

Key Native Ecosystem Operational Plan for Haywards Scenic Reserve

2020-2025



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1. Purpose

The purpose of the five-year Key Native Ecosystem (KNE) Operational Plan for Haywards Scenic Reserve KNE site is to:

- Identify the parties involved
- Summarise the ecological values and identify the threats to those values
- Outline the objectives to improve ecological condition
- Describe operational activities (eg, ecological weed control) that will be undertaken, who will undertake the activities and the allocated budget

KNE Operational Plans are reviewed every five years to ensure the activities undertaken to protect and restore the KNE site are informed by experience and improved knowledge about the site.

This KNE Operational Plan is aligned to key policy documents that are outlined below (in Section 2).

2. Policy Context

Regional councils have responsibility for maintaining indigenous biodiversity, as well as protecting significant vegetation and habitats of threatened species, under the Resource Management Act 1991 (RMA)¹.

Plans and Strategies that guide the delivery of the KNE Programme are:

Greater Wellington Long Term Plan

The Long Term Plan (2018-2028)² outlines the long term direction of the Greater Wellington Regional Council (Greater Wellington) and includes information on all our major projects, activities and programmes for the next 10 years and how they will be paid for. This document outlines that Greater Wellington will actively manage selected high value biodiversity sites. Most of this work is undertaken as part of the KNE Programme.

Proposed Natural Resources Plan

The Proposed Natural Resources Plan (PNRP)³ provides the high level strategic framework which sets out how Greater Wellington, Mana whenua partners and the community work together and includes:

- Guiding Principles that underpin the overall management approach of the plan (eg, Kaitiakitanga)
- Sites with significant indigenous biodiversity values
- Sites of significance to mana whenua (refer to Schedules B, C and D)

Greater Wellington Biodiversity Strategy

The Greater Wellington Biodiversity Strategy⁴ (the Strategy) is an internal document that sets a framework that guides how Greater Wellington protects and manages biodiversity in the Wellington region to work towards the Vision.

Vision
Healthy ecosystems thrive in the Wellington region and provide habitat for native biodiversity

The Strategy provides a common focus across Greater Wellington’s departments and guides activities relating to biodiversity. The Vision is underpinned by four operating principles and three strategic goals. Goal One drives the delivery of the KNE Programme.

Goal One
Areas of high biodiversity value are protected or restored

3. The Key Native Ecosystem Programme

The KNE Programme is a voluntary programme of work. There is no statutory obligation for Greater Wellington to do this work. Greater Wellington invites selected landowners to discuss whether they would like to be involved in the programme. When work is done on private land, it is at the discretion of landowners, and their involvement in the programme is entirely voluntary. Involvement may just mean allowing work to be undertaken on that land.

The programme seeks to protect some of the best examples of original (pre-human) ecosystem types in the Wellington region by managing, reducing, or removing threats to their ecological values. Sites with the highest biodiversity values have been identified and prioritised for management. Sites are identified as of high biodiversity value for the purposes of the KNE Programme by applying the four ecological significance criteria described below.

Representativeness	Rarity/ distinctiveness	Diversity	Ecological context
The extent to which ecosystems and habitats represent those that were once typical in the region but are no longer common place	Whether ecosystems contain Threatened/At Risk species, or species at their geographic limit, or whether rare or uncommon ecosystems are present	The levels of natural ecosystem diversity present, ie, two or more original ecosystem types present	Whether the site provides important core habitat, has high species diversity, or includes an ecosystem identified as a national priority for protection

A site must be identified as ecologically significant using the above criteria and be considered “sustainable” for management in order to be considered for inclusion in

the KNE Programme. “Sustainable” for the purposes of the KNE Programme is defined as: a site where the key ecological processes remain intact or continue to influence the site and resilience of the ecosystem is likely under some realistic level of management.

KNE sites can be located on private or publicly owned land. However, land managed by the Department of Conservation (DOC) is generally excluded from this programme.

KNE sites are managed in accordance with five-year KNE plans prepared by Greater Wellington’s Biodiversity department. Greater Wellington works with the landowners, mana whenua and other operational delivery providers to achieve mutually beneficial goals.

4. Haywards Scenic Reserve Key Native Ecosystem site

The Haywards Scenic Reserve KNE site is a 121 ha lowland beech forest with podocarp-broadleaf forest remnants. The KNE site is located on the Hutt Valley’s Eastern Hills overlooking Lower Hutt City (see Appendix 1, Map 1). The KNE site contains Haywards Eastern Hills Scenic Reserve and adjacent areas of regenerating native lowland beech forest and is bisected by the Te Whiti Firebreak, with the Konini Firebreak forming the KNE site’s eastern boundary. The KNE site is located within the Hutt Valley’s forested eastern hill ranges providing linkages for wildlife between Upper Hutt and Wainuiomata. The KNE site contains the only pukatea forest remnant in the Wellington Region⁵ and has a high diversity of plant species supporting populations of native birds, lizards, and land-snails.

5. Parties involved

There are many organisations, groups and individuals that play important roles in the care of the KNE site.

5.1. Landowner

The Hutt City Council (HCC) owns and administers all of the land contained within the KNE site boundary as a “Scenic Reserve” under the Reserves Act 1977. HCC manages the Haywards Scenic reserve in accordance with the Bush Reserves Management Plan⁶. The Haywards Scenic Reserve KNE site is identified in the Hutt City Council District Plan⁷ as a “General Recreation” and “Passive Recreation” activity area, and “Significant Natural Resource Site” with specific rules associated.

5.2. Operational delivery

HCC and Greater Wellington are the main management partners and have worked collaboratively to manage the KNE site’s pest control operations for a number of years.

Within Greater Wellington, the Biodiversity and Biosecurity departments are responsible for delivering the activities outlined within this KNE operational plan. The Biodiversity department is the overarching lead department for Greater Wellington on the coordination of biodiversity management activities and advice within the KNE site. The Biosecurity department coordinates and carries out pest control activities.

HCC undertakes ecological weed control as part of track maintenance, manages recreational activities such as mountain biking and tramping, and provides the primary contact for community groups.

5.3. Mana whenua partners

The KNE site is a Statutory Acknowledgement Area for Ngāti Toa Rangatira (see Table 1)⁸ and they are aware that their areas of interest are located on territorial authority land. Greater Wellington will provide key contact details for HCC to Ngāti Toa Rangatira if they wish to consult directly with them about the values at the site.

Table 1: Ngāti Toa Rangatira Statutory Acknowledgement Area in Haywards Scenic Reserve KNE site⁹

Statutory Acknowledgement Area	Mana whenua values
<p>Hutt River and its tributaries (Schedule D2, PNRP¹⁰)</p>	<p>The Hutt River (Te Awa Kairangi) is of historical and cultural importance to Ngati Toa Rangatira. The iwi claim an association with the Hutt River from the time of their participation in the invasion of the Hutt Valley during 1819 and 1820</p> <p>During that campaign, the taua marched around the western side of Te Whanganui a Tara, defeating the local iwi as they went. When the war party reached the Hutt River, they constructed rafts which they used to aid them in their invasion of the Hutt Valley</p> <p>Although Ngati Toa Rangatira did not remain in the area after this invasion, the Hutt River continued to be important to the iwi following their permanent migration and settlement in the lower North Island in the late 1820s and early 1830s. The relationship of Ngati Toa Rangatira to the Hutt Valley and River was not one defined by concentrated settlement and physical presence. Rather, the iwi felt their claim to the land was strong based on the powerful leadership of Te Rauparaha and Te Rangihaeata and the relationship they had with iwi residing in the Hutt Valley who had been placed there by Ngati Toa in the 1830s. For some years these iwi in the Hutt Valley paid tribute of goods such as canoes, eels and birds to Te Rauparaha and Te Rangihaeata</p> <p>Ngati Toa Rangatira have a strong historical connection with the Hutt River and its tributaries, and the iwi consider that the river is included within their extended rohe and it is an important symbol of their interests in the Harataunga area</p> <p>Te Awa Kairangi was traditionally an area for gathering piharau, or the freshwater blind eel, as well as tuna (eel) from its tributaries. Harataunga also supported flax plantations, which were used by early Maori for trading with settlers. The river was also of great importance as it was the largest source of freshwater in the area</p> <p>The river was also an important transport route, and small waka were used along the length of Te Awa Kairangi</p>

5.4. Stakeholders

The Friends of Waiwhetu's Haywards Scenic Reserve are an active community group who help maintain the scenic reserve's track network, undertake pest plant control and replant native trees where needed. Several volunteers also service some of the pest animal control network within the KNE site on a regular basis.

The KNE site is recognised by DOC as a Designated Ecological Site but they are not actively involved in management of the site (See Appendix 1, Map 2).

6. Ecological values

This section describes the various ecological components and attributes that make the KNE site important. These factors determine the site's value at a regional scale and how managing it contributes to the maintenance of regional biodiversity.

6.1. Ecological designations

Table 2, below, lists ecological designations at all or part of the Haywards Scenic Reserve KNE site.

Table 2: Designations at the Haywards Scenic Reserve KNE site

Designation level	Type of designation
National	<p>Haywards Scenic Reserve KNE site is identified as a Scenic Reserve under the Reserves Act 1977</p> <p>The majority of the KNE site has been identified by DOC as a Designated Ecological Site:</p> <ul style="list-style-type: none"> • Eastern Hutt Hills Bush (1015) <p>See Appendix 1, Map 2</p>
District	<p>Haywards Scenic Reserve KNE site has been identified in the HCC District Plan as several Significant Natural Resource Sites:</p> <ul style="list-style-type: none"> • Eastern Hills Bush(12) • Haywards Scenic Reserve (16), and • Wainuiomata West Bush (58)
Other	<p>The Haywards Scenic Reserve KNE site is scheduled under the PNRP as a Statutory Acknowledgement Area for Ngāti Toa Rangatira:</p> <ul style="list-style-type: none"> • Hutt River and its tributaries (Schedule D2)

6.2. Ecological significance

The Haywards Scenic Reserve KNE site is considered to be of regional importance because:

- It contains a highly **representative** ecosystem that was once typical or commonplace in the region
- It contains ecological features that are **rare or distinctive** in the region
- It contains ecosystem **diversity**, with several ecosystem types represented within the KNE site boundary, including several naturally uncommon ecosystems
- Its **ecological context** is valuable at the landscape scale as it provides habitat for threatened indigenous species and is an important wildlife linkage.

