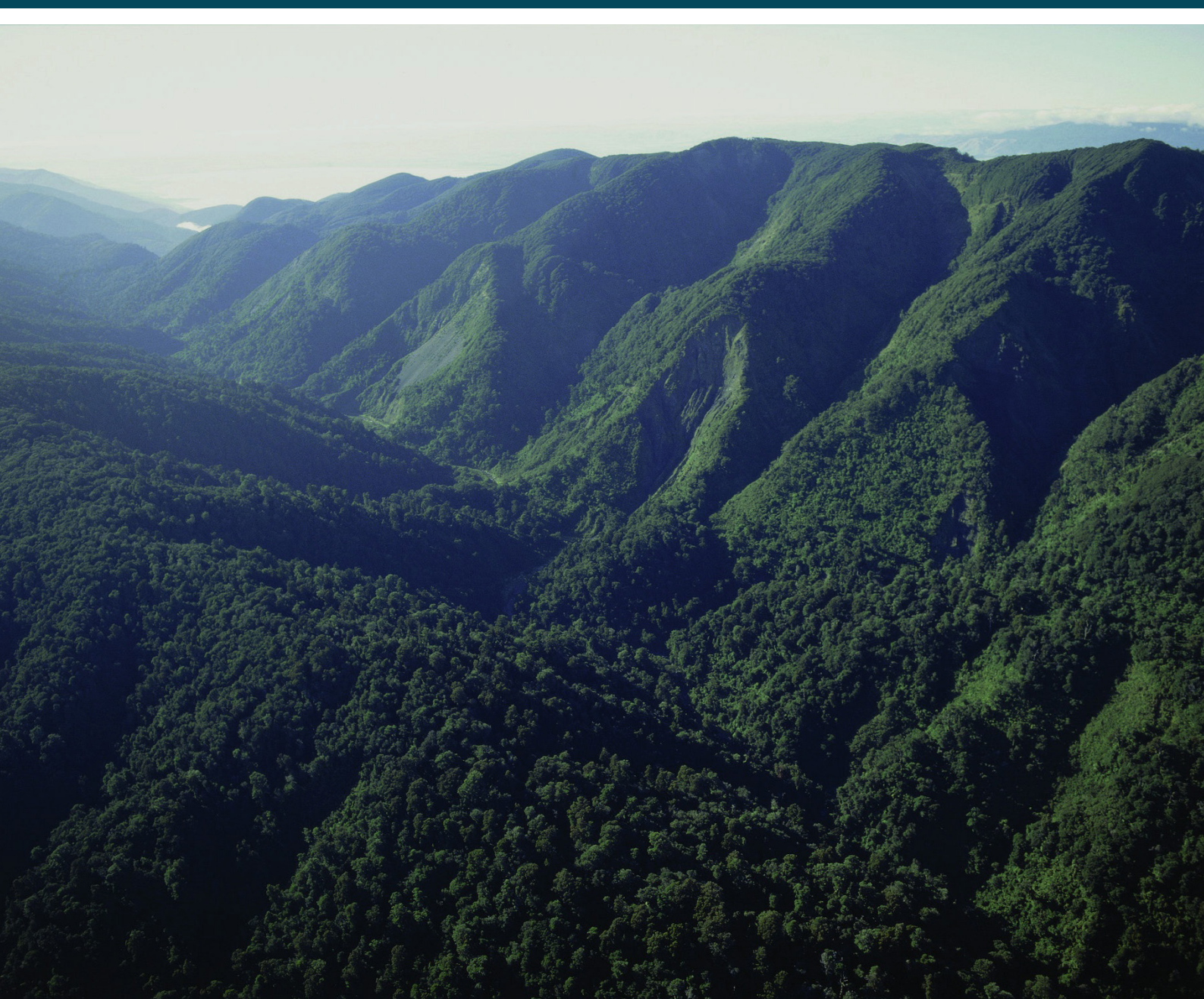


Key Native Ecosystem Operational Plan for Wainuiomata Orongorongo

2018-2021



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1. Purpose

The purpose of the three-year Key Native Ecosystem (KNE) Operational Plan for Wainuiomata/Orongorongo 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 three 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) 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 Schedules B, C, Schedule D)

Hutt and Wainuiomata/Orongorongo Water Collection Areas Management Plan

The Wainuiomata/Orongorongo Water Collection Area is set aside and managed under the Wellington Regional Water Board Act 1972 for water collection purposes.

Management of the area is also guided by the National Environmental Standards for Sources of Human Drinking Water (2008), drinking water standards, a water safety plan and a number of statutory and strategic plans. In 2016 an overarching management plan for the Hutt and Wainuiomata/Orongorongo Water Collection Areas³ was developed to outline goals, objectives and actions to guide and inform the management of the water collections areas and operational plans, such as this KNE operational plan. The water collection area management plan identifies five goals:

1. *Maximise the **quality** of raw water and minimise the extent of water treatment required*
2. *Manage threats to water **supply** to maintain volumes of raw water*
3. *Maintain and enhance the significant **ecosystem and biodiversity values** of the water collection areas*
4. *Maintain the **cultural heritage** values of the water collection areas, including managed **recreational access***
5. *Maintain **collaborative working relationships** between management agencies and with others to achieve water quality, supply and biodiversity objectives*

These goals are relevant to this KNE operational plan as the outcomes of biodiversity management are a key component in the delivery of the Water Collection Management Plan's objectives. Optimum water quality is achieved via healthy aquatic and terrestrial ecosystems, and managing the key threats to water quality and supply also supports biodiversity objectives. For example, maintaining low numbers of pest animals such as deer and goats reduces the risk of water contamination by protozoa such as cryptosporidium and giardia (which they can carry) and also reduces the loss of vegetation cover that can contribute to soil erosion, thereby threatening water quality.

