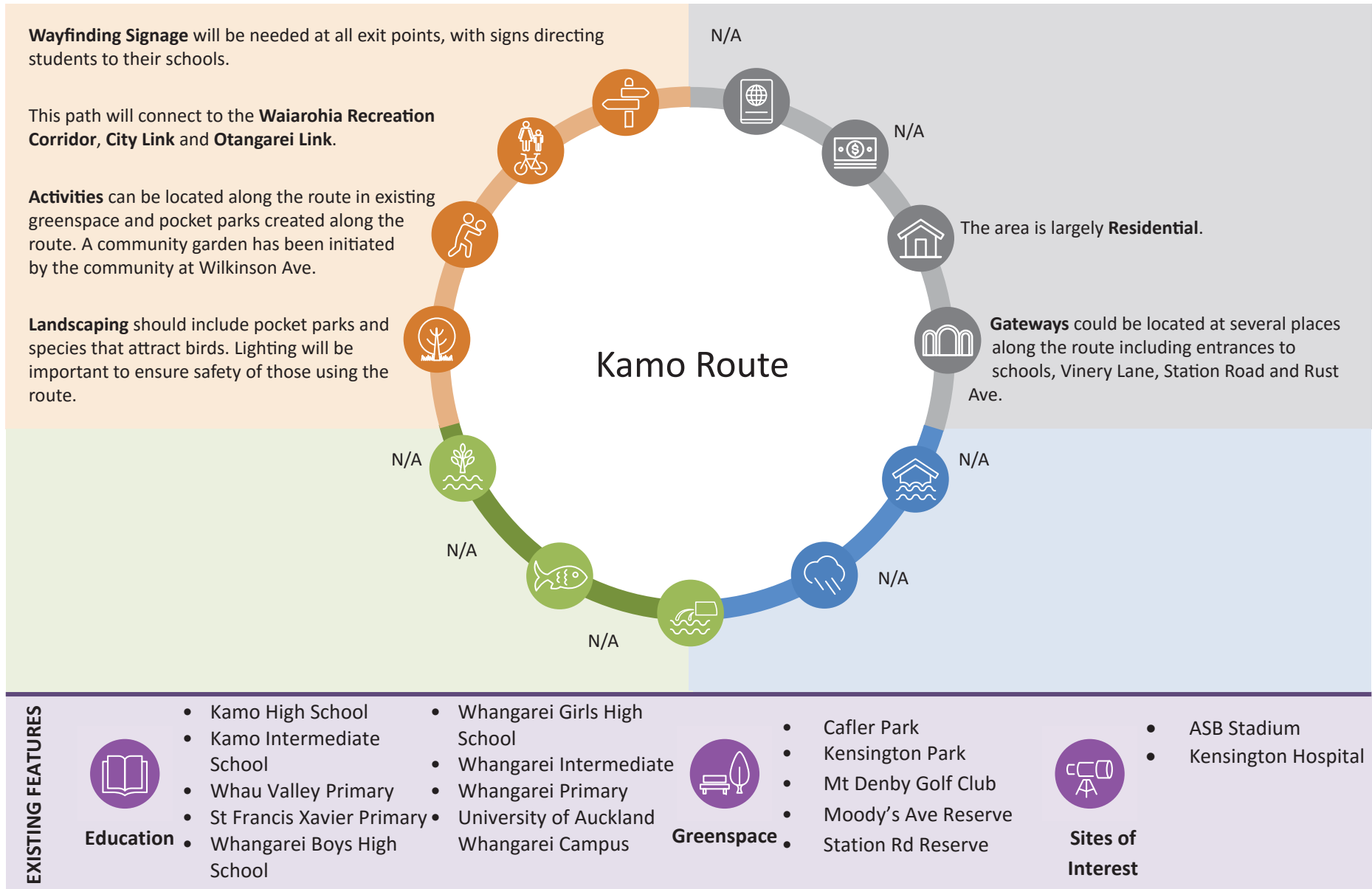
The pathway will be realised in stages over three years commencing in 2016. There is additional scope for pocket parks along the route, which could contain activities such as community gardens, outdoor games or fitness equipment. Landscaping will need to take into account lighting and seating along the route and vegetation should be planted to attract bird species to use the route as an ecological corridor.



Figure 96 The Railway corridor at Manse St



Figure 97 The Kamo Route will follow the railway corridor



City Link

The City Link will connect the planned Kamo Route and Wairohia Recreational Corridor with the Town Basin, via the CBD. It is anticipated that this will be a signposted route, rather than a physical pathway. Entry points for the route will be at Vinery Lane, Cameron Street and Rust Avenue. The route is intended to assist tourists and commuters through the CBD, while avoiding conflict with traffic as much as possible. This includes the Cameron Street Mall and Laneway shared space development completed in 2015. Landscaping and signage will be essential in making this route user friendly.

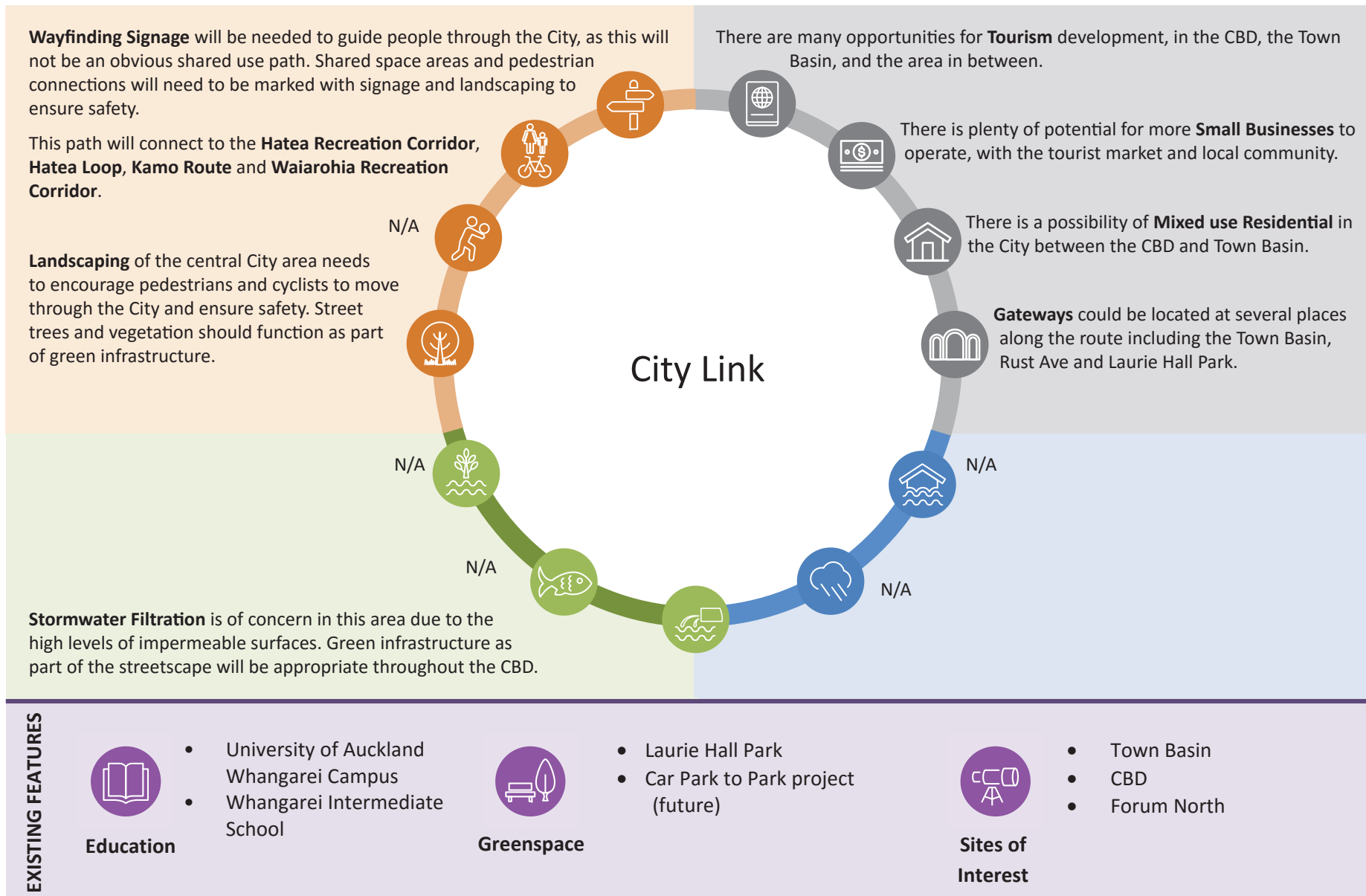
There are increased incentives and enhanced connections between areas of economic activity. Tourism is enhanced and visitors are easily able to navigate the City on foot or bicycle.