Representativeness

The Threatened Environment Classification system¹¹ indicates that the KNE site predominately consists of habitat that is either At Risk (lower slopes) or Less reduced (in extent) and better protected (upper slopes), see Appendix 1, Map 3. The lower slopes of the KNE site are representative of habitat that has been much reduced and fragmented with only 20-30% of indigenous habitat in this type of environment remaining nationally.

Rarity/distinctiveness

New Zealand's national threat classification system¹² lists two plant, one bird, two reptiles, one invertebrate and four freshwater fish species as nationally Threatened or At Risk within the KNE site. Two lizard species are also regionally Threatened/At Risk within the KNE site¹³. Nationally threatened species are listed in Appendix 2 and regionally threatened species are listed in Appendix 3.

The KNE site also contains the only pukatea (*Laurelia novae-zelandiae*) forest remnant in the Wellington Region¹⁴

Diversity

The Singers and Rogers¹⁵ classification of pre-human vegetation indicates the KNE site was dominated by hard beech (*Nothofagus truncata*) forest (MF20), with a small area of kahikatea (*Dacrycarpus dacrydioides*), pukatea forest (WF8) in the lower reach south of the Te Whiti firebreak (see Appendix 1, Map 4). There is considered to be 51% and 1% respectively of these forest types remaining in the Wellington Region compared to their original extent¹⁶. These forest types still remain within the KNE site albeit in a reduced extent.

Ecological context

The KNE site has a high diversity of plant species supporting populations of native birds, lizards, and land-snails and provides linkages for wildlife between Upper Hutt and Wainuiomata.

6.3. Ecological features

The Haywards Scenic Reserve KNE site is located in the Eastern Hutt Hills with HCC reserve land to the north, east and south. The western side of the KNE site is bounded by residential land. The lower slopes of the KNE site are located within the Wellington Ecological District, with the upper slopes within the Tararua Ecological District¹⁷. Both ecological districts are characterised by steep, strongly faulted hill ranges and have windy, wet and mild climates¹⁸.

Vegetation communities and plants

Over 100 plant species have been recorded within the KNE site, including 40 species of trees and shrubs, 20 species of fern, 8 climbers and 6 orchid species¹⁹. The KNE site contains a sizable area of podocarp-broadleaf forest consistent with the original MF20 and WF8 forest types immediately south of the Te Whiti Firebreak²⁰ where large rimu (*Dacrydium cupressinum*), miro (*Prumnopitys ferruginea*), hard beech and pukatea emerge above a canopy of tawa (*Beilschmiedia tawa*), hīnau (*Elaeocarpus dentatus*) and māhoe (*Meliccytus ramiflorus*). This area is considered to have the highest ecological value within the KNE site given its mature status and species present. Other flora of note in this area includes the nationally threatened ramarama (*Lophomyrtus bullata*) and white climbing rata (*Metrosideros diffusa*); and several species of significance to iwi including kōtukutuku (*Fuchsia excorticata*) and tōtara (*Podocarpus totara*)²¹.

The remainder of the KNE site is largely comprised of regenerating lowland forest containing hard beech, black beech (*Fuscospora solandri*), and maire taike (*Mida salicifolia*) as canopy trees. Other species present include red matipo (*Myrsine australis*), tarata/lemonwood (*Pittosporum eugenioides*), mataī (*Prumnopitys taxifolia*), lancewood (*Pseudopanax crassifolius*), ngaio (*Myoporum laetum*), heketara (*Oleria rani*), kōhūhū, (*Pittosporum tenuifolium*) and kahikatea. The drier slopes and ridgelines consist of kāmahi (*Weinmannia racemosa*), hīnau, rewarewa (*Knightia excelsa*), northern rātā (*Metrosideros robusta*), mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea robusta*).

The reserve contains a well-developed understory of broadleaf species which includes five finger (*Pseudopanax arboreus*), rangiora (*Brachyglottis repanda*), hangehange (*Geniostoma ligustrifolium* var. *ligustrifolium*), karamū (*Coprosma lucida*) and mamaku (*Cyathea medullaris*). Rengarenga lily (*Arthropodium cirratum*), hook grass (*Uncinia* sp.), fern species, supplejack (*Ripogonum scandens*) and kiekie (*Freycinetia banksii*) are present in the forest understorey. Nīkau palm (*Rhopalostylis sapida*) is common in the gullies²².

The upper slopes have been subject to fire damage and as a result are characterised by regenerating native scrub vegetation such as mānuka, flax (*Phormium cookianum*), broadleaf (*Griselinia littoralis*), five finger, hangehange and mamaku growing through dense gorse (*Ulex europaeus*).

Species

Birds

The nationally At-Risk New Zealand bush falcon (kārearea; *Falco novaeseelandiae*) is thought to be breeding locally, with regular reports of pairs sighted within the KNE site provided by local residents²³. Bellbird (*Anthornis melanura*), and other indigenous forest birds such as fantail (*Rhipidura fuliginosa*), tūi (*Prothemadera novaeseelandiae*), kererū (*Hemiphaga novaeseelandiae*), grey warbler (*Gerygone igata*), tomtit (*Petroica macrocephala*), silvereve (*Zosterops lateralis*) and morepork (*Ninox novaeseelandiae*) are present within the KNE site^{24,25}.

Fish

The nationally At-Risk longfin eel (*Anguilla dieffenbachii*), īnanga (*Galaxias mactulatus*), banded kōkopu (*Galaxias fasciatus*), giant bully (*Gobiomorphus gobioides*) and giant kōkopu (*Galaxias argenteus*), and the more common native shortfin eel (*Anguilla australis*), common bully (*Gobiomorphus cotidianus*), and yelloweye mullet (*Aldrichetta forsteri*) are present in the Waiwhetu Stream downstream and may occur in the tributaries contained within the KNE site²⁶.

Reptiles

The nationally At-Risk and regionally Threatened barking gecko (*Naultinus punctatus*) has been recorded several times within the KNE site²⁷, whilst the nationally and regionally At-Risk ngahere gecko (*Mokopirirakau* “southern North Island”) is likely to be present within the KNE site as it has been recorded to the southeast of the site in the Eastern Hutt Hills²⁸.

Invertebrates

The KNE site has a high diversity of native land snails with 61 species recorded and micro snails especially numerous during a survey in 2005²⁹. The nationally At-Risk snail *Allodiscus pallidus* was recorded during this survey. This diversity is unusually high and reflective of a healthy ecosystem.

7. Threats to ecological values at the KNE site

Ecological values can be threatened by human activities, and by introduced animals and plants that change ecosystem dynamics. The key to protecting and restoring biodiversity as part of the KNE Programme is to manage threats to the ecological values at each KNE site.

7.1. Key threats

The primary threats to the ecological values of the KNE site are from ecological weeds, pest animals and wild fire.

Ecological weeds including woody, climbing, ground-covering and non-local native species have been controlled over many years within the KNE site (See Appendix 4 for a list of weeds recorded at the KNE site). The largest infestations present within the KNE site are of climbing asparagus (*Asparagus scandens*). Japanese honeysuckle (*Lonicera japonica*), Himalayan honeysuckle (*Leycesteria formosa*), jasmine (*Lonicera japonica*) and tradescantia (*Tradescantia flumensis*) are also priority species commonly observed within the KNE site. The KNE site has a large suburban fringe to the west and high visitor usage resulting in the reinvasion of significant numbers of weed species.

The priority pest animal threats within the KNE site are possums (*Trichosurus vulpecula*), rats (*Rattus* spp.), mustelids (*Mustela* spp.) and red/fallow deer (*Cervus elaphus/Dama dama*)), as these species are known to have the greatest impact on native forest regeneration, food resource availability and can prey on native birds and their eggs, and lizards. Additional pest animal threats within the KNE site include feral, stray and domestic cats (*Felis catus*) that are likely to predate on native birds and their eggs, and hedgehogs which prey on eggs and chicks of ground-nesting birds, lizards and snails. Pest animals are likely to invade from outside the KNE site and are likely to be an enduring threat to the biodiversity values within the KNE site.

Wildfires have historically affected the integrity of the KNE site since the arrival of the first European settlers to the Wellington Region³⁰. While firebreaks are in place, there is still a risk of fire causing damage to the KNE site given the presence of gorse in the landscape which is highly flammable.

The KNE site is an area of high recreational usage with an extensive network of multi-use tracks regularly used for tramping, dog walking, mountain biking and horse riding. A new multi-purpose recreational use track known as the Te Whiti Riser was built by HCC over 2015/2016 in Operational Area B. This track is primarily used by day-walkers and mountain bikers. Effective management of these tracks is required to ensure they do not impact on the biodiversity values of the KNE site.

While the key threats discussed in this section are recognised as the most significant, a number of other threats to the KNE site's values have also been identified. Table 3 presents a summary of all known threats to the Haywards Scenic Reserve KNE site (including those discussed above), detailing which operational areas they affect, how each threat impacts on ecological values, and whether they will be addressed by operational activities.