Parks Network Plan

Management of Wainuiomata Recreation Area which is included within the Wainuiomata/Orongorongo KNE site is guided by the Greater Wellington Parks Network Plan (PNP)⁴. This plan guides the recreational and amenity uses of Wainuiomata Recreation Area as well as identifying opportunities to protect biodiversity values.

Greater Wellington Biodiversity Strategy

The Greater Wellington Biodiversity Strategy⁵ (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 Key Native Ecosystem (KNE) Programme.

<p>Goal One</p> <p>Areas of high biodiversity value are protected or restored</p>
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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 three-year KNE plans prepared by the Greater Wellington’s Biodiversity department. Greater Wellington works with the landowners, mana whenua and other operational delivery providers to achieve mutually beneficial goals.

4. Wainuiomata/Orongorongo Key Native Ecosystem site

The Wainuiomata/Orongorongo KNE site (7,364 ha) is located in Wainuiomata, east of Moores Valley and west of the main range of the Remutaka Ranges. It encompasses the headwaters of the Wainuiomata and Orongorongo rivers, and in terms of management areas includes all of the Wainuiomata/Orongorongo Water Collection Area and the Wainuiomata Recreation Area.

The KNE site is clad almost entirely with original native forest. It contains podocarp-broadleaf and beech forest, including one of the largest areas of unlogged lowland podocarp forest in the lower North Island⁶. It is rich in native flora and fauna constituting some of the highest biodiversity values of any forest ecosystem in the Wellington region.

The KNE site is bounded by contiguous native forest of the Remutaka Forest Park to the east and south, and privately owned native scrub and farmland to the north and west.

In 2003 Wellington Regional Council approved the funding of an ecological mainland island within part of the KNE site; the Wainuiomata Mainland Island (see operational area C, Appendix 1, Map 3). Work on establishing an intensive pest control infrastructure in this area commenced in 2005 and a strategic plan⁷ for the development of the project was produced in 2007.

Although the strategic plan remains an important resource and reference point, this KNE plan now supersedes that document in describing the operational activities that are planned for the Wainuiomata Mainland Island.

5. Parties involved

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

5.1. Landowner and land managers

All land within the Wainuiomata/Orongorongo KNE site is owned by or vested in Greater Wellington and has been set aside for the purpose of harvesting source water for treatment and supply to the cities of Wellington, Porirua, Lower Hutt and Upper Hutt.

Wellington Water Limited (Wellington Water) manages the water supply in accordance with the Hutt and Wainuiomata/Orongorongo Water Collection Areas Management Plan⁸. This plan identifies the broad scale management required to protect biodiversity values of the site which play a role in providing quality source water (eg, a complete native forest structure). This KNE operational plan provides further detail of management activities being implemented to protect those biodiversity values. Some of these management activities are funded by Wellington Water. Wellington Water maintains water supply assets and the associated infrastructure within the site.

The Greater Wellington Parks department manages access to both the Wainuiomata/Orongorongo Water Collection Area and the Wainuiomata Recreation Area. They also maintain assets such as roads, tracks and amenity areas within the KNE site.

The Greater Wellington Biodiversity department manages the biodiversity values of the KNE site in accordance with the Hutt and Wainuiomata/Orongorongo Water Collection Areas Management Plan⁹ and the KNE programme.

5.2. Operational delivery

Within Greater Wellington, the Biodiversity, Biosecurity, Environmental Science and Parks departments are responsible for delivering the 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 most pest control activities. The Environmental Science department carries out a range of output and outcome monitoring activities. The Parks department carries out some pest control activities and undertakes planting.

Members of Hutt Valley Tramping Club contribute towards the delivery of the KNE plan by assisting the Environmental Science department to undertake small mammal monitoring.

5.3. Mana whenua partners

Taranaki Whānui ke te Upoko o te Ika a Maui (Taranaki Whānui) and Ngāti Toa Rangatira (Ngāti Toa) are Greater Wellington's mana whenua partners in Wainuiomata/Orongorongo KNE site (see Tables 1 and 2). Greater Wellington is committed to identifying ways in which kaitiakitanga can be strengthened by exploring opportunities for a whenua partners to be involved in the plan development or operational delivery of the KNE site.

Table 1: Taranaki Whānui sites of significance in Wainuiomata/Orongorongo KNE site¹⁰

Sites of significance	Mana whenua values
Orongorongo River mouth	Mahinga kai, tauranga waka, wāhi tapu
Wainuiomata River mouth and coast	Mahinga kai

Table 2: Ngāti Toa sites of significance in Wainuiomata/Orongorongo KNE site¹¹

Sites of significance	Mana whenua values
Wainuiomata River	<p>Ngā mahi a