Figure 99 Anzac Day memorial service in Laurie Hall Park



Figure 100 The Laneway opening party



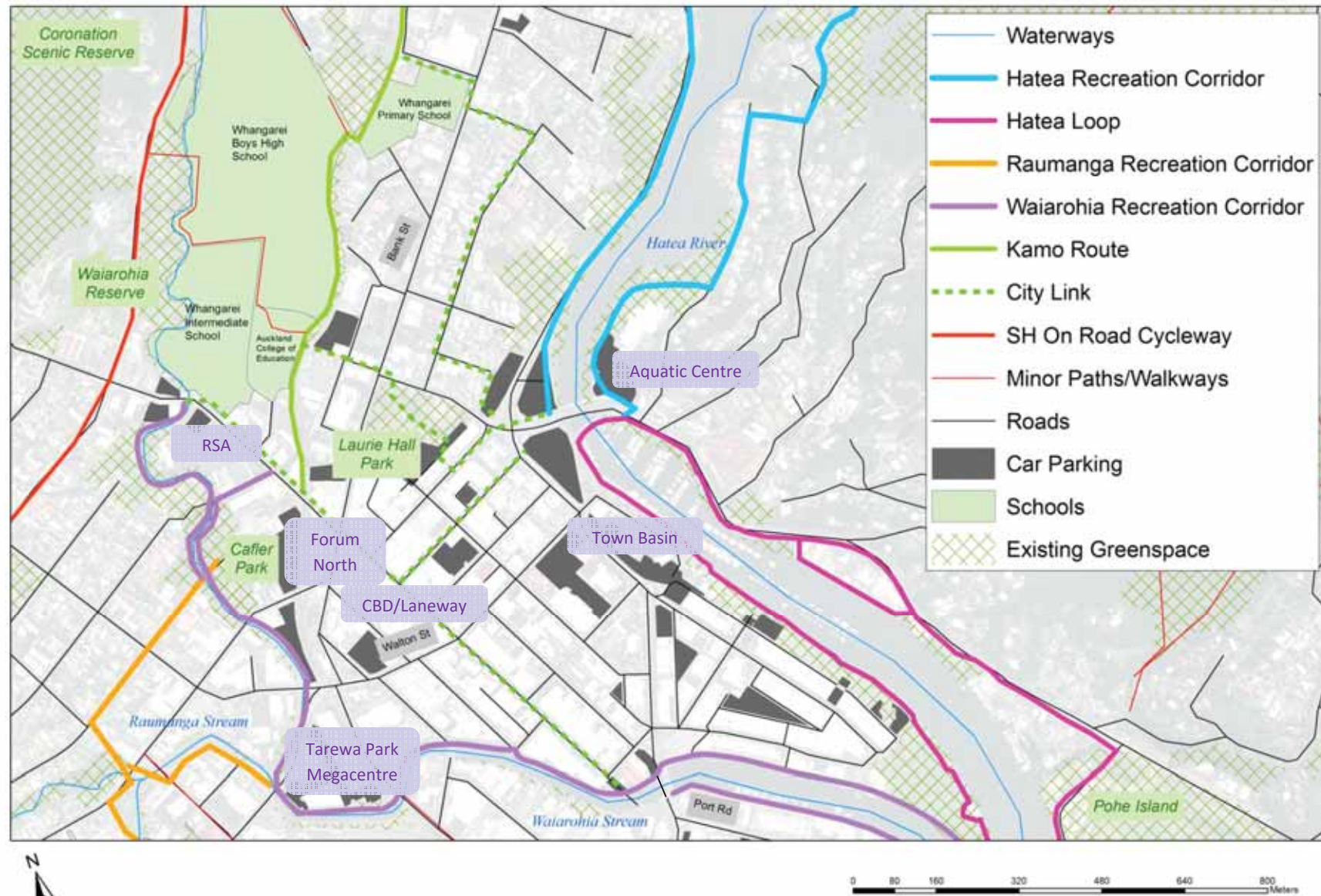


Figure 101 City Link

Maunu Connection

This shared use path will connect Raumanga Valley Road with Pompellier Estate Drive along the base of the hill behind Maunu. Due to the steep topography, connections from the streets to the pathway will need to be steps, with grooves in the side of the stairs to allow for bikes to be moved from the residential area at the top of the hill to the pathway at the bottom of the hill. Ecological restoration in the reserve areas along this route would benefit local fauna and provide a stepping stone from Pukenui Forest.



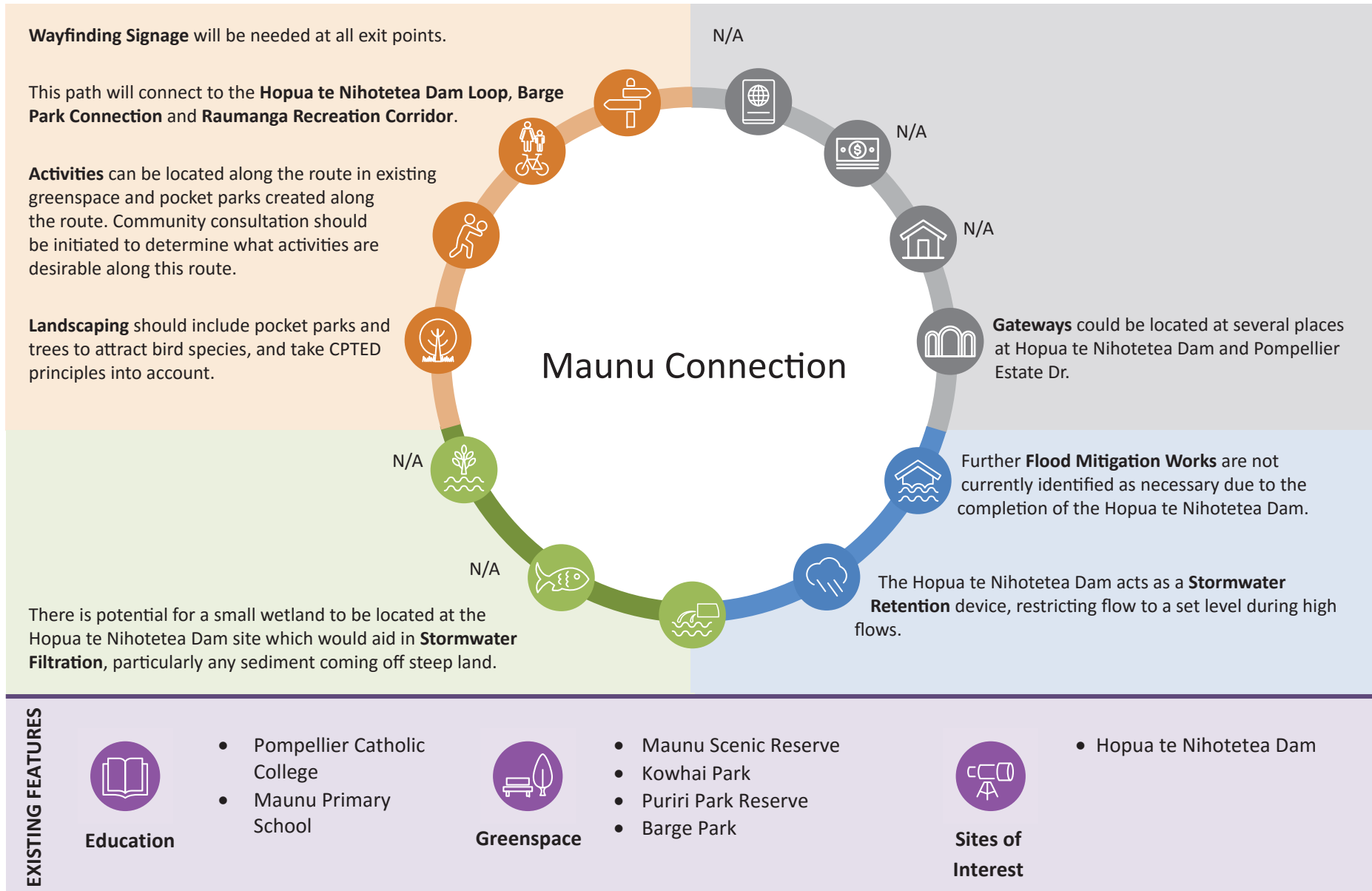
Figure 102 The Maunu Connection will join Pompellier Estate with Raumanga Valley Rd via the Maunu Scenic Reserve



Figure 103 Hopua te Nihotetea Dam viewed from Raumanga Valley Rd



Figure 104 Maunu Scenic Reserve



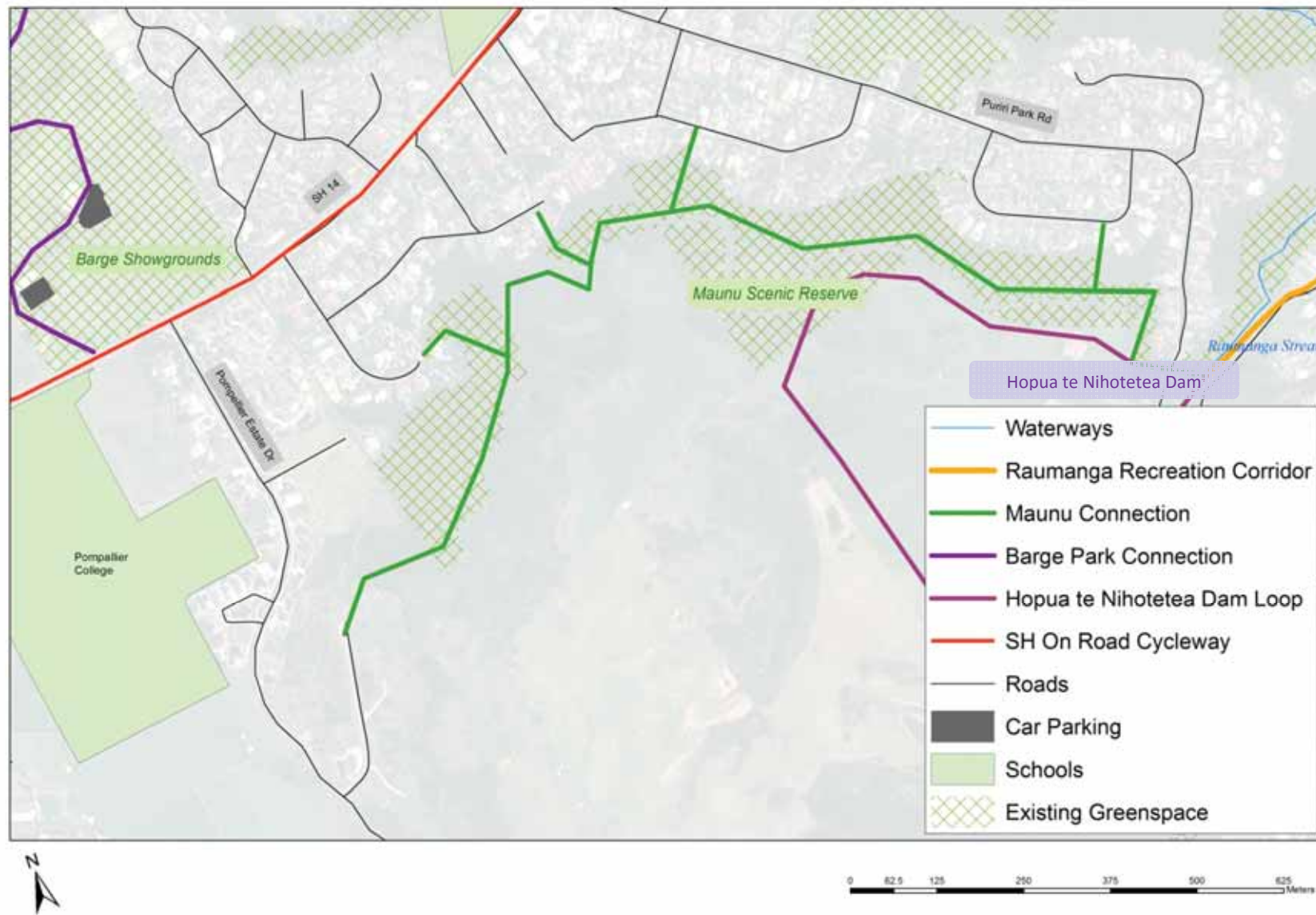


Figure 105 Maunu Connection

Barge Park Connection

This route will connect to the numerous paths through the showgrounds, reserve and Kiwi North, which are currently popular recreation sites, particularly for dog walkers. The path will extend to the fringes of Pukenui Forest and connect onto Pukenui Road. Amenity planting and additional facilities may be required along this route. It will primarily be for recreational purposes, however there is opportunity for ecological restoration and enhancement in the area.