Table 3: Summary of all known and potential threats to ecological values present at the Haywards Scenic Reserve KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Location
Ecological weeds		
EW-1	Climbing weeds can smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include climbing asparagus (<i>Asparagus scandens</i>), Japanese honeysuckle (<i>Lonicera japonica</i>), and Himalayan honeysuckle (<i>Leycesteria formosa</i>) (see Appendix 4)	Entire KNE site
EW-2	Woody ecological weed species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include sycamore (<i>Acer pseudoplatanus</i>), radiata pine (<i>Pinus radiata</i>), and blackberry (<i>Rubus fruticosus</i> agg.) (see Appendix 4)	Entire KNE site
EW-3	Ground covering or scrambling ecological weeds smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include tradescantia (<i>Tradescantia flumensis</i>), arum lily (<i>Zantedeschia aethiopica</i>) and African club moss (<i>Selaginella kraussiana</i>) (see Appendix 4)	Entire KNE site
EW-4	Non-local native tree species can displace locally-native vegetation. Key weed species include karaka (<i>Corynocarpus laevigatus</i>), lacebark (<i>Hoheria populnea</i>) and pūriri (<i>Vitex lucens</i>) (See Appendix 4)	Entire KNE site
Pest animals		
PA-1	Possums (<i>Trichosurus vulpecula</i>) browse palatable canopy vegetation until it can no longer recover ^{31,32} . This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates ³³	Entire KNE site
PA-2	Rats (<i>Rattus</i> spp.) browse native fruit, seeds and vegetation. They compete with native fauna for food and can reduce forest regeneration. They also prey on invertebrates, lizards and native birds ^{34,35}	Entire KNE site
PA-3	Mustelids (stoats ^{36,37} (<i>Mustela erminea</i>), ferrets ^{38,39} (<i>M. furo</i>) and weasels ^{40,41} (<i>M. nivalis</i>)) prey on native birds, lizards and invertebrates, reducing their breeding success and potentially causing local extinctions	Entire KNE site
PA-4	Red deer (<i>Cervus elaphus</i>) and fallow deer (<i>Dama dama</i>) browse the forest understory and can significantly change vegetation composition by preferential browsing and preventing regeneration ^{42,43,44}	Entire KNE site
PA-5	Hedgehogs (<i>Erinaceus europaeus</i>) prey on native invertebrates ⁴⁵ , lizards ⁴⁶ and the eggs ⁴⁷ and chicks of ground-nesting birds ⁴⁸	Entire KNE site
PA-6*	House mice (<i>Mus musculus</i>) browse native fruit, seeds and vegetation, and prey on invertebrates. They compete with native fauna for food and can reduce forest regeneration. They also prey on invertebrates, lizards and small eggs and nestlings ^{49,50}	Entire KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Location
PA-7*	Feral, stray and domestic cats (<i>Felis catus</i>) prey on native birds ⁵¹ , lizards ⁵² and invertebrates ⁵³ , reducing native fauna breeding success and potentially causing local extinctions ⁵⁴	Entire KNE site
PA-8*	Feral pigs (<i>Sus scrofa</i>) root up the soil and eat roots, invertebrates, seeds and native plants preventing forest regeneration ⁵⁵	Entire KNE site
PA-9*	Rabbits (<i>Oryctolagus cuniculus</i>) and hares (<i>Lepus europaeus</i>) graze on palatable native vegetation and prevent natural regeneration in some environments ⁵⁶	Entire KNE site
PA-10*	Wasps (<i>Vespula</i> spp.) adversely impact native invertebrates and birds through predation and competition for food resources. They also affect nutrient cycles in beech forests ⁵⁷	Entire KNE site
PA-11*	Goats (<i>Capra hircus</i>) browsing affects the composition and biomass of native vegetation in the understory tiers of forest habitats, preventing regeneration of the most palatable understory species and reducing species diversity ⁵⁸	Entire KNE site
Human activities		
HA-1	Structures in waterways and the water quality of the Waiwhetu Stream may prevent migration of aquatic species. This could result in loss of aquatic species from within the KNE site	Streams in the KNE site
HA-2*	Garden waste dumping often leads to ecological weed invasions into natural areas. Common weed species introduced at this KNE site include tradescantia (<i>Tradescantia flumensis</i>), plectranthus (<i>Plectranthus ciliatus</i>), and agapanthus (<i>Agapanthus praecox</i>)	Western KNE site boundary (urban sections)
HA-3*	Recreational use and track creation can cause damage and disturbance of the native ecosystem. It is also likely to disturb native fauna and introduce ecological weeds	Along tracks within the KNE site
HA-4*	Dogs (<i>Canis lupus familiaris</i>), if uncontrolled/unleashed can disturb or kill nesting birds and chicks, and lizards within the KNE site, particularly in close proximity to walking tracks ⁵⁹	Along tracks within the KNE site
Other threats		
OT-1*	Fire causes habitat loss and creates conditions suitable for ecological weed invasion	Entire KNE site
OT-2*	Small forest remnants are effected by environmental impacts on their edges such as changing environmental conditions (eg, soil moisture or temperature levels), changing physical environment (eg, different plant assemblages compared to the interior) and changing species interactions (eg, increased predation by invasive species) ^{60,61}	KNE site boundary

*Threats marked with an asterisk are not addressed by actions in the operational delivery schedule

8. Vision and objectives

8.1. Vision

The Haywards Scenic Reserve KNE site is dominated by healthy native forest vegetation communities supporting thriving populations of native birds, land snails, reptiles and fish.

8.2. Objectives

Objectives help to ensure that operational activities carried out are actually contributing to improvements in the ecological condition of the site.

The following objectives will guide the operational activities at the Haywards Scenic Reserve KNE site.

1. **To protect and expand the core high value native forest area**
2. **To provide safe nesting habitat and refuge opportunities for native forest birds**
3. **To improve the sites ability to support native land snails**
4. **To improve the habitat for native lizards**
5. **To improve the sites ability to support native fish**

9. Operational activities

Operational activities are targeted to work towards the objectives above (Section 8.2) by responding to the threats outlined in Section 7. The broad approach to operational activities is described briefly below, and specific actions, with budget figures attached, are set out in the operational delivery schedule (Table 4).

It is important to note that not all threats identified in Section 7 can be adequately addressed. This can be for a number of reasons including financial, legal, or capacity restrictions.

9.1. Ecological weed control

The aim of weed control is to protect and expand the existing highest value core forest area within the KNE site. Greater Wellington will focus on controlling climbing asparagus, which is widespread throughout the KNE site, with some areas dominated by heavy infestations that have out-competed the native understory vegetation. This activity will increase native plant dominance in the core forest and encourage native forest regeneration throughout the rest of the KNE site.

Greater Wellington Biosecurity staff will undertake targeted grid searches to identify and treat climbing asparagus primarily in Operational Area A and secondarily in Operational Area B. This grid search and control operation started in 2015 within the mature core forest area immediately south of Te Whiti firebreak (which is the highest biodiversity value area) in Operational Area A. The grid searches will expand out from

the core forest during the five years of this plan sweeping north to south within Operational Area A, and south to north within Operational Area B. This is aimed at initially protecting the highest value biodiversity area and radiating out from there. During the targeted grid searches for climbing asparagus, other high priority weed species, as listed in Appendix 4 of this plan (ie, Japanese honeysuckle, jasmine, banana passionfruit, tradescantia, etc) will be controlled if observed.

HCC undertakes ecological weed control as part of their maintenance of the firebreaks and main tracks (eg, Te Whiti Riser mountain bike track) in the KNE site. Generally this weed control is undertaken within 1-2m either side of these tracks/firebreaks on a quarterly basis. HCC also responds to public requests for weed control and have identified a number of key weed species that they target specifically for control across the district. Pine trees within the KNE have previously been controlled through ring-barking and/or poison application. HCC will monitor the progress of the pine control within the KNE site.

The Friends of Waiwhetu's Haywards Scenic Reserve undertake climbing asparagus control within the KNE site. They are supported and managed by HCC and liaise directly with Greater Wellington when planning annual weed control work to ensure we are working in complementary areas.

9.2. Pest animal control

The aim of pest animal control at the KNE site is to reduce the browsing pressure on native vegetation, and reduce predation pressure on native forest birds, reptiles and land snails that inhabit the KNE site. The reduction in pest animals will help provide safer nesting habitat and refuge for native birds, facilitate regeneration of the native forest and also provide an increased abundance of food resources for native fauna. Pest animal control will be specifically targeted at controlling possums, rats, mustelids red and fallow deer, and hedgehogs which are the biggest threats to native fauna and flora at the KNE site.

A Pelifeed® bait station network was installed in Operational Area A in 2015 and was extended to Operational Area B in 2016 to run along the Te Whiti Riser mountain bike track, the top of the northern firebreak and along the northern most edge of the KNE site boundary (see Appendix 1, Map 6). Greater Wellington Biosecurity staff and several volunteers service the bait stations with an anticoagulant bait on a three-monthly basis and will continue to do so for the life of this plan. Additional services are also undertaken by the volunteers on an ad-hoc basis. This control method is known to keep possums and rats to low densities. This bait station network is continuous with a large bait station network bordering the KNE site to the south-east. These bait-stations are funded by HCC targeting possums and rats and will help to prevent incursions into the KNE site.

A network of DOC 200 kill-traps were installed in 2016 within Operational Area A (the highest value biodiversity area of the KNE site) and Operational Area B (along the Te Whiti Riser mountain bike track, the top of the northern firebreak and along the northern most edge of the KNE boundary) to target mustelids and hedgehogs, that are threats to native fauna within the KNE site (see Appendix 1, Map 6). These kill-traps are usually baited with dehydrated rabbit meat and serviced on a three-monthly basis

by Greater Wellington Biosecurity staff and several volunteers. This service will continue for the life of this plan. Additional services are also undertaken by the volunteers on an ad-hoc basis.

Greater Wellington supports the volunteers with training and provision of bait/gear. Greater Wellington Biosecurity staff undertake an annual health & safety and maintenance audit of the pest animal network within the KNE site to check the condition of the infrastructure and identify any health and safety risks to users.

Red and fallow deer have become an increasing issue in Haywards Scenic Reserve and the surrounding hillside. They will be controlled within the KNE site to minimise their impact on the ecological values of the forest, as heavy browsing of favoured plant species by deer can eliminate individual native species from an area resulting in the loss of diversity and functionality of the original native forest ecosystem and prevent natural regeneration of native seedlings. Deer control will be undertaken annually within the KNE site as an addition to a wider deer control operation that HCC funds in the Eastern Hutt Hills. Deer control will focus on the parts of the KNE site where tracking and browsing of native plants has been observed.

Professional hunters are contracted by Greater Wellington to hunt the targeted areas and shoot all wild deer observed, if safe to do so. Four hunting days have been allocated per annum for within Hayward's Scenic Reserve KNE site. The hunters are required to remove carcasses of shot deer from water courses but, they do not recover venison for consumption. The control operations are focused in higher risk areas, often closer to residential properties and walking tracks.

9.3. Land snail survey

Over 61 species of land snails have been recorded within the KNE site⁶² including some rare species, with the most recent survey undertaken in 2008. The findings noted that the high diversity of land snails within the area was a reflection of a healthy ecosystem and suggested a stronghold in the region⁶³.

Given several years of pest animal control has now been undertaken at the site through the KNE programme (since 2015) it will be worthwhile exploring the potential to resurvey the land snail population within Haywards to see if the current management has made a difference to the population.

During 2022/23, the Biodiversity Advisor for the site will investigate engaging a consultant to undertake a survey of the KNE site for native land snails (and also identify options for further habitat enhancement or protection for land snails within the KNE site). The cost for this is not yet known with funding expected to be diverted from the weed/deer control budget for that year if appropriate and provided HCC approves.

9.4. Assessing fish passage

Several threatened native fish species have been recorded in the Waiwhetu Stream downstream of the Haywards Scenic Reserve KNE site. However, there is no recorded information as to whether migratory fish have access to the tributaries which are located within KNE site.