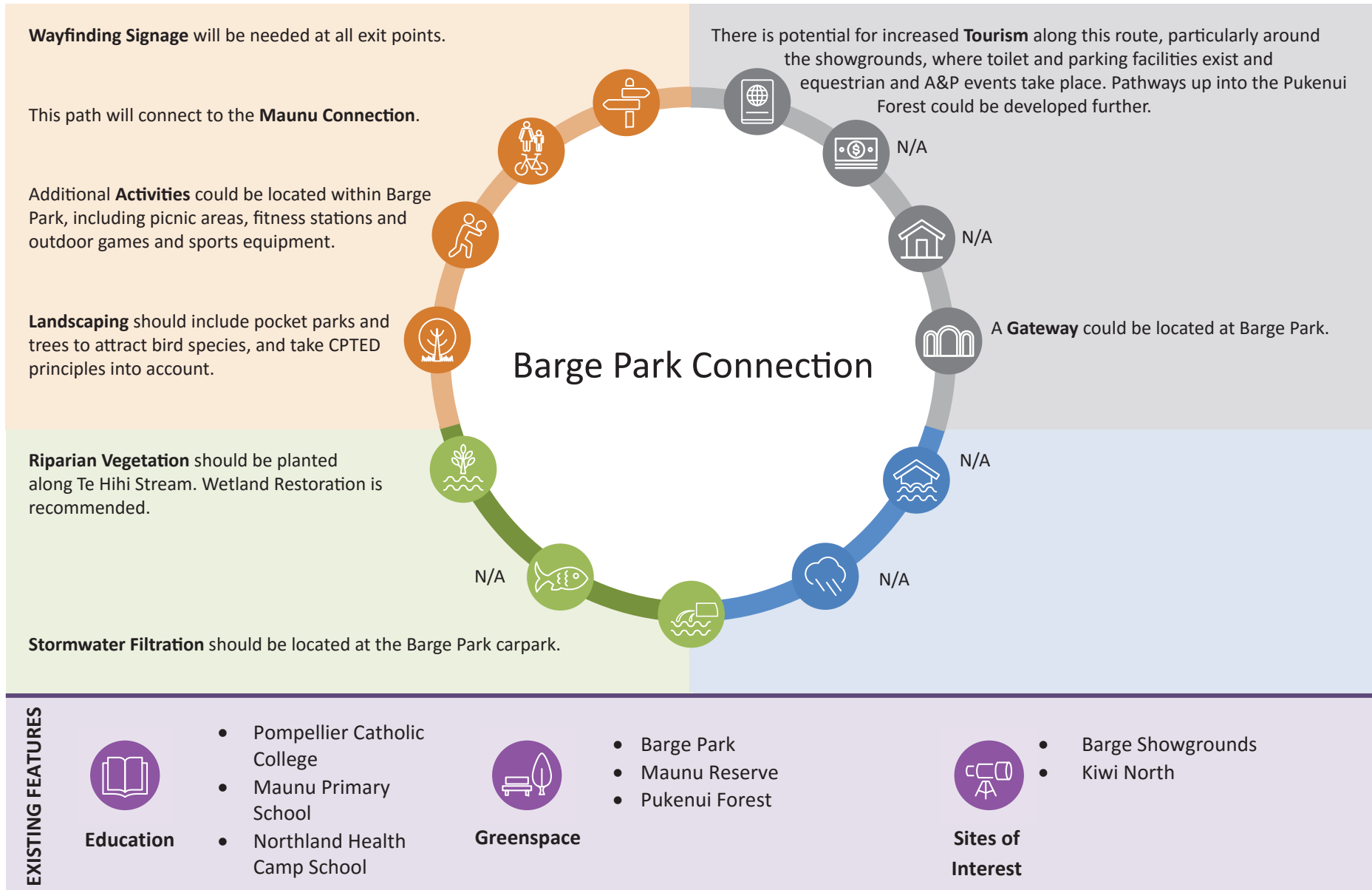
Figure 106 Pond located in the lower Barge Showgrounds



Figure 107 Wetland located in the lower Barge Showgrounds



Figure 108 Views across Barge Park to Pukenui Forest



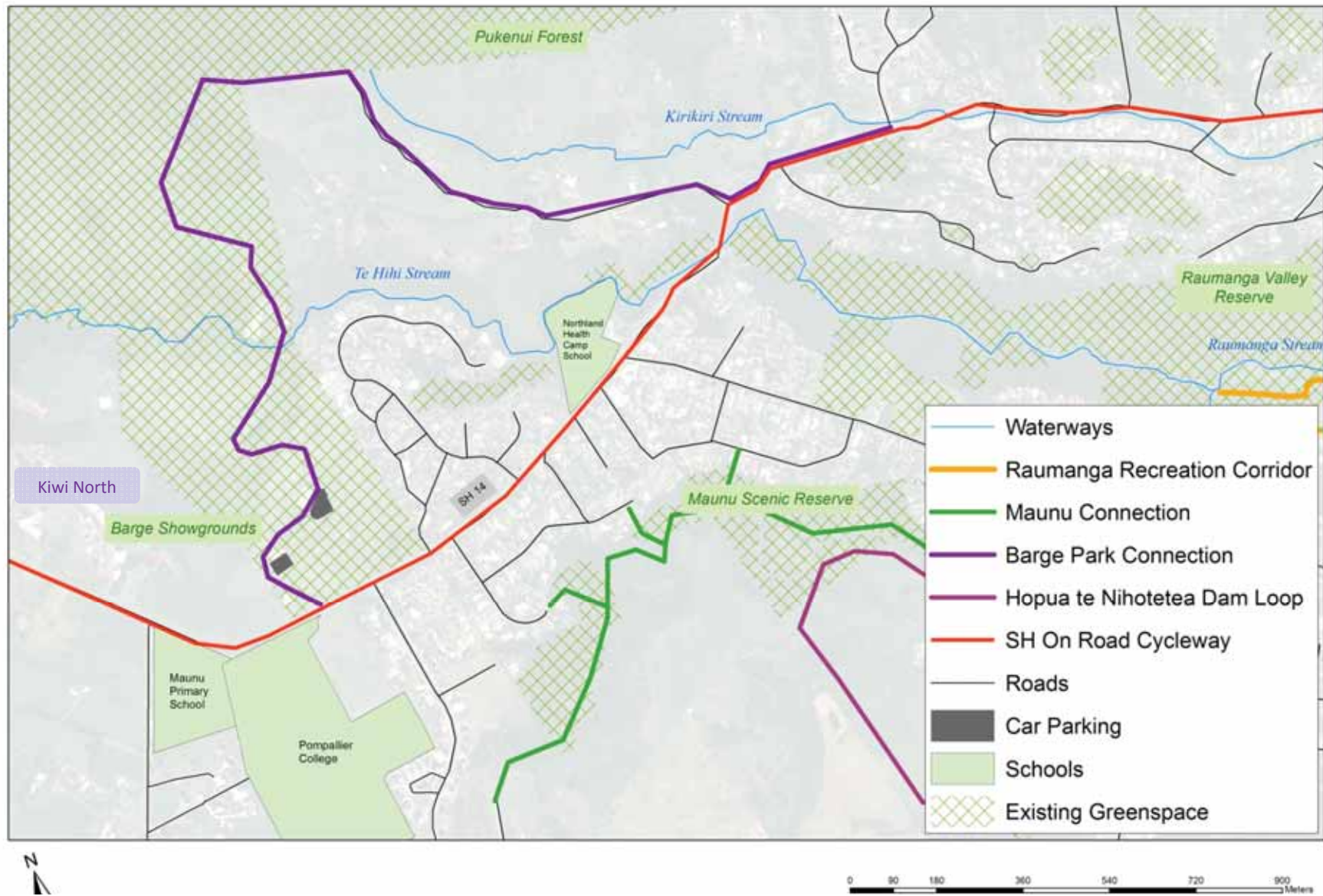


Figure 109 Barge Park Connection

Hopua te Nihotetea Dam Loop

The site of the Hopua te Nihotetea Dam provides an opportunity for a recreational loop walkway, which will be accessible when the dam is not in flood. Below the structure at the outfall site is the potential for a permanent wetland, as water flow is continuous. There is also an opportunity for an ephemeral wetland to be created at the top of the site, however any landscaping will need to take into account the nature of the dam and the potential for high volumes of water at the site during flood.

Flood protection works become opportunities to enhance urban amenity and increase sense of place, providing additional benefits for the community.