The Greater Wellington Biodiversity Advisor for the KNE site will undertake a visual assessment of potential barriers to fish migration within the KNE site in 2020/21. This assessment will be undertaken using the National Institute of Water and Atmospheric Research (NIWA) Fish Passage Assessment Survey mobile application based on the New Zealand Fish Passage Guidelines⁶⁴. The results of this survey and any remediation recommendations will be discussed with HCC.

9.5. Monitoring

Several fixed photopoints will be installed at the KNE site by the Greater Wellington Biodiversity Advisor in 2020/21 in areas where climbing asparagus has been/is being controlled. The photopoints will be used to monitor the success of the control work and to assess the regeneration rate of native vegetation with annual monitoring undertaken.

10. Future opportunities

Opportunities available within the KNE site for HCC, Greater Wellington, volunteers and/or other agencies to explore to add value to biodiversity management of the site in the future include:

- Expanding the pest animal network with more traps and bait stations, and additional servicing of the pest animal network between services in an effort to further reduce the pressure on native forest bird species
- Targeted threatened plant species protection through hand weeding/cut and paste of ecological weeds in vicinity, eg, white climbing rata
- Revegetation planting of native forest species (and threatened species) in areas where climbing asparagus and other weed species have been controlled in an effort to accelerate native regeneration.

11. Operational delivery schedule

The operational delivery schedule in Table 4 shows the actions planned to achieve the stated objectives for the Haywards Scenic Reserve KNE site, and their frequency and indicative cost over the five-year period from 1 July 2020 to 30 June 2025. The budget for each year is indicative only and subject to change. A map of operational areas can be found in Appendix 1 (see Map 5).

Table 4: Five-year operational plan for the Haywards Scenic Reserve KNE site

Objective	Management Activity	Operational area	The actions: description/detail/ comments	Intended 5 year outcome	Implementing party	Frequency and indicative cost				
						2020/21	2021/2022	2022/23	2023/24	2024/25
1	Ecological weed control	A & B	Climbing asparagus grid search and control using herbicide [control of other key weed species in Appendix 4 if observed]	An expansion of the core high value forest area and overall increase in dominance of native forest plant communities	Greater Wellington Biosecurity Department / volunteers	✓ \$12,000	✓ \$12,000	✓ \$12,000*	✓ \$12,000	✓ \$12,000
1	Ecological weed control/track maintenance	1-2m either side of main tracks	Weed control immediately either side of the main tracks/firebreaks on a quarterly basis and ad hoc responses to public reports	Prevent reinvasion of ecological weeds along main tracks/firebreaks	Hutt City Council	✓ \$**	✓ \$**	✓ \$**	✓ \$**	✓ \$**
1,2,3,4	Pest animal control	A & B	Service bait stations and DOC 200 kill-traps quarterly to control possums, rats, mustelids and hedgehogs (with additional services by volunteers ad-hoc)	An increase in abundance of native forest birds, lizards and land snails	Greater Wellington Biosecurity Department / volunteers	✓ \$3,200	✓ \$3,200	✓ \$3,200	✓ \$3,200	✓ \$3,200

Objective	Management Activity	Operational area	The actions: description/detail/comments	Intended 5 year outcome	Implementing party	Frequency and indicative cost				
						2020/21	2021/2022	2022/23	2023/24	2024/25
1,2,3,4	Pest animal control	A & B	Annual maintenance service and safety audit of bait station and trap network to ensure safe and effective operation (includes cost of gear)	Fully functioning pest animal network	Greater Wellington Biosecurity Department	✓ \$1,600	✓ \$1,600	✓ \$1,600	✓ \$1,600	✓ \$1,600
1,2,3,4	Pest animal control	A & B	Provision of gear/bait to volunteers for servicing the pest animal network	Fully serviced pest animal network	Greater Wellington Biosecurity Department	✓ \$1,800	✓ \$1,800	✓ \$1,800	✓ \$1,800	✓ \$1,800
1	Pest animal control	Determined annually	Control deer once a year by shooting. Up to four hunter days allocated (includes contract management cost)	Forest understorey continues to regenerate naturally	Greater Wellington Biosecurity Department	✓ \$2,400	✓ \$2,400	✓ \$2,400*	✓ \$2,400	✓ \$2,400
3	Land snail survey	A & B	Investigate engaging a consultant to undertake a survey for native land snails and identify options for habitat enhancement for land snails	Awareness of native land snails present and their prime habitat requirements	Consultant / Greater Wellington Biodiversity Advisor			✓ \$***		
5	Fish passage assessment	A & B	A visual assessment of barriers to fish migration will be undertaken with recommendations provided (if appropriate)	Native fish habitat and linkages are supported	Greater Wellington Biodiversity Advisor	✓ Advisor time				

Objective	Management Activity	Operational area	The actions: description/detail/comments	Intended 5 year outcome	Implementing party	Frequency and indicative cost				
						2020/21	2021/2022	2022/23	2023/24	2024/25
1	Monitoring	A & B	To set-up photopoints in 2020/21 and annually review them	Monitor the success of control work and observe changes in vegetation	Greater Wellington Biodiversity Advisor	✓ Advisor time	✓ Advisor time	✓ Advisor time	✓ Advisor time	✓ Advisor time

* Some budget may be diverted towards the land snail survey if appropriate

**Cost unknown

**Cost to be confirmed closer to the time

12. Funding contributions

12.1. Budget allocated by Greater Wellington

Table 5 below shows the budget allocated by Greater Wellington for the life of this plan for operational activities at the site. The budget for each year is indicative only and subject to change.

Table 5: Greater Wellington allocated budget for the Haywards Scenic Reserve KNE site

Management activity	Timetable and resourcing				
	2020/21	2021/2022	2022/23	2023/24	2024/25
Ecological weed control	\$6,000	\$6,000	\$6,000*	\$6,000	\$6,000
Pest animal control	\$4,500	\$4,500	\$4,500*	\$4,500	\$4,500
Land snail survey	-	-	\$**	-	-
Total	\$10,500	\$10,500	\$10,500	\$10,500	\$10,500

* Some budget may be diverted towards a land snail survey if appropriate

**Cost to be confirmed

12.2. Budget allocated by HCC

Table 6 below shows the budget allocated by HCC for the life of this plan for operational activities at the site. The budget is subject to confirmation through the long term planning process.

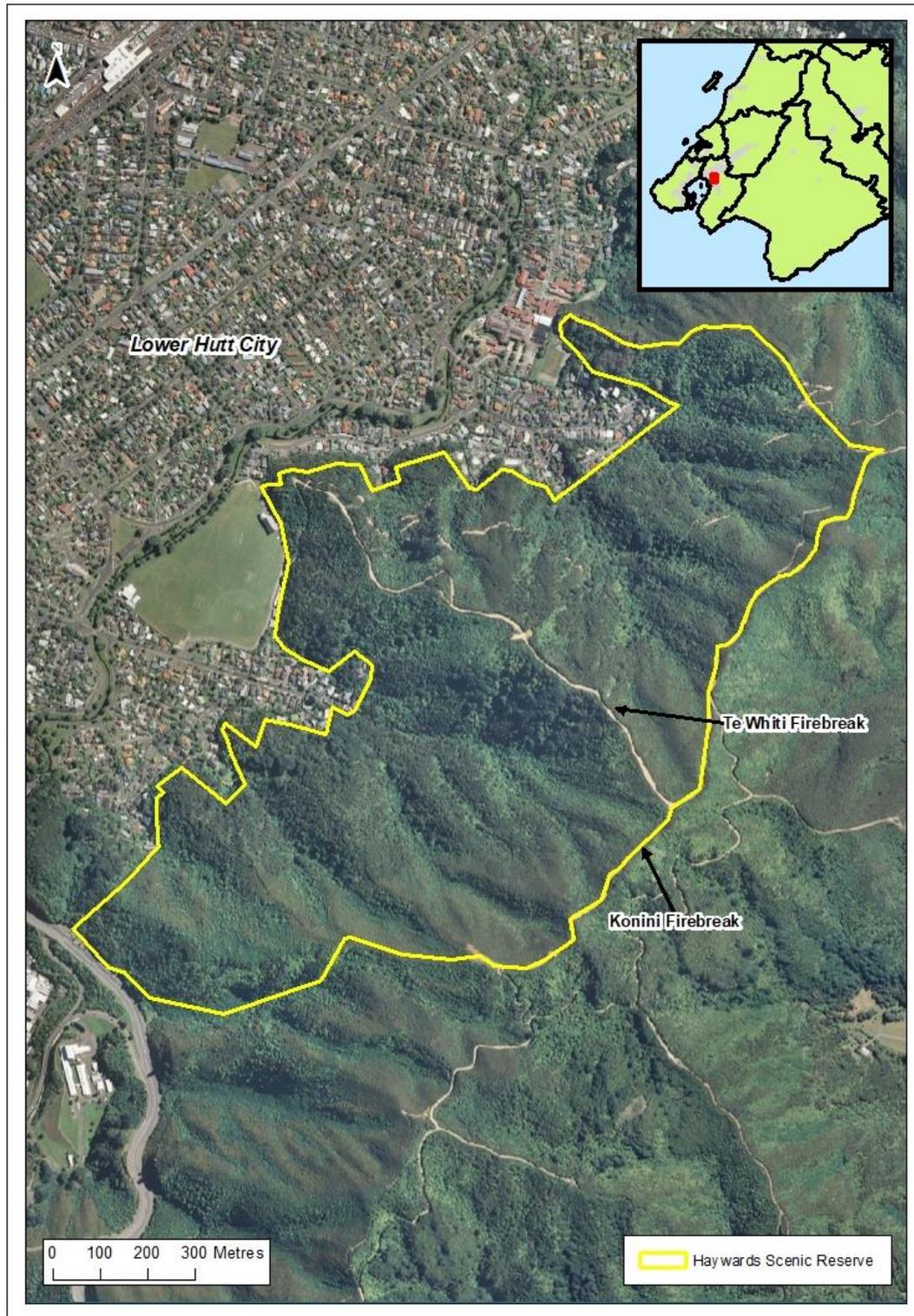
Table 6: HCC allocated budget for the Haywards Scenic Reserve KNE site

Management activity	Timetable and resourcing				
	2020/21	2021/2022	2022/23	2023/24	2024/25
Ecological weed control	\$6,000	\$6,000	\$6,000*	\$6,000	\$6,000
Pest animal control	\$4,500	\$4,500	\$4,500*	\$4,500	\$4,500
Land snail survey	-	-	\$**	-	-
Total	\$10,500	\$10,500	\$10,500	\$10,500	\$10,500

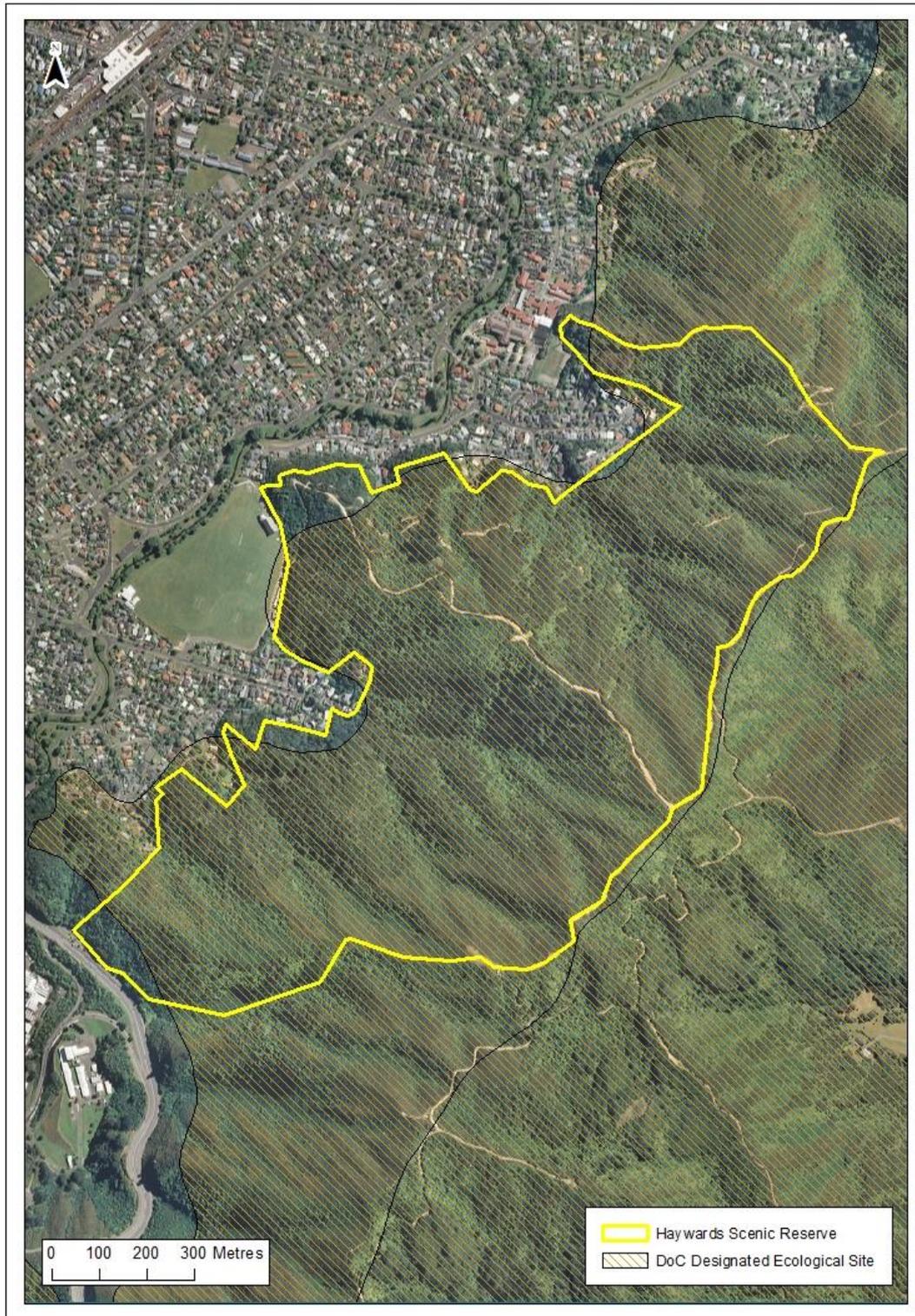
* Some budget may be diverted towards the land snail survey if appropriate and provided HCC approve at the time

**Cost to be confirmed

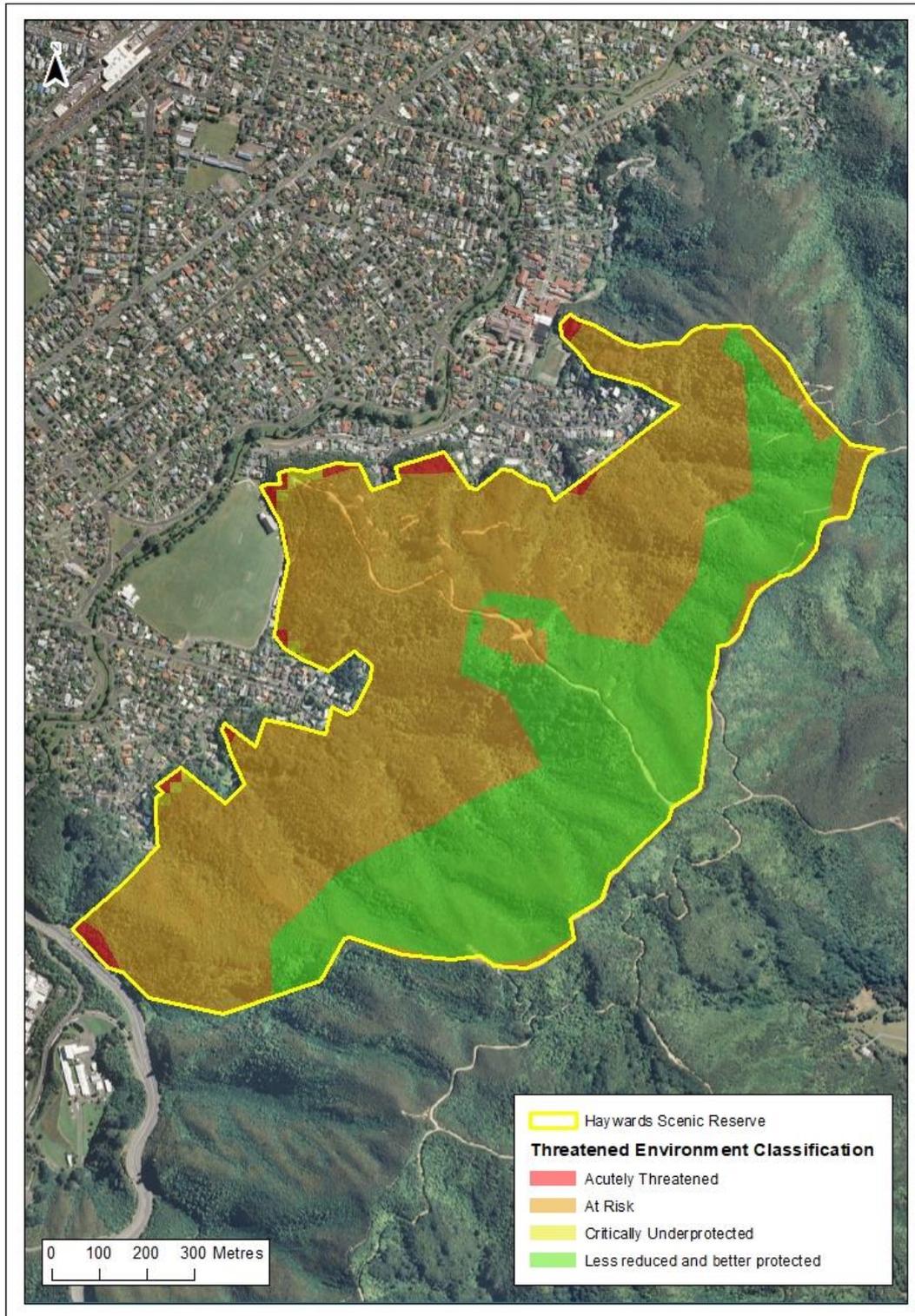
Appendix 1: Site maps



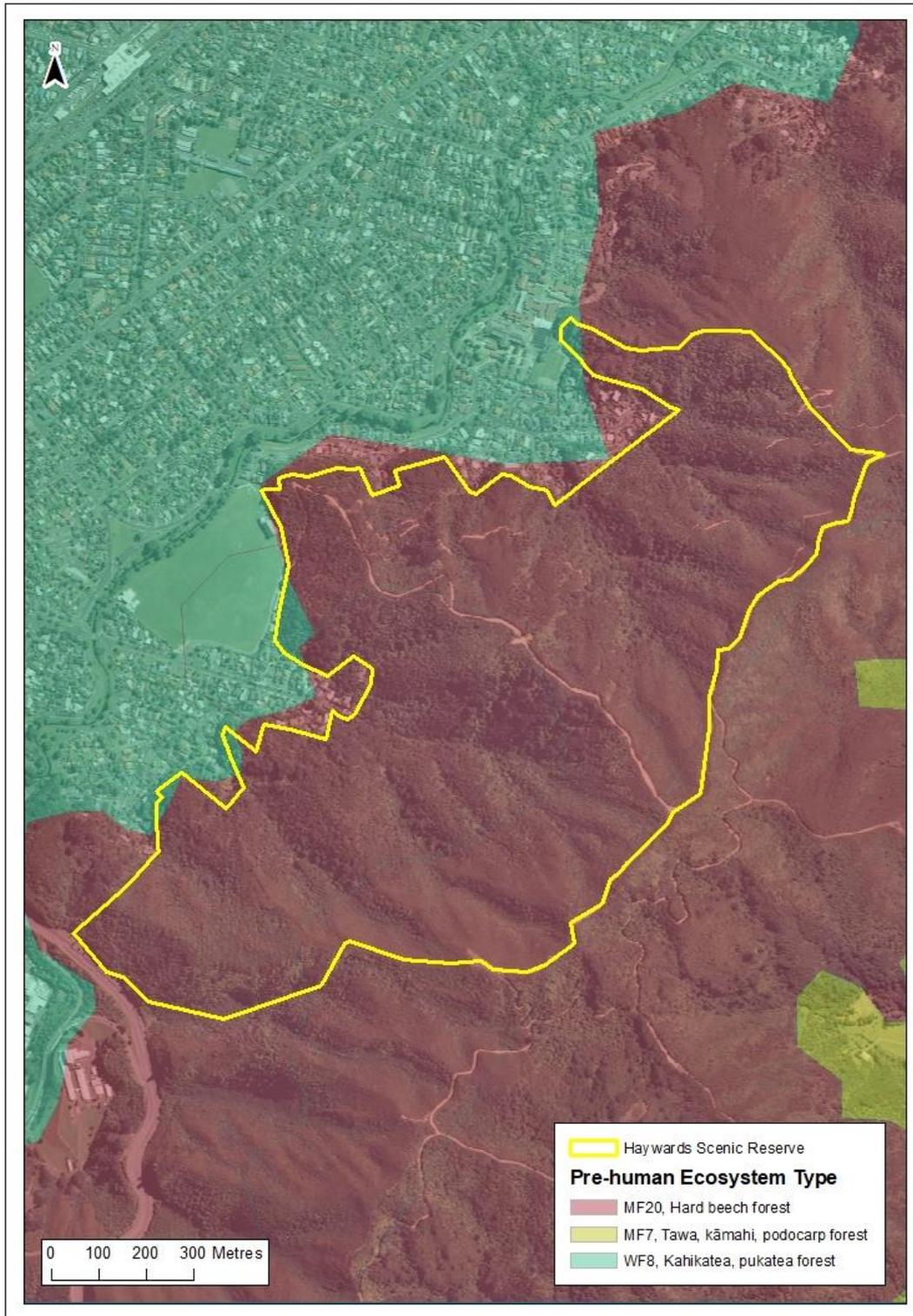
Map 1: The Haywards Scenic Reserve KNE site boundary