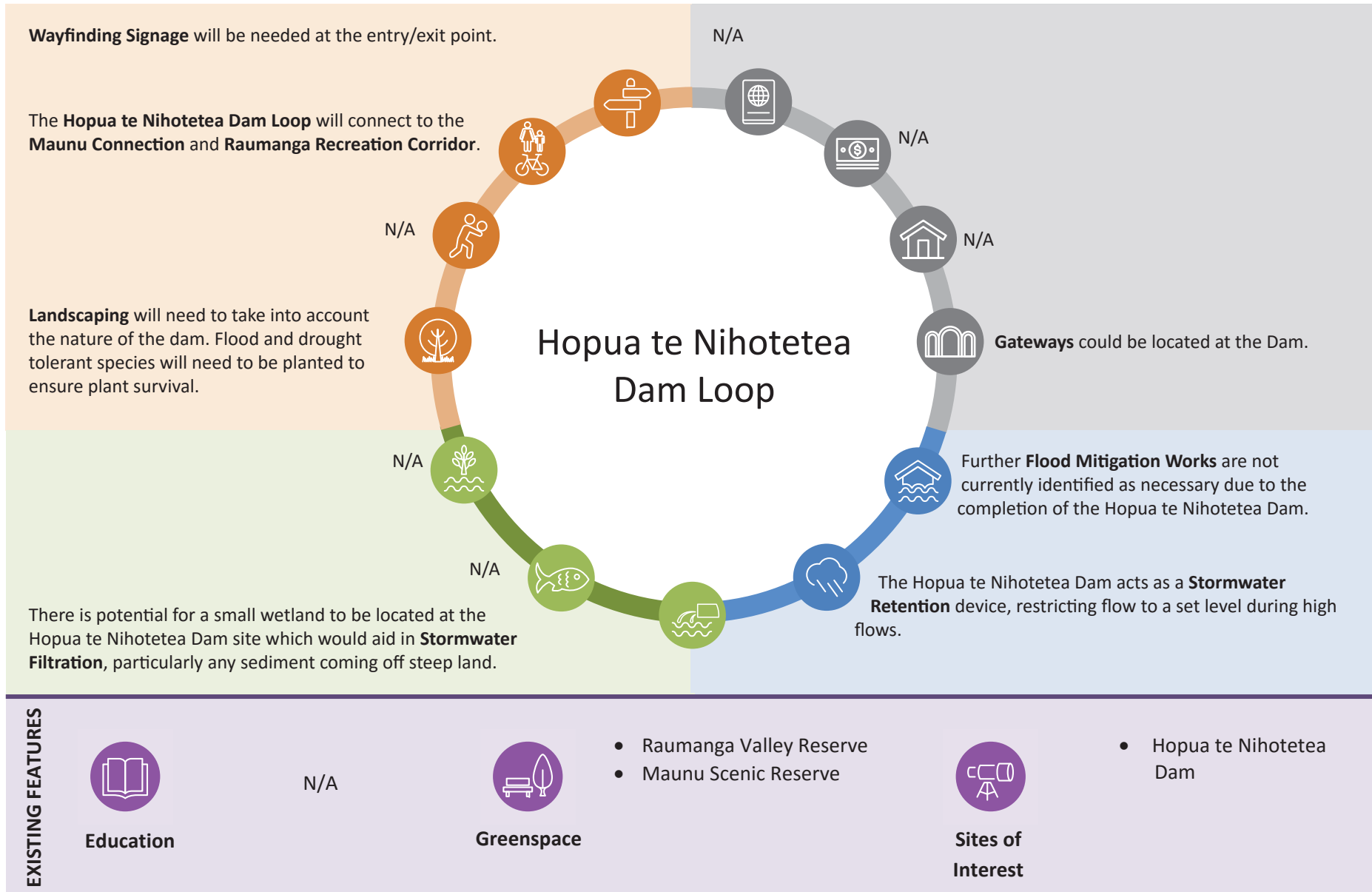
Figure 110 Tributary of the Raumanga Stream



Figure 111 The retention zone at the base of the Hopua te Nihotetea Dam



Figure 112 The retention area of the Hopua te Nihotetea Dam



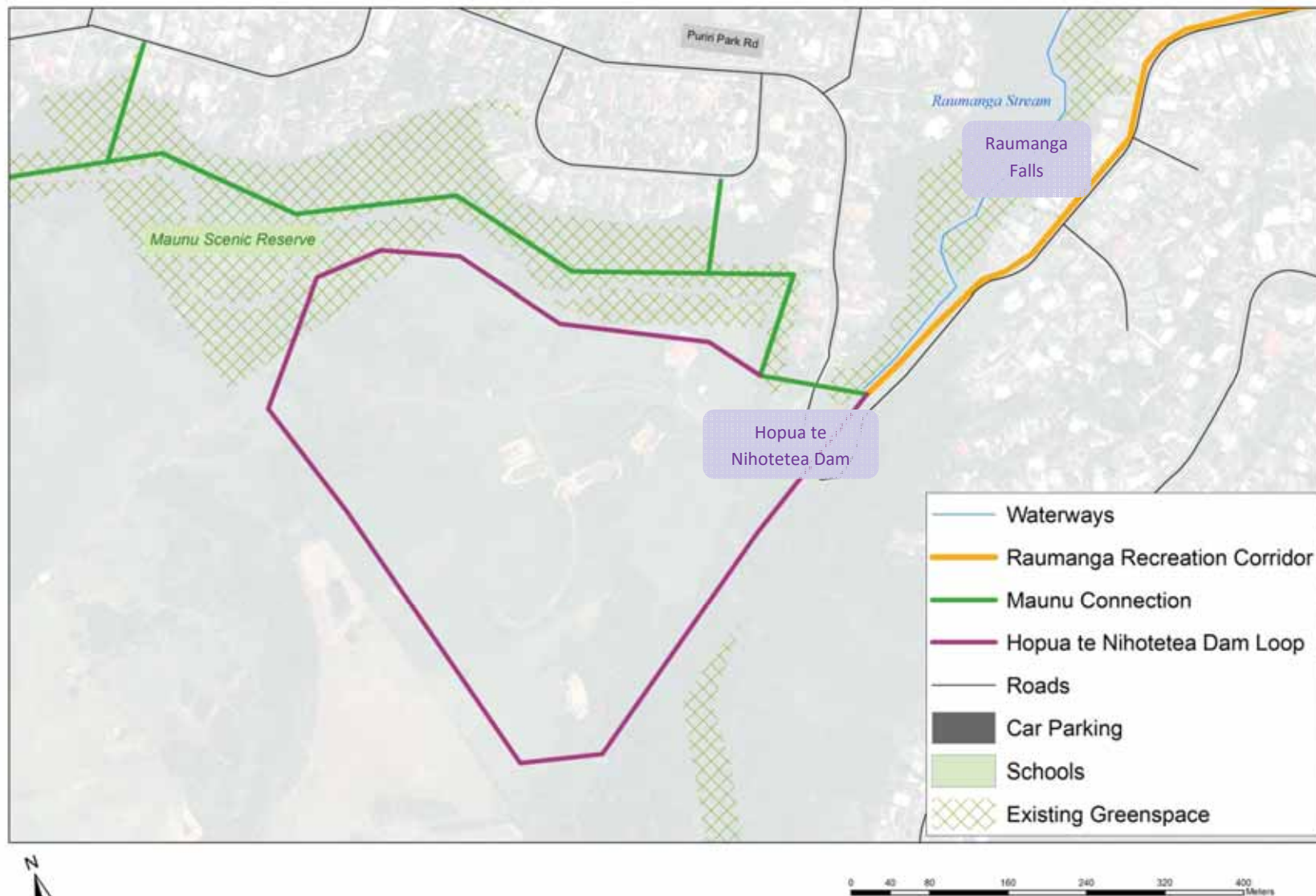


Figure 113 Hopua te Nihotetea Dam Loop

IMPLEMENTATION

STRATEGIC OPPORTUNITIES

The Blue/Green Network Strategy provides a long term vision for the future of Whangarei's waterways and greenspace. An important role of the Strategy is to provide an overarching strategic framework that informs policy development and implementation of relevant projects. The physical improvements (e.g. planting, infrastructure) recommended in the Strategy are expected to be implemented over an extended period of time as opportunities arise. This could involve a 50 year implementation horizon. In addition to the physical improvements there are a number of initiatives that Council can undertake to facilitate the process. This is to ensure that all aspects and benefits identified in the Strategy are taken into account as decisions on project design and implementation are made.

Policy and Planning Initiatives

Rezone land

When considering population growth or redevelopment of an area, structure or precinct plans are created to assess a number of potential issues, including infrastructure capacity, community needs and transport. Where required, recommendations for rezoning are made. A plan change is then needed to put the recommendations into effect.

The Strategy recommends creating mixed use residential developments in the City. This is not currently zoned for and a plan change will be needed for developments of this kind to go ahead.

A Precinct Plan for Hihiaua Peninsula has been completed and its recommendations have now been progressed to draft plan change PC132. Outside of the Hihiaua Peninsula, the Inner City Development Plan (under development) will make recommendations on rezoning to provide for mixed use residential development in the City. The plan will set out Council's direction on development and growth in the Inner City area, including the Town Basin and land adjacent to the Waiarohia Stream, over the next 20-30 years.

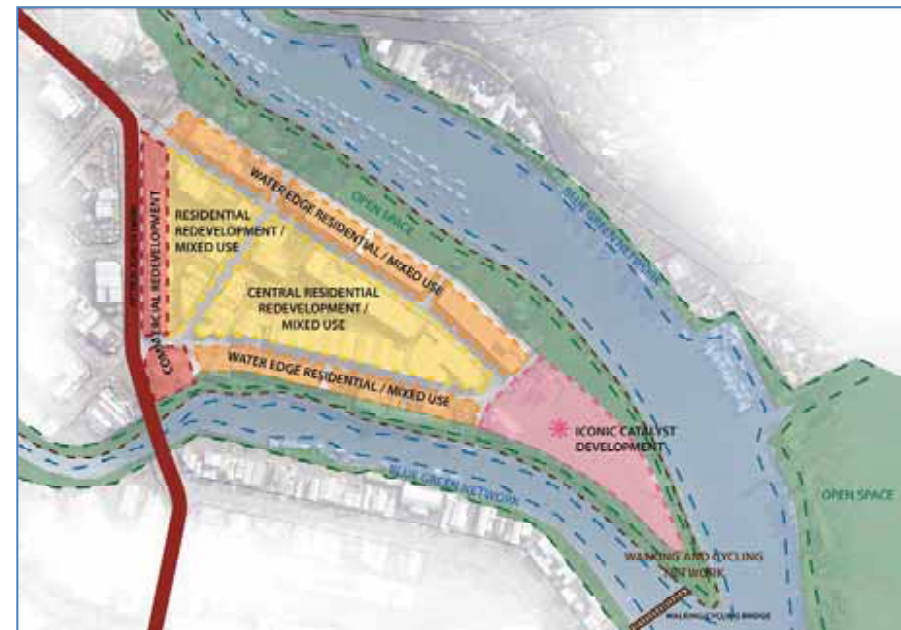


Figure 114 Concept Framework for Hihiaua Peninsula (Hihiaua Precinct Plan)

Create Urban Design guidelines

There is currently no set of urban design guidelines to guide higher density residential development across the City. The Hihiaua Precinct Plan contains some guidelines for potential development on Hihiaua Peninsula and the Inner City Development Plan will address urban form in the Inner City area, however this will leave a number of areas without guidance. Development of a complete set of urban design guidelines will be needed to ensure that Council's expectations of development are met. The document will provide guidance to developers, consultants, and the community.