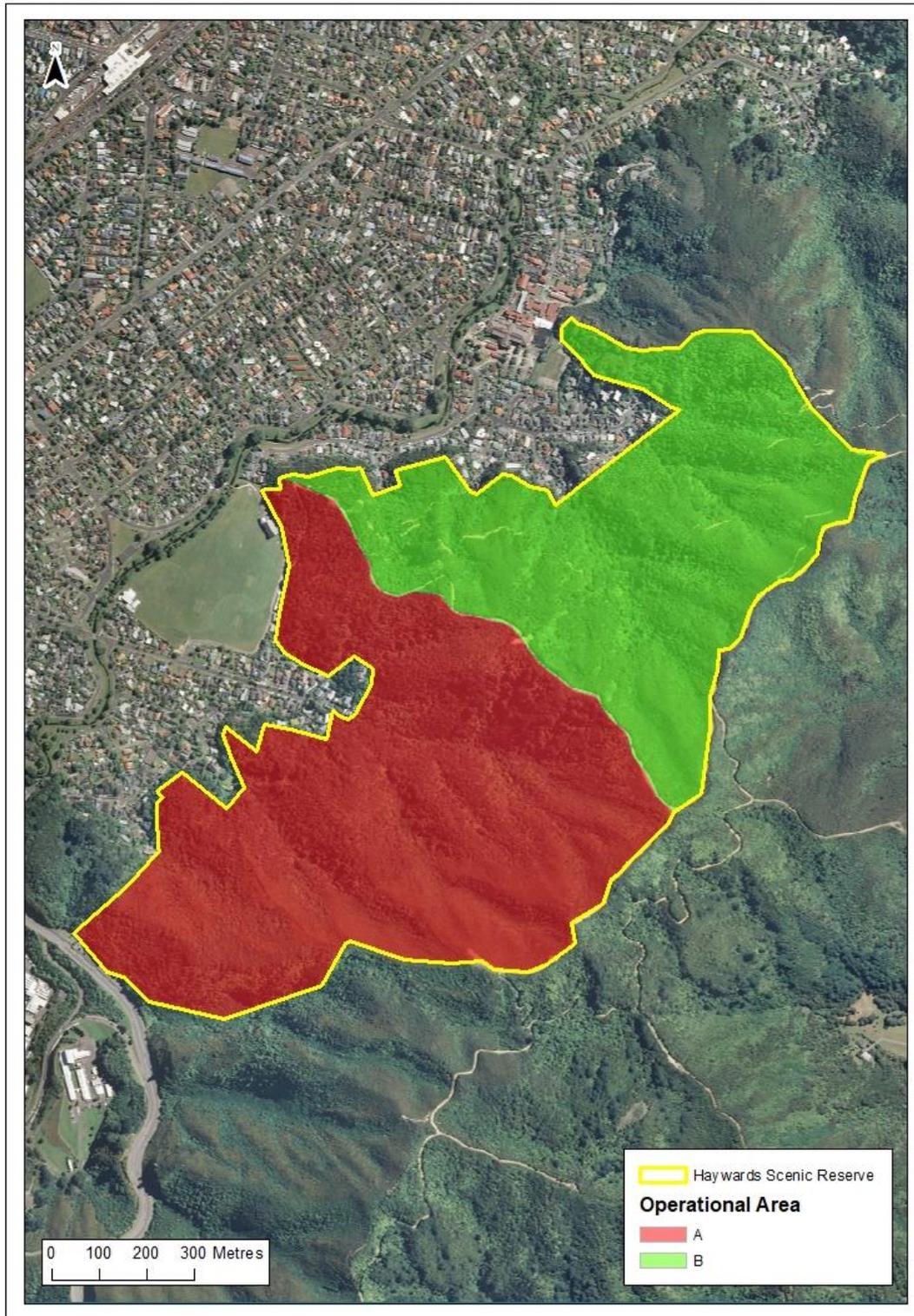
Map 2: Location of DOC Designated Ecological Sites within and immediately surrounding Haywards Scenic Reserve KNE site



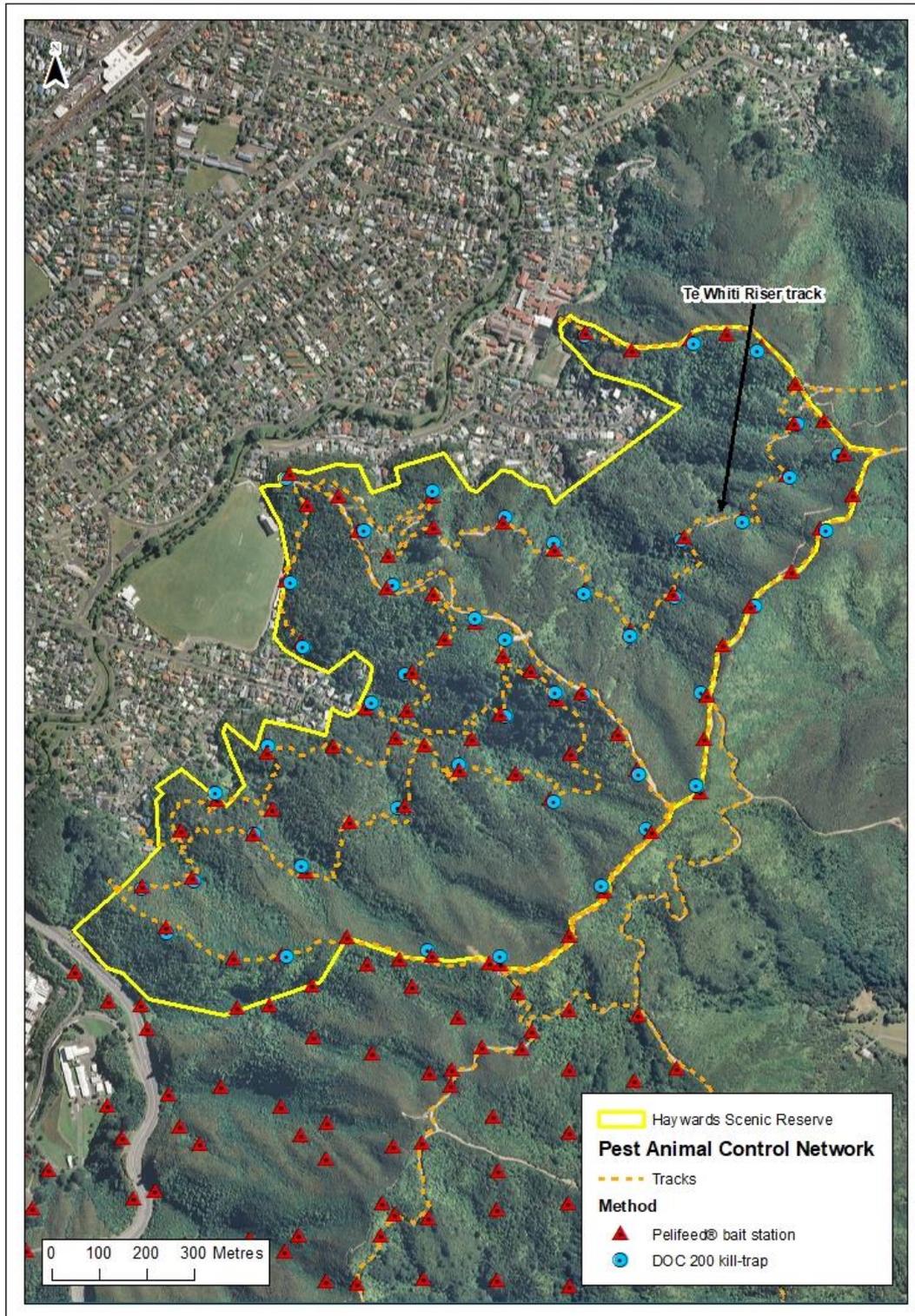
Map 3: Land Environment New Zealand (LENZ) threat classifications for the Haywards Scenic Reserve KNE site. Note the LENZ threat classification has been clipped to the KNE boundary for this map



Map 4: Pre-human ecosystem types for the Haywards Scenic Reserve KNE site and surrounds (Singers and Rogers, 2014)⁶⁵



Map 5: Ecological weed control operational areas in the Haywards Scenic Reserve KNE site



Map 6: Pest animal control network in the Haywards Scenic Reserve KNE site. The Te Whiti Riser mountain bike track is indicated for reference. Note this map also shows the location of bait stations outside the KNE site to the south and east that are funded by HCC. Note that deer control occurs across the site

Appendix 2: Nationally threatened species list

The New Zealand Threat Classification System lists species according to their threat of extinction. The status of each species group (plants, reptiles, etc) is assessed over a five-year cycle⁶⁶. Species are regarded as Threatened if they are classified as Nationally Critical, Nationally Endangered or Nationally Vulnerable. They are regarded as At Risk if they are classified as Declining, Recovering, Relict or Naturally Uncommon. Table 7 below lists Threatened and At Risk species that are resident in, or regular visitors to, the Haywards Scenic Reserve KNE site.