Review associated Bylaws.

A number of bylaws apply in areas covered by the Strategy, which could preclude certain activities or initiatives that the Strategy recommends. These include, but are not limited to, the Dog Management Bylaw 2013, the Public Places Bylaw 2014 and the Hawkers, Mobile Shops, Stalls and Stalls Bylaw 2005. As bylaws are reviewed, consistency with the Strategy needs to be considered.

Strategic Planning Initiatives

A number of Council's strategic documents are out of date and need to be brought in line with the Strategy. In addition, there are a number of gaps in Council's strategic planning that should be completed within one to three years, before large scale physical improvements take place.

Create a Signage Strategy

Signage is important in directing people to where they want to go and advising them of how long journeys will take. Currently there are a number of signs around the Town Basin, Hatea Loop (Figure 115) and

several parks and reserves. However, the signage is not consistent between areas. As the network of pathways expands, and additional projects are developed, a strategy will need to be developed to ensure a consistent message and experience is available for tourists and local alike. Wayfinding signage, including maps, trail markers and information points, will need to be developed, ensuring clarity and consistency with standard international symbols.



Figure 115 Current signage on the Hatea Loop Walkway

Update the Walking and Cycling Strategy

The Walking and Cycling Strategy is currently scheduled to be updated in 2017. Any updates should expand on the network proposed in this document and investigate the feasibility of some of the proposed routes. The strategy needs to address mobility concerns and ensure that walkways/cycleways/shared use paths that are unsuitable for wheelchair users, mobility scooters and children's prams are clearly marked. Cycleways should also not be put in without some form of landscaping plan – this should be addressed at the design stage.

Create an Economic Development Strategy

A comprehensive Economic Development Strategy needs to be created for the District as a whole, with a section devoted to development in the City. This has been previously recommended in the Whangarei District Growth Strategy: Sustainable Futures 30/50 Implementation Plan 2012 as an action, but has yet to be completed. Once adopted, this document will guide business owners, developers and council staff alike in determining the direction of future economic growth in the District.

Create a Stormwater Management Strategy

A Stormwater Management Strategy is required to ensure that stormwater goals, such as stormwater quality or hazard mitigation, are met over time. A similar strategy has already been completed and adopted for Wastewater Management. A number of Council departments are involved in stormwater management, through policy, consents, compliance, asset management and planning for growth. In addition, the Northland Regional Council also has obligations regarding stormwater management. A strategic document will enable all staff involved across organisations to adopt a consistent approach to stormwater management. The strategy will need to be long term and should inform catchment management plans, policy development, resource consents (at both district and regional level), asset management and any review of the Stormwater Management Bylaw 2008.

Update the Open Space Strategy

The Open Space Strategy needs to be updated to include developments that have occurred since its adoption in 2001, and to align with current documentation, including the Biodiversity Strategy 2012, Reserve Management Plans and the Whangarei 20/20 Momentum document.

There is increased value of land along waterways, with areas transformed into mixed use residential developments where people can live, work and play.



Figure 116 Mair Park - part of the Parihaka Reserves Management Plan

MANAGEMENT ACTIONS AND PROJECT PHASING

Cross Agency Working

In order for the Strategy to be effective, multiple parties will need to commit to implementing the Strategy over the long term. The two main contributors will be the Whangarei District Council and the Northland Regional Council. However, buy-in will be required from iwi/hapu, a number of community groups, agencies, businesses, landowners, and private developers to ensure the Strategy's success.

Each of the themes addressed in the Strategy require a different level and set of expertise to implement. Some projects can be easily realised in terms of time, cost, expertise and planning, whereas large infrastructure projects can take years to fully implement and require the input of highly skilled professionals across multiple organisations.

Opportunities for external funding also differ and are more likely to be available to small, community led projects (e.g. fitness equipment, community gardens) or large, government subsidised projects (e.g. commuter cycleways). As funding becomes available to different groups, individual projects can be progressed, with a view to contributing to the whole.

It may be beneficial for a working group to be set up with representatives across Northland Regional Council and Whangarei District Council. A regular meeting would ensure that any projects being undertaken at either council align with the Strategy and are collaborated on. By collaborating, future remedial work will not be required, e.g. removing a

cycleway to make way for flood protection due to lack of communication at the project planning stage.

Prioritisation

The implementation of the Strategy is expected to be long-term, up to 50 years. Project prioritisation will be necessary as public funding is limited.

Criteria to select projects could be based on the following:

- Projects adjacent to existing features/projects currently in process, e.g. extending existing pathways or enhancing existing parks.
- Projects that can access external funding, e.g. Central government currently is providing additional funding for commuter cycleways.
- Projects that are easy to implement, e.g. projects that don't require a lot of resources, consultation or permissions, or can be completed by the community with minimal council involvement.
- Projects on council land, e.g. where projects take place completely on council owned land, projects can proceed without land purchase or negotiation of easements.



Figure 117 Cross-agency working group on improving the water quality at Whangarei Falls

ISSUES

Managing Competing Interests

Land ownership

Infrastructure, such as flood protection structures and cycleways, cannot always be constructed on Council administered land. Where public land is held by agencies other than Council, such as the Ministry of Education, easements need to be negotiated, which can take over a year to complete. There are several options for building across private land but these come at a cost and are time consuming. For projects where only a 10m stretch along a stream bank is required, land purchase is often not a practical solution. Negotiating easements with owners is the preferred option for constructing walkways/cycleways/shared use paths as they require little land. However, the process can take 3-6 months per property, which can slow a project down considerably if easements over numerous properties need to be acquired. For cycleways, often a small area at the rear of a property is all that is required, whereas flood protection may require the purchase of an entire property, particularly if a structure or building needs to be removed. Land purchase is a lengthy process and requires consultation. Property owners may refuse to sell their land to Council, in which case the Public Works Act needs to be considered.

Preventing new buildings from being built in the riparian margins will be necessary to ensure that future development does not encroach on the waterway, affecting the ability of using the riparian margins for shared

use paths, flood protection or ecological functions. Provisions could be made in the District Plan to ensure riparian margins are protected.

Whilst many improvements can be made on public land, large developments and private car parking can have a major effect on stormwater quality. It is apparent, especially after rainfall, that there is oil, sediment and other vehicle pollutants entering the stormwater system from carparks. While Council can address some of these issues on public car parking, many of our large carpark areas are privately owned by retailers, such as supermarkets and big box retailers. Improving water quality from these sources could make a big difference to the water quality of local streams and the Harbour.



Figure 118 Waitaua arm of the Hatea River - one side planted, the other in grass

Getting private owners to plant and maintain their stream banks with suitable native species to provide quality habitat and bank stability is not currently incentivised in either the rural or urban environment. During subdivision is generally the only time that Council can influence landscaping plans to request riparian planting. Urban Design Guidelines should include appropriate landscaping around streams for new developments in the inner city along the waterways.

Planting requirements

There are competing requirements for planting which can make it difficult to select plants that address all issues. Plant selection to address water run-off quality issues will be different to those selected for habitat, amenity, public safety, flood management or shading of paths. It is unlikely that all elements can be addressed at once and prioritisation will need to be given to those that are most important at a particular location. Managing for water quality and habitat will be of higher priority for suburban areas and streams where there are no walkways/cycleways/shared use paths adjacent. For cycleways, and urban areas public safety will be paramount. Ensuring that planting doesn't impede water flow in flood conditions will be important on the lower Raumanga, Waiarohia and Hatea waterways.

Traffic

Off-road cycleways largely limit the conflict with traffic, however there are a number of places where crossing roads or traversing bridges will be required. Roading requirements will need to be considered to ensure that pedestrians and cyclists are able to cross easily and that any timed crossing points, e.g. traffic lights, are phased to ensure that waiting times for crossing are limited. Bridges should have separate cycling lanes where

possible. These need to be considered when new bridges are constructed. Clip on extensions may be an option to retrofit current bridges.

Users

There are a number of different user groups anticipated to use the walkway/cycleway/shared use path network including pedestrians, cyclists, mobility impaired, children and dog walkers. By constructing the walkways/cycleways/shared use paths as wide and as flat as possible, multiple users can travel in both directions safely and with minimal conflict. Issues can arise where large groups of cyclists travel in groups across the pathway, rather than in a line. This is a particular issue where you have groups of small children, who can be more unpredictable in their movements than adults. Where possible it may be better to separate the cyclists from the pedestrians into different lanes. If certain user groups are excluded from a pathway, due to accessibility, environmental or other reasons, then signage needs to be clear that they are unable to use a particular path. This is particularly important for mobility impaired users

Public Safety

Crime Prevention through Environmental Design (CPTED)

Crime, or the fear of crime, can prevent people from using parks, retail and entertainment areas and other amenities, particularly at night. The perception of an area as safe is important in maintaining a vibrant economy and encouraging people to utilise facilities such as walkways/cycleways/shared use paths and parks. Places that are safe and feel safe attract people, activity and investment.

In addition to law enforcement programs, crime prevention is something that can be improved through quality urban and landscape design. The CPTED approach is one that is used widely in planning by focusing on reducing opportunities and therefore the motivation for criminal activity.