Table 7: Nationally Threatened and At Risk species at the Haywards Scenic Reserve KNE site

Scientific name	Common name	Threat status	Observation
Plants(vascular) ⁶⁷			
<i>Lophomyrtus bullata</i>	Ramarama	Threatened – Nationally critical	iNaturalist 2019 ⁶⁸
<i>Metrosideros diffusa</i>	White climbing rata	Threatened – Nationally vulnerable	iNaturalist 2019 ⁶⁹
Birds ⁷⁰			
<i>Falco novaeseelandiae ferox</i>	New Zealand bush falcon, kārearea	At Risk – Recovering	Bell 2014 ⁷¹
Reptiles ⁷²			
<i>Mokopirirakau</i> “southern North Island”	Ngahere gecko	At Risk – Declining	iNaturalist 2019 ⁷³
<i>Naultinus punctatus</i>	Barking gecko	At Risk – Declining	Department of Conservation 2014 ⁷⁴
Freshwater fish ⁷⁵			
<i>Anguilla dieffenbachii</i>	longfin eel	At Risk – Declining	NIWA 2019 ⁷⁶
<i>Galaxias argenteus</i>	Giant kōkopu	At Risk – Declining	NIWA 2019 ⁷⁷
<i>Galaxias mactulatus</i>	Inanga	At Risk – Declining	NIWA 2019 ⁷⁸
<i>Gobiomorphus gobioides</i>	Giant bully	At Risk – Naturally uncommon	NIWA 2019 ⁷⁹
Invertebrates (snails excluding Powelliphanta) ⁸⁰			
<i>Allodiscus pallidus</i>	-	At Risk – Naturally uncommon	Roscoe, 2005 ⁸¹ (also recorded on iNaturalist)

Appendix 3: Regionally threatened species list

Table 8 below lists Regionally Threatened and At Risk species that have been recorded in the Haywards Scenic Reserve KNE site.

Table 8: Regionally Threatened and At Risk species recorded in the Haywards Scenic Reserve KNE site

Scientific name	Common name	Threat status	Observation
Reptiles ⁸²			
<i>Mokopirakau</i> “southern North Island”	Ngahere gecko	At Risk – Declining	iNaturalist 2019 ⁸³
<i>Naultinus punctatus</i>	Barking gecko	Regionally threatened – Vulnerable	Department of Conservation 2014 ⁸⁴

Appendix 4: Ecological weed species

Table 9 below lists key ecological weed species that have been recorded in the Haywards Scenic Reserve KNE site. Species have been prioritised for control according to their weediness and practicality of control (1 = high priority, 4 = low priority).

Table 9: Ecological weed species recorded in the Haywards Scenic Reserve KNE site

Scientific name	Common name	Priority	Weed type
<i>Akebia quinata</i>	Chocolate vine, five leaf akebia	1	Climber
<i>Asparagus aethiopicus</i>	Bushy asparagus	1	Ground cover
<i>Asparagus scandens</i>	Climbing asparagus	1	Climber
<i>Bomarea</i> sp.	Bomarea	1	Ground cover
<i>Clematis vitalba</i>	Old man's beard	1	Climber
<i>Delairea odorata</i>	German ivy	1	Climber
<i>Dipogon lignosus</i>	Mile-a-minute vine	1	Climber
<i>Euonymus japonicus</i>	Japanese spindle tree	1	Woody
<i>Hedera helix</i> subsp. <i>helix</i>	Ivy	1	Climber
<i>Hedychium gardnerianum</i>	Kahili ginger	1	Ground cover
<i>Jasminum polyanthum</i>	Jasmine	1	Climber
<i>Leycesteria formosa</i>	Himalayan honeysuckle	1	Climber
<i>Lonicera japonica</i>	Japanese honeysuckle	1	Climber
<i>Pandorea pandorana</i>	Wonga wonga vine	1	Climber
<i>Passiflora tripartita</i> var. <i>mollissima</i>	Banana passionfruit	1	Climber
<i>Pseudopanax</i> sp.*	<i>Pseudopanax</i> hybrids	1	Woody
<i>Tradescantia fluminensis</i>	Tradescantia	1	Ground cover
<i>Acacia ulicifolia</i>	Prickly Moses	2	Woody
<i>Acer pseudoplatanus</i>	Sycamore	2	Woody
<i>Buddleja davidii</i>	Buddleia	2	Woody
<i>Chrysanthemoides monilifera</i>	Boneseed	2	Woody
<i>Convolvulus arvensis</i>	Convolvulus	2	Climber
<i>Cortaderia selloana</i>	Pampas	2	Ground cover
<i>Cotoneaster glaucophylla</i>	Cotoneaster	2	Woody
<i>Crataegus monogyna</i>	Hawthorn	2	Woody
<i>Crocsmia xrocosmiiflora</i>	Montbretia	2	Ground cover
<i>Ehrharta erecta</i>	Veldt grass	2	Ground cover
<i>Elaeagnus xreflexa</i>	Elaeagnus	2	Woody

Scientific name	Common name	Priority	Weed type
<i>Galeobdolon luteum</i>	Aluminium plant (Artillery plant)	2	Ground cover
<i>Helichrysum petiolare</i>	Licorice plant	2	Woody
<i>Ilex aquifolium</i>	Holly	2	Woody
<i>Iris foetidissima</i>	Stinking iris	2	Ground cover
<i>Ligustrum lucidum</i>	Tree privet	2	Woody
<i>Nephrolepis cordifolia</i>	Tuber ladder fern	2	Ground cover
<i>Plectranthus ciliatus</i>	Plectranthus	2	Ground cover
<i>Rubus</i> sp. (<i>R. fruticosus</i> agg.)	Blackberry	2	Woody
<i>Sambucus nigra</i>	Elderberry	2	Woody
<i>Selaginella kraussiana</i>	African clubmoss, selaginella	2	Ground cover
<i>Syzygium smithii</i>	Lillypilly, monkey apple	2	Woody
<i>Tropaeolum majus</i>	Nasturtium	2	Ground cover
<i>Zantedeschia aethiopica</i>	Arum lily	2	Ground cover
<i>Acacia longifolia</i>	Sydney golden wattle	3	Woody
<i>Agapanthus praecox</i>	Agapanthus	3	Ground cover
<i>Allium triquetrum</i>	Onion weed	3	Ground cover
<i>Cytisus scoparius</i>	Broom	3	Woody
<i>Erica lusitanica</i>	Spanish heath	3	Woody
<i>Erigeron karvinskianus</i>	Mexican daisy	3	Ground cover
<i>Genista monspessulana</i>	Montpellier broom	3	Woody
<i>Vinca major</i>	Periwinkle	3	Ground cover
<i>Chamaecytisus palmensis</i>	Tree lucerne	4	Woody
<i>Corynocarpus laevigatus</i> *	Karaka	4	Woody
<i>Foeniculum vulgare</i>	Fennel	4	Ground cover
<i>Hoheria populnea</i>	Lacebark	4	Woody
<i>Pinus radiata</i>	Radiata pine	4	Woody
<i>Solanum nigrum</i>	Black nightshade	4	Ground cover
<i>Ulex europaeus</i>	Gorse	4	Woody
<i>Vitex lucens</i>	Puriri	4	Woody

* Denotes a New Zealand native plant that is not local to the KNE site

References

- ¹ New Zealand legislation. 1991. Resource Management Act 1991.
- ² Greater Wellington Regional Council. Greater Wellington Regional Council Long Term Plan: 2018 – 2028.
- ³ Greater Wellington Regional Council. 2019. Proposed Natural Resources Plan. P. 608.
- ⁴ Greater Wellington Regional Council. 2016. Greater Wellington Regional Council Biodiversity Strategy. <http://www.gw.govt.nz/assets/council-publications/Biodiversity-Strategy-2016.pdf>
- ⁵ Department of Conservation. 1999. Ecological Site Inventory Details – Eastern Hutt Hills Bush. 3 pp.
- ⁶ Hutt City Council. 2008. Bush Reserves Management Plan. Revised 2014.
- ⁷ Hutt City Council. 2016. District Plan.
- ⁸ Greater Wellington Regional Council. 2019. Proposed Natural Resources Plan. P. 608.
- ⁹ Greater Wellington Regional Council. 2019. Proposed Natural Resources Plan. P. 608.
- ¹⁰ Greater Wellington Regional Council. 2019. Proposed Natural Resources Plan. P. 608.
- ¹¹ Walker S, Cieraad E, Grove P, Lloyd K, Myers S, Park T, Porteous T. 2007. Guide for users of the threatened environment classification, Version 11, August 2007. Landcare Research New Zealand. 34p plus appendix.
- ¹² New Zealand Threat Classification System (NZTCS) <http://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/>
- ¹³ Crisp P. 2020. Conservation status of indigenous lizard species in the Wellington region. Greater Wellington Regional Council, January 2020. WRC/ESCI-G-20/2.
- ¹⁴ Department of Conservation. 1999. Ecological Site Inventory Details – Eastern Hutt Hills Bush. 3 pp.
- ¹⁵ Singers NJD, Rogers GM. 2014. A classification of New Zealand's terrestrial ecosystems. Science for Conservation No. 325. Department of Conservation, Wellington. 87pp.
- ¹⁶ Crisp P, Singers N. 2015. Terrestrial ecosystems of the Wellington region.
- ¹⁷ Department of Conservation. 1987. Ecological Regions and Districts of New Zealand
- ¹⁸ Department of Conservation. 1987. Ecological Regions and Districts of New Zealand.
- ¹⁹ Park GN. 1971. An Ecological Survey of Haywards Scenic Reserve.
- ²⁰ Friends of Waiwhetu – Haywards Scenic Reserve. 2015. Tracks in the Hayward Scenic Reserve. <http://www.waiwhetu.org/tracks.htm>
- ²¹ Park GN. 1971. An Ecological Survey of Haywards Scenic Reserve, Hutt Valley. Prepared for Hutt City Council. 40p.
- ²² Park GN. 1971. An Ecological Survey of Haywards Scenic Reserve, Hutt Valley. Prepared for Hutt City Council. 40p.
- ²³ Bell D. 2014. NZ Falcon Survey - Wellington Region data extract. Accessed: 30 November 2014.
- ²⁴ <https://www.naturespace.org.nz/history/history-friends-waiwhetus-hayward-scenic-reserve>.
- ²⁵ Reuben Harland, Greater Wellington Regional Council, pers comm.2019.
- ²⁶ NIWA. 2019. NZ Freshwater Fish Database. <https://www.niwa.co.nz/freshwater-and-estuaries/nzffd>. Accessed December 2019.
- ²⁷ Department of Conservation. 2014. Department of Conservation Herpetofauna Database (Bioweb). Accessed: May 2014.
- ²⁸ iNaturalist. <https://www.inaturalist.org/taxa/384811-Hoplodactylus-%22southern-north-island%22>. Accessed December 2019.
- ²⁹ Roscoe D. 2005. Land Molluscs of Waiwhetu, Petone.
- ³⁰ Friends of Waiwhetu – Haywards Scenic Reserve. 2015. Tracks in the Hayward Scenic Reserve. <http://www.waiwhetu.org/tracks.htm>
- ³¹ Pekelharing CJ, Parkes JP, Barker RJ. 1998. Possum (*Trichosurus vulpecula*) densities and impacts on fuchsia (*Fuchsia excorticata*) in South Westland, New Zealand. New Zealand Journal of Ecology 22(2): 197–203.
- ³² Nugent G, Sweetapple P, Coleman J, Suisted P. 2000. Possum feeding patterns. Dietary tactics of a reluctant folivore. In: Montague TL ed. The brushtail possum: Biology, impact and management of an introduced marsupial. Lincoln, Manaaki Whenua Press. Pp. 10–19.