The Ministry of Justice has developed national guidelines for CPTED in New Zealand, which identifies seven qualities of safer places. These aspects need to be considered carefully when designing and engineering paths on the proposed walkway/cycleway/shared use path network. By their nature, these routes will tend to locate to the rear of buildings and houses and so CPTED principles will have to be considered very carefully to ensure that these walkways/cycleways/shared use paths do not facilitate criminal activity.

Access: Safe movement and connections

Tunnels and underpasses should be short, with exits visible from entryways and no places where offenders could potentially hide or entrap victims. There should be multiple entry and exit points from the pathway network to ensure that people are able to exit the network if they feel unsafe. Walkways/cycleways/shared use paths that are not intended for use at night should have low to no level of lighting to discourage users. This will not be appropriate in all locations where surveillance may be an issue.

Surveillance and sightlines: See and be seen

Areas and walkways/cycleways/shared use paths that are overlooked by buildings are less likely to experience criminal activity as the risk of being seen is high. For areas that are not overlooked it is important to ensure that buildings, fencing and vegetation do not block sightlines and that appropriate lighting is provided to discourage crime.

Layout: Clear and logical orientation

Well defined routes that are clearly signposted encourage people to move through the space. Where possible, activity from adjacent buildings should face towards the area, through windows or building frontages.

Activity mix: Eyes on the street

Mixed use neighbourhoods provide more opportunities for people to be seen, as if one use of an area is finished for the day, i.e. retail, other users of the space will still be present, i.e. residents. Areas with multiple user groups will provide a more vibrant atmosphere and round the clock surveillance.

Sense of ownership: Showing a space is cared for

Neglected areas foster a negative perception of an area. People are more likely to avoid these areas. Community involvement in designing a space assists in developing a connection to that space and encourages community ownership.

Quality environments: Well designed, managed and maintained environments

Good quality spaces which are maintained to a high standard will support community ownership. Facilities should be resistant to vandalism.

Physical protection: Using active security measures

CCTV Cameras, fencing and other physical devices to deter crime can be effective tools where other aspects of CPTED are unable to be used.



Figure 119 City Safe staff, surveillance cameras and Summer Safe volunteers keep an eye on our communities

Accessibility

Catering for the mobility impaired is important in meeting Council's obligations to the community. While not all walkways/cycleways/shared use paths will be able to be fully accessible it is important that those labelled as such are able to be accessed by a range of people with mobility impairments. Scooters, wheelchairs and walking frame users have different needs and walkways/cycleways/shared use paths need to accommodate these.

Entry and exit points to the pathway network will need to be angled and sloped appropriately to reduce collisions between users and to avoid users ending up in vegetation or a waterway. They will also need to be spaced regularly to ensure that users do not become trapped along a pathway.

Maintenance

Stormwater infrastructure

Grey infrastructure is generally low maintenance and only needs replacing towards the end of its lifespan. Green infrastructure is high maintenance, needing regular upkeep to ensure its effectiveness and to retain its amenity value.

Provision for ongoing maintenance has been identified within Council as the greatest barrier to investing in green infrastructure. It is often easier to secure "one-off" funding for replacement of pipes, etc. rather than obtaining a lower level of long-term funding for green features. Engineers often regard green infrastructure as an expensive option, however it provides additional benefits that grey infrastructure alone cannot

achieve. 'Whole of life' costs can come out at a similar level as grey infrastructure, depending on the design and implementation.

A long-term maintenance programme for the ongoing upkeep of these features is important, as is identifying responsibilities for the maintenance of the structures. It may be that the responsibility for maintaining the plants (high frequency) falls under Parks and Recreation, whereas the substrate (low frequency) falls under Waste and Drainage. Wherever the responsibilities lie, it is important that overall maintenance is funded and budgeted for to maximise the benefits.

Walkways/cycleways/shared use paths

All walkways/cycleways/shared use paths will need regular maintenance. With the extension of the walkway/cycleway/shared use path network over the next 50 years, an increase in the budget for maintenance of these will be required. Walkways/cycleways/shared use paths will need to be kept at a high standard and landscaping will need to be managed to ensure public safety and amenity values are maintained. It will be important that any unevenness or damage to paths labelled as fully accessible are fixed as soon as possible to ensure that mobility impaired users are able to use these facilities.

Riparian planting

When planting, a number of plants will not survive the first summer. These plants will need to be replaced the following planting season to ensure a complete riparian belt. Gaps in planting can allow weeds to move back in to an area, which will reduce the viability of the riparian zone for ecological purposes and will reduce the amenity of the streamside.

Inadequate weed control can cause further loss of plants, as weeds quickly overgrow planted seedlings. Young natives will need regular weed control for up to four years until they are big enough to outcompete weed species, something that is not usually considered when undertaking community planting days or planting riparian zones in semi-rural areas.

Maintenance is essential in ensuring that riparian planting is effective long-term. Unfortunately, there is usually debate about whose responsibility it is to maintain these features, both between and within organisations, and a lack of funding allocated by politicians to ensure long-term consistent upkeep. Communities are generally interested in being involved in mass planting days but are less engaged in maintenance tasks such as weed releasing. Without this maintenance, outcomes will be poor and the initial investment in plants will be devalued.



Figure 120 Volunteers at a muck-in day do maintenance at one of the community planting sites

ACKNOWLEDGEMENTS

CONSULTATION

This document was created with input from a number of sources. Particular acknowledgment is given to Northland Regional Council for providing the author with access to unpublished data and expert advice and to Juliane Chetham, who provided cultural input on behalf of Te Huinga.

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APPENDICES

APPENDIX 1 – GLOSSARY OF TERMS

Active Frontages: where businesses overlook and interact with their environment, through windows and entrances, promoting safe, pedestrian-friendly environments.

Biodiversity: diversity among and within plant and animal species in an environment.

Bioinfiltration: a pollution control technique using living material to capture and biologically degrade pollutants.

Biophilia: a love of life and the living world; the affinity of human beings for other life forms.

Bioretention Systems: a vegetated depression located on site that is designed to collect, store and infiltrate stormwater runoff.

Blue/Green Network: a holistic way of planning, incorporating “blue” water-based elements (i.e. watercourses, rivers, streams, drains) and “green” vegetation based elements (i.e. parks, forests, gardens riparian strips, planting).

Channelization/Channelized: to take a natural watercourse and channel the water, usually through concrete structures.

City: refers to Whangarei City.

Climate Change: a long-term change in the earth’s climate, used generally to indicate changes in climate due to an increase in the global average water and atmospheric temperature.

Council: refers to Whangarei District Council.

Diadromous: a term used to describe fish who migrate between fresh and salt waters as part of their life cycle.

District: refers to Whangarei District.

Ecological Connection/Corridor: an area or strip of land that connects two significant ecological areas together, allowing plants, birds, animals and insects to migrate between the areas.

Ecosystem: a dynamic complex of plant, animal and micro-organism communities and their non-living environment, linked together through nutrient cycling and energy flow and interacting as a functional unit.

Ecosystem Services: the renewable and non-renewable stocks of natural resources and processes that support life and economic activities, i.e. soil retention, water retention and purification, air quality etc.

Flood Corridor: an area which is used to guide and contain floodwaters and pass water safely to the sea.

Gateway: a site, junction, building, monument or landscape feature that marks an entrance, arrival point or significant threshold to an area of interest e.g. park, neighbourhood, City.

Green Roofs: a roof planted with vegetation, offering energy conservation and stormwater control.

Greenspace: an area of grass, trees, or other vegetation set apart for recreational or aesthetic purposes in an otherwise urban environment.

Greenway Flood Corridor: a corridor of open space that is managed for environmental benefits, improving stormwater quality and reducing flooding events.

Gross Pollutant Trap: a device used for water quality control that removes solids typically greater than five millimetres conveyed by stormwater runoff, i.e. litter, debris and coarse sediments.

Heat Island Effect: a City or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities such as modification of land surfaces.

Impermeable Surfaces: areas that do not permit the flow of water through them. e.g. concreted areas, carparks, roads.

Infrastructure: the fundamental facilities and systems serving an area such as transportation networks, sewerage and stormwater networks.

Kawanatanga: government.

Macroinvertebrate: organisms without backbones, which are visible to the eye without the aid of a microscope. Aquatic macroinvertebrates live

on, under and around rocks and sediment on the bottoms of lakes, rivers and streams.

Macroinvertebrate Index Sampling: testing the macroinvertebrate community as a means of measuring water quality, ecosystem health and the impacts of pollution.

Mahinga Kai: garden, cultivation.

Matauranga: education, knowledge, wisdom, understanding and skill.

Mauri: life force or ethos.

Mixed Use Developments: a blend of land uses in one area, generally commercial and residential activities.

Obesogenic Environment: an environment that helps or contributes to obesity.

Open Space: an area of land that is valued for natural processes and wildlife, for agricultural and sylvan production, for active and passive recreation and/or for providing other public benefits.

Pervious Pavement: pavement with a base and subbase that allows the movement of stormwater through the surface.

Plan Change: a legal process to make changes to the District Plan, such as re-zoning land or amending District Plan rules.

Pocket Parks: a small park accessible to the general public.

Rangatiratanga: the right to self-govern, chiefly status.

Recreational Corridor: an area which provides recreational activities.

Reverse Sensitivity: when an established activity is adversely affected by a new activity.

Riparian Margin: pertaining to the banks of a stream. Most often used to describe the vegetation along a stream.

Rohe: area within which iwi or hapu claims mana whenua (authority over land based resources).

Sedimentation: fragmental material that originates from weathering of rocks and is transported by, suspended in, or deposited by water or air or is accumulated by other natural agencies.

Strategy: refers to this document – the Blue/Green Network Strategy.

Sustainable Development: development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Tangata Whenua: indigenous people, local people, hosts.

Taonga: property, goods, possessions, effects, treasure, something prized.

Te Ao Maori: the world around us (physical, spiritual and cultural) is intrinsically interlinked and must be considered in its entirety.

Transpiration: the quantity of water absorbed, evaporated, transpired and used directly in plant tissue.

Turangawaewae: domicile, place where one has rights of residence and belonging through kinship and whakapapa.