- ³³ Sweetapple PJ, Fraser KW, Knightbridge PI. 2004. Diet and impacts of brushtail possum populations across the invasion front in South Westland, New Zealand. *New Zealand Journal of Ecology* 28(1): 19–33.
- ³⁴ Daniel MJ. 1973. Seasonal diet of the ship rat (*Rattus r. rattus*) in lowland forest in New Zealand. *Proceedings of the New Zealand Ecological Society* 20: 21–30.
- ³⁵ Innes JG. 2005. Ship rat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 187–203.
- ³⁶ Murphy E, Maddigan F, Edwards B, Clapperton K. 2008. Diet of stoats at Okarito Kiwi Sanctuary, South Westland, New Zealand. *New Zealand Journal of Ecology* 32(1): 41–45.
- ³⁷ King CM and Murphy EC. 2005. Stoat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 261–287.
- ³⁸ Ragg JR. 1998. Intraspecific and seasonal differences in the diet of feral ferrets (*Mustela furo*) in a pastoral habitat, east Otago, New Zealand. *New Zealand Journal of Ecology* 22(2): 113–119.
- ³⁹ Clapperton BK, Byron A. 2005. Feral ferret. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 294–307.
- ⁴⁰ King CM. 2005. Weasel. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 287–294.
- ⁴¹ King CM, Flux M, Innes JG, Fitzgerald BM. 1996. Population biology of small mammals in Pureora Forest Park: 1. Carnivores (*Mustela erminea*, *M.furo*, *M.nivalis* and *Felis catus*). *New Zealand Journal of Ecology* 20(2): 241–251.
- ⁴² Stewart GH, Wardle JA and Burrows LE. 1987. Forest understory changes after reduction in deer numbers, Northern Fiordland, New Zealand. *New Zealand Journal of Ecology* 10: 35–42.
- ⁴³ Nugent G, Fraser W. 2005. Red deer. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 401–419.
- ⁴⁴ Nugent G, Asher G. 2005. Fallow deer. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 447–459.
- ⁴⁵ Jones C, Sanders MD. 2005. European hedgehog. In: King CM ed. *The handbook of New Zealand mammals*. 2nd edition. Melbourne, Oxford University Press. Pp. 81–94.
- ⁴⁶ Spitzen-van der Sluijs AM, Spitzen J, Houston D, Stumpel AHP. 2009. Skink predation by hedgehogs at Macraes Flat, Otago, New Zealand. *New Zealand Journal of Ecology* 33(2): 205–207.
- ⁴⁷ Jones C, Moss K, Sanders M. 2005. Diet of hedgehogs (*Erinaceus europaeus*) in the upper Waitaki Basin, New Zealand. Implications for conservation. *New Zealand Journal of Ecology* 29(1): 29–35.
- ⁴⁸ Jones C, Sanders MD. 2005. European hedgehog. In: King CM ed. *The handbook of New Zealand mammals*. 2nd edition. Melbourne, Oxford University Press. Pp. 81–94.
- ⁴⁹ Ruscoe WA, Murphy EC. 2005. House mouse. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 204–221.
- ⁵⁰ Newman DG. 1994. Effect of a mouse *Mus musculus* eradication programme and habitat change on lizard populations on Mana Island, New Zealand, with special reference to McGregor's skink, *Cyclodina macgregori*. *New Zealand Journal of Ecology* 21: 443–456.
- ⁵¹ King CM, Flux M, Innes JG, Fitzgerald BM. 1996. Population biology of small mammals in Pureora Forest Park: 1. Carnivores (*Mustela erminea*, *M.furo*, *M.nivalis* and *Felis catus*). *New Zealand Journal of Ecology* 20(2): 241–251.
- ⁵² Reardon JT, Whitmore N, Holmes KM, Judd LM, Hutcheon AD, Norbury G, Mackenzie DI. 2012. Predator control allows critically endangered lizards to recover on mainland New Zealand. *New Zealand Journal of Ecology* 36(2): 141–150.
- ⁵³ King CM, Flux M, Innes JG, Fitzgerald BM. 1996. Population biology of small mammals in Pureora Forest Park: 1. Carnivores (*Mustela erminea*, *M.furo*, *M.nivalis* and *Felis catus*). *New Zealand Journal of Ecology* 20(2): 241–251.
- ⁵⁴ Gillies C, Fitzgerald BM. 2005. Feral cat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 308–326.
- ⁵⁵ McIlroy JC. 2005. Feral pigs. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 334–345.
- ⁵⁶ Norbury G, Flux JEC. 2005. Brown hare. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 151–158.

- ⁵⁷ Beggs JR. 2001. The ecological consequences of social wasps (*Vespula* spp.) invading an ecosystem that has an abundant carbohydrate resource. *Biological Conservation* 99: 17–28.
- ⁵⁸ Parkes. JP. 2005. Feral goat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 374–391.
- ⁵⁹ Holderness-Roddam B. 2011. The effects of domestic dogs (*Canis familiaris*) as a disturbance agent on the natural environment. Thesis submitted at University of Tasmania, Hobart.
- ⁶⁰ Young A, Mitchell N. 1994. Microclimate and vegetation edge effects in a fragmented podocarp-broadleaf forest in New Zealand. *Biological Conservation* 67: 63–72.
- ⁶¹ Norton DA. 2002. Edge effects in a lowland temperate New Zealand rainforest. DOC Science Internal Series 27. Department of Conservation, Wellington.
- ⁶² Roscoe D. 2005. *Land Molluscs of Waiwhetu*, Petone.
- ⁶³ Owen Spearpoint, Greater Wellington Regional Council, pers comm. 2015.
- ⁶⁴ National Institute of Water & Atmospheric Research Ltd (NIWA). 2018. *New Zealand Fish Passage Guidelines: For structures up to 4 metres*. NIWA CLIENT REPORT No: 2018019HN. 229p.
- ⁶⁵ Singers NJD, Rogers GM. 2014. A classification of New Zealand's terrestrial ecosystems. *Science for Conservation* No. 325. Department of Conservation, Wellington. 87pp.
- ⁶⁶ Department of Conservation. 2008. *New Zealand Threat Classification System manual*.
- ⁶⁷ de Lange PJ, Rolfe JR, Barkla JW, Courtney SP, Champion PD, Perrie LR, Beadel SM, Ford KA, Breitwieser I, Schönberger I, Hindmarsh-Walls R, Heenan PB, Ladley K. 2017. Conservation status of New Zealand indigenous vascular plants, 2017. *New Zealand Threat Classification Series* 22. 86 p.
- ⁶⁸ iNaturalist. 2019. <https://www.inaturalist.org/>. Accessed January 2020.
- ⁶⁹ iNaturalist. 2019. <https://www.inaturalist.org/>. Accessed January 2020.
- ⁷⁰ Robertson HA, Baird K, Dowding JE, Elliott GP, Hitchmough RA, Miskelly CM, McArthur N, O'Donnell CFJ, Sagar PM, Scofield RP, Taylor GA. Conservation status of New Zealand birds, 2016. *New Zealand Threat Classification Series* 19. 27 p.
- ⁷¹ Bell D. 2014. NZ Falcon Survey - Wellington Region data extract. Accessed: 30 November 2014.
- ⁷² Hitchmough R, Barr B, Lettink M, Monks J, Reardon J, Tocher M, Van Winkel D, Rolfe J. 2016. Conservation status of New Zealand reptiles, 2015. *New Zealand Threat Classification Series* 17. 14 p.
- ⁷³ iNaturalist. 2019. <https://www.inaturalist.org/>. Accessed January 2020.
- ⁷⁴ Department of Conservation. 2014. Bioweb Herpetofauna database. Accessed March 2014.
- ⁷⁵ Dunn NR, Allibone RM, Closs GP, Crow SK, David BO, Goodman JM, Griffiths M, Jack DC, Ling N, Waters JM and Rolfe JR. 2017. Conservation status of New Zealand freshwater fishes, 2017. *New Zealand Threat Classification Series* 24. 11 p.
- ⁷⁶ NIWA. 2019. NZ Freshwater Fish Database. <https://www.niwa.co.nz/freshwater-and-estuaries/nzffd>. Accessed December 2019.
- ⁷⁷ NIWA. 2019. NZ Freshwater Fish Database. <https://www.niwa.co.nz/freshwater-and-estuaries/nzffd>. Accessed December 2019.
- ⁷⁸ NIWA. 2019. NZ Freshwater Fish Database. <https://www.niwa.co.nz/freshwater-and-estuaries/nzffd>. Accessed December 2019.
- ⁷⁹ NIWA. 2019. NZ Freshwater Fish Database. <https://www.niwa.co.nz/freshwater-and-estuaries/nzffd>. Accessed December 2019.
- ⁸⁰ Mahlfeld K, Brook FJ, Roscoe DJ, Hitchmough RA, Stringer IAN. 2012. The conservation status of New Zealand terrestrial Gastropoda excluding *Powelliphanta*. *New Zealand Entomologist* 35(2): 103–109.
- ⁸¹ Roscoe D. 2005. *Land Molluscs of Waiwhetu*, Petone.
- ⁸² Crisp P. 2020. Conservation status of indigenous lizard species in the Wellington region. Greater Wellington Regional Council, January 2020. WRC/ESCI-G-20/2.
- ⁸³ iNaturalist. 2019. <https://www.inaturalist.org/>. Accessed January 2020.
- ⁸⁴ Department of Conservation. 2014. Bioweb Herpetofauna database. Accessed March 2014.

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