Urban Renewal: a program of land re-development.

Urbanisation: an increase in the proportion of people living in urban areas compared to rural areas, creating an urban or City environment.

Waahi Tapu: sacred or significant sites and areas.

Wetland: land with a wet, spongy soil, where the water table is at or above the land surface for at least part of the year.

Whakapapa: learning from the past, in order to move into the future.

APPENDIX 2 – BIODIVERSITY TABLES

The following tables were produced by combining biodiversity inventories from the reserve management plans for Barge Park, Pukenui Forest Reserves and the Parihaka Reserves, which are adjacent to the City. The inventories are not exhaustive and are likely lacking in species present in these reserves. For native species their national status has been taken from the Department of Conservation's Threat Classification Series (2012). In some cases scientific names for flora have changed since the reserve management plans were compiled; updated names have been incorporated into this document.

Table 3 Native flora recorded in the surrounds of Whangarei City and their status

Maori Name, Common Name	Scientific Name	National Status
(No Common Name)	<i>Loxsoma cunninghamii</i>	Not Threatened
Aka	<i>Metrosideros perforata</i>	Not Threatened
Akakura, Carmine Rata	<i>Metrosideros carminea</i>	Not Threatened
Akepiro	<i>Olearia furfuracea</i>	Not Threatened
Baumea	<i>Machaerina</i> sp.	-
Bracken	<i>Pteridium esculentum</i>	Not Threatened
Centella	<i>Centella uniflora</i>	Not Threatened
Climbing Shield Fern	<i>Rumohra adiantiformis</i>	Not Threatened
Clubmoss	<i>Lycopodiella cernua</i>	Not Threatened
Common Maidenhair	<i>Adiantum cunninghamii</i>	Not Threatened
Creeping Cudweed	<i>Euchiton japonicus</i>	Not Threatened
Cutty Grass	<i>Carex</i> sp.	-
Cutty Grass	<i>Gahnia setifolia</i>	Not Threatened
Duckweed	<i>Lemna minor</i>	Not Threatened
Dwarf Bog Rush	<i>Schoenus maschalinus</i>	Not Threatened
Fork Fern	<i>Tmesipteris elongata</i>	Not Threatened
Fork Fern	<i>Tmesipteris lanceolata</i>	Not Threatened
Giant Clubmoss	<i>Lycopodium deuterodensum</i>	Not Threatened
Green Hood Orchid	<i>Pterostylis alobula</i>	Not Threatened

Maori Name, Common Name	Scientific Name	National Status
Hall's Totara	<i>Podocarpus cunninghamii</i>	Not Threatened
Hangehange	<i>Geniostoma ligustrifolium</i>	Not Threatened
Hanging Spleenwort	<i>Asplenium flaccidum</i>	Not Threatened
Harakeke, Flax	<i>Phormium tenax</i>	Not Threatened
Heketara	<i>Olearia rani</i>	Not Threatened
Heruheru, Crepe Fern	<i>Leptopteris hymenophylloides</i>	Not Threatened
Horoeka, Lancewood	<i>Pseudopanax crassifolius</i>	Not Threatened
Hound's Tongue	<i>Microsorium pustulatum</i>	Not Threatened
Houpara	<i>Pseudopanax lessonii</i>	Not Threatened
Kahikatea	<i>Dacrycarpus dacrydioides</i>	Not Threatened
Kanuka	<i>Kunzea ericoides</i>	Not Threatened
Karaka	<i>Corynocarpus laevigatus</i>	Not Threatened
Karamu	<i>Coprosma lucida</i>	Not Threatened
Karamu	<i>Coprosma rhamnoides</i>	Not Threatened
Karamu	<i>Coprosma robusta</i>	Not Threatened
Karamu	<i>Coprosma spathulata</i>	Not Threatened
Karapapa	<i>Alseuosmia quercifolia</i>	Not Threatened
Kareao, Supplejack	<i>Ripogonum scandens</i>	Not Threatened
Kauri	<i>Agathis australis</i>	Not Threatened
Kauri Grass	<i>Astelia trinervia</i>	Not Threatened
Kawaka	<i>Libocedrus plumosa</i>	Naturally Uncommon
Kawakawa, Pepper Tree	<i>Piper excelsum</i>	Naturally Uncommon
Kidney Fern	<i>Cardiomanes reniforme</i>	Not Threatened
Kiekie	<i>Freycinetia banksii</i>	Not Threatened
Kiokio	<i>Blechnum novae-zelandiae</i>	Not Threatened
Kohekohe	<i>Dysoxylum spectabile</i>	Not Threatened
Kohurangi (Nationally Threatened)	<i>Brachyglottis kirkii</i>	Not Threatened
Koromiko	<i>Hebe</i> sp.	-
Kowhai	<i>Sophora microphylla</i>	Not Threatened
Kumarahou	<i>Pomaderris kumeraho</i>	Not Threatened
Kuta, Club Rush	<i>Schoenoplectus tabernaemontani</i>	Not Threatened
Lance Fern	<i>Blechnum chambersii</i>	Not Threatened

Maori Name, Common Name	Scientific Name	National Status
Lance Fern	<i>Blechnum membranaceum</i>	Not Threatened
Large-Leaf Mahoe	<i>Meliclytus macrophyllus</i>	Not Threatened
Leatherleaf Fern	<i>Pyrrosia eleagnifolia</i>	Not Threatened
Mahoe, Whiteywood	<i>Meliclytus ramiflorus</i>	Not Threatened
Makamaka	<i>Ackama rosifolia</i>	Not Threatened
Mamaku	<i>Cyathea medullaris</i>	Not Threatened
Mamangi	<i>Coprosma arborea</i>	Not Threatened
Mangeao	<i>Litsea calicaris</i>	Not Threatened
Mangemange, Bushman's Mattress	<i>Lygodium articulatum</i>	Not Threatened
Manuka	<i>Leptospermum scoparium</i>	Not Threatened
Mapou	<i>Myrsine australis</i>	Not Threatened
Matai	<i>Prumnopitys taxifolia</i>	Not Threatened
Mingimingi	<i>Leptecophylla juniperina</i>	Not Threatened
Mingimingi	<i>Leucopogon fasciculatus</i>	Not Threatened
Miro	<i>Prumnopitys ferruginea</i>	Not Threatened
Mokimoki, Fragrant Fern	<i>Microsorium scandens</i>	Not Threatened
Moku, Hen And Chicken Fern	<i>Asplenium bulbiferum</i>	Not Threatened
Native Grass	<i>Oplismenus hirtellus</i>	Not Threatened
Native Lobelia	<i>Lobelia anceps</i>	Not Threatened
Neinei	<i>Dracophyllum latifolium</i>	Not Threatened
Nertera	<i>Nertera dichondrifolia</i>	Not Threatened
Nikau	<i>Rhopalostylis sapida</i>	Not Threatened
Northern Rata	<i>Metrosideros robusta</i>	Not Threatened
Onion Orchid	<i>Microtis parviflora</i>	Not Threatened
Orchid	<i>Caladenia bartletti</i>	Naturally Uncommon
Orchid	<i>Caladenia chlorostyla</i>	Not Threatened
Orchid	<i>Microtis unifolia</i>	Not Threatened
Orchid	<i>Orthoceras novae-zelandiae</i>	Not Threatened
Orchid	<i>Pterostylis agathicola</i>	Not Threatened
Orchid	<i>Pterostylis banksii</i>	Not Threatened
Orchid	<i>Pterostylis trullifolia</i>	Not Threatened
Orchid	<i>Thelymitra aff. longifolia</i>	Data Deficient
Orchid	<i>Thelymitra carnea</i>	Not Threatened
Orchid	<i>Thelymitra longifolia</i>	Not Threatened
Orchid	<i>Thelymitra pauciflora</i>	Not Threatened
Orchid	<i>Thelymitra pulchella</i>	Not Threatened

Maori Name, Common Name	Scientific Name	National Status
Orchid	<i>Thelymitra x. dentata</i>	Sterile Hybrid
Pakihi Rush	<i>Machaerina teretifolia</i>	Not Threatened
Para, King Fern	<i>Ptisana salicina</i>	Declining
Parataniwha	<i>Elatostema rugosum</i>	Not Threatened
Pate	<i>Schefflera digitata</i>	Not Threatened
Perching Lily	<i>Collospermum hastatum</i>	Not Threatened
Pig Fern, Lace Fern, Scented Fern	<i>Paesia scaberula</i>	Not Threatened
Pigeonwood	<i>Hedycarya arborea</i>	Not Threatened
Pikiarero	<i>Clematis foetida</i>	Not Threatened
Piripiri	<i>Hymenophyllum demissum</i>	Not Threatened
Ponga, Silver Tree Fern	<i>Cyathea dealbata</i>	Not Threatened
Puawhananga	<i>Clematis paniculata</i>	Not Threatened
Puka, Akapuka	<i>Griselinia lucida</i>	Not Threatened
Pukatea	<i>Laurelia novae-zelandiae</i>	Not Threatened
Pukio, Carex	<i>Carex secta</i>	Not Threatened
Pukupuku, Rasp Fern	<i>Doodia australis</i>	Not Threatened
Puriri	<i>Vitex lucens</i>	Not Threatened
Putaputaweta, Marble Leaf	<i>Carpodetus serratus</i>	Not Threatened
Rahurahu, Gully Fern	<i>Pneumatopteris pennigera</i>	Not Threatened
Rangiora, Bushman's Friend	<i>Brachyglottis repanda</i>	Not Threatened
Rata Piki	<i>Metrosideros fulgens</i>	Not Threatened
Raupo	<i>Typha orientalis</i>	Not Threatened
Raurekau, Kanono, Manono	<i>Coprosma grandifolia</i>	Not Threatened
Red Pondweed	<i>Potamogeton cheesemanii</i>	Not Threatened
Rewarewa	<i>Knightia excelsa</i>	Not Threatened
Rimu	<i>Dacrydium cupressinum</i>	Not Threatened
Rosy Maidenhair Fern	<i>Adiantum hispidulum</i>	Not Threatened
Rush	<i>Schoenus tendo</i>	Not Threatened
Rushes	<i>Juncus sp.</i>	-
Sedge	<i>Scirpus sp.</i>	-
Sedge	<i>Carex sp.</i>	-
Sedge	<i>Schoenus apogon</i>	Not Threatened
Shaking Brake Fern	<i>Pteris tremula</i>	Not Threatened
Shining Spleenwort	<i>Asplenium oblongifolium</i>	Not Threatened
Showy Willow-Herb	<i>Epilobium pallidiflorum</i>	Not Threatened
Small Kiokio	<i>Blechnum procerum</i>	Not Threatened

Maori Name, Common Name	Scientific Name	National Status
Spike Sedge	<i>Eleocharis acuta</i>	Not Threatened
Starwort	<i>Callitriche</i> sp.	-
Sundew Orchid	<i>Drosera hookeri</i>	Coloniser
Swamp Kiokio	<i>Blechnum minus</i>	Not Threatened
Swamp Millet	<i>Isachne globosa</i>	Not Threatened
Tanekaha	<i>Phyllocladus trichomanoides</i>	Not Threatened
Tangle Fern Sp.	<i>Gleichenia</i> sp.	-
Taraire	<i>Beilschmiedia tarairi</i>	Not Threatened
Tarawera, Button Fern	<i>Pellaea rotundifolia</i>	Not Threatened
Tauhinu	<i>Pomaderris phyllicifolia</i>	Nationally endangered
Taurepo, New Zealand Gloxinia	<i>Rhabdothamnus solandri</i>	Not Threatened
Tawa	<i>Beilschmiedia tawa</i>	Not Threatened
Tawheowheo	<i>Quintinia serrata</i>	Not Threatened
Thread Fern	<i>Blechnum filiforme</i>	Not Threatened
Thread Fern	<i>Blechnum fraseri</i>	Not Threatened
Ti Kouka, Cabbage Tree	<i>Cordyline australis</i>	Not Threatened
Ti Ngahere, Forest Cabbage Tree	<i>Cordyline banksii</i>	Not Threatened
Titoki	<i>Alectryon excelsus</i>	Not Threatened
Toropapa	<i>Alseuosmia banksii</i> var. <i>linariifolia</i> and other variations	Naturally Uncommon
Toru	<i>Toronia toru</i>	Not Threatened
Totara	<i>Podocarpus totara</i>	Not Threatened
Towai (Aka Tawhero)	<i>Weinmannia silvicola</i>	Not Threatened
Tree Orchid	<i>Earina mucronata</i>	Not Threatened
Turutu	<i>Dianella nigra</i>	Not Threatened
Umbrella Fern	<i>Sticherus flabellatus</i>	Not Threatened
Waewaekoukou	<i>Lycopodium volubile</i>	Not Threatened
Whauwhau Paku, Five Finger	<i>Pseudopanax arboreus</i>	Not Threatened
Wheki	<i>Dicksonia squarrosa</i>	Not Threatened
White Maire (Serious Decline)	<i>Nestegis lanceolata</i>	Not Threatened
Willow-Leaved Maire	<i>Mida salicifolia</i>	Not Threatened

Table 4 Native fauna recorded in the surrounds of Whangarei City and their status

Maori, Common Name	Scientific Name	National Status
Banded Kokopu	<i>Galaxias fasciatus</i>	Not Threatened
Common Bully	<i>Gobiomorphus cotidianus</i>	Not Threatened
Cran's Bully	<i>Gobiomorphus basalis</i>	Not Threatened
Freshwater Crab	<i>Amarinus lacustris</i>	Naturally Uncommon
Freshwater Limpet	<i>Latia</i> sp.	Not Threatened
Kakariki, Red-Crowned Parakeet	<i>Cyanoramphus novaezelandiae</i>	Relict
Kawaupaka, Little Shag	<i>Phalacrocorax melanoleucos</i>	Not Threatened
Kotare, Kingfisher	<i>Todiramphus sanctus vagans</i>	Not Threatened
Koura	<i>Paranephrops planifrons</i>	Not Threatened
Kukupu, Kereru, NZ Pigeon	<i>Hemiphaga novaeseelandiae</i>	Not Threatened
Kuruwhengi, Australasian Shoveler	<i>Anas rhynchotis</i>	Not Threatened
Miromiro, North Island Tomtit	<i>Petroica macrocephala toitoi</i>	Not Threatened
North Island Kaka	<i>Nestor meridionalis septentrionalis</i>	Nationally Vulnerable
North Island Kiwi	<i>Apteryx mantelli</i>	Nationally Vulnerable
Papango, NZ Scaup	<i>Aythya novaeseelandiae</i>	Not Threatened
Parera, Grey Duck	<i>Anas superciliosa</i>	Nationally Critical
Pekapeka, Long-Tailed Bat	<i>Chalinolobus tuberculatus</i> "North Island"	Nationally Vulnerable
Pipiwaharauoa, Shining Cuckoo	<i>Chrysococcyx lucidus</i>	Not Threatened
Piwakawaka, North Island Fantail	<i>Rhipidura fuliginosa placabilis</i>	Not Threatened
Pukeko	<i>Porphyrio porphyrio melanotus</i>	Not Threatened
Putangitangi, Paradise Shelduck	<i>Tadorna variegata</i>	Not Threatened
Puweto, Spotless Crane	<i>Porzana tabuensis plumbea</i>	Relict
Riroriro, Grey Warbler	<i>Gerygone igata</i>	Not Threatened
Ruru, Morepork	<i>Ninox novaeseelandiae</i>	Not Threatened
Tauhau, Silvereye	<i>Zosterops lateralis</i>	Not Threatened
Tete, Grey Teal	<i>Anas gracilis</i>	Not Threatened
Tui	<i>Prosthemadera novaeseelandiae</i>	Not Threatened
Tuna, Long Finned Eel	<i>Anguilla dieffenbachii</i>	Declining
Tuna, Short Finned Eel	<i>Anguilla australis</i>	Not Threatened
Warou, Welcome Swallow	<i>Hirundo neoxena</i>	Not Threatened

Table 5 Introduced and pest flora

Common Name	Scientific Name
Aristea	<i>Aristea ecklonii</i>
Arum Lily	<i>Zantedeschia aethiopica</i>
Australian Fireweed	<i>Senecio bipinnatisectus</i>
Bartlettina	<i>Bartlettina sordida</i>
Bishop Pine	<i>Pinus muricata</i>
Black Nightshade	<i>Solanum nigrum</i>
Blackberry	<i>Rubus fruticosus</i>
Buttercup	<i>Ranunculus repens</i>
Cleaver	<i>Galium aparine</i>
Climbing Asparagus	<i>Asparagus scandens</i>
Common Foxglove	<i>Digitalis purpurea</i>
Cow Parsley	<i>Anthriscus sylvestris</i>
Crack Willow	<i>Salix fragilis</i>
Cudweed	<i>Gamochaeta simplicicaulis</i>
Eucalypt	<i>Eucalyptus spp.</i>
Fireweed	<i>Senecio minimus</i>
Fleabane	<i>Pulicaria dysenterica</i>
German Ivy	<i>Senecio mikanioides</i>
Giant Rush	<i>Juncus pallidus</i>
Gorse	<i>Ulex europaeus</i>
Grass Leaved Rush	<i>Juncus planifolius</i>
Hawkbit	<i>Leontodon taraxacoides</i>
Himalayan Feather Grass	<i>Miscanthus nepalensis</i>
Inkweed	<i>Phytolacca octandra</i>
Japanese Honeysuckle	<i>Lonicera japonica</i>
Jersey Cudweed	<i>Pseudognaphalium luteoalbum</i>
Jerusalem Cherry	<i>Solanum pseudocapsicum</i>

Common Name	Scientific Name
Kahili Ginger	<i>Hedychium gardnerianum</i>
Lotus	<i>Lotus major</i>
Mexican Devilweed	<i>Ageratina adenophora</i>
Mistflower	<i>Ageratina riparia</i>
Moth Plant	<i>Araujia sericifera</i>
Narrow Leaved Plantain	<i>Plantago lanceolata</i>
Oxygen Weed	<i>Elodea sp.</i>
Pampas	<i>Cortaderia spp.</i>
Pine	<i>Pinus radiata</i>
Purple Cudweed	<i>Gamochaeta purpurea</i>
Purple Top	<i>Verbena bonariensis</i>
Ragwort	<i>Jacobaea vulgaris</i>
Reed Sweet Grass	<i>Glyceria maxima</i>
Selaginella	<i>Selaginella kraussiana</i>
Soft Rush	<i>Juncus effusus</i>
Sorrell	<i>Rumex sp.</i>
Taiwanese Cherry	<i>Prunus campanulata</i>
Tradescantia, Wandering Jew	<i>Tradescantia fluminensis</i>
Watercress	<i>Nasturtium officinale</i>
Yellow Sedge	<i>Carex Demissa</i>

Table 6 Introduced and pest fauna

Common Name	Scientific Name
Australian Magpie	<i>Gymnorhina tibicen</i>
Blackbird	<i>Turdus merula</i>
Brown Trout	<i>Salmo trutta</i>
Brush-tail Possum	<i>Trichosurus vulpecula</i>
Cattle	<i>Bos taurus</i>
Chaffinch	<i>Fringilla coelebs</i>
Dog	<i>Canis familiaris</i>
Eastern Rosella	<i>Platycercus eximius</i>
Feral Cat	<i>Felis catus</i>
Feral Goat	<i>Capra hircus</i>
Ferret	<i>Mutela furo</i>
Green And Gold Bell Frog	<i>Litoria aurea</i>
Hedgehog	<i>Erinaceus europaeus</i>
House Sparrow	<i>Passer domesticus</i>
Mallard	<i>Anas platyrhynchos</i>
Mosquitofish	<i>Gambusia affinis</i>
Mouse	<i>Mus musculus</i>
Norway Rat	<i>Rattus norvegicus</i>
Pig	<i>Sus scrofa</i>
Rainbow Trout	<i>Oncorhynchus mykiss</i>
Ship Rat	<i>Rattus rattus</i>
Southern Bell Frog	<i>Litoria raniformis</i>
Stoat	<i>Mustela erminea</i>
Yellowhammer	<i>Emberiza citrinella</i>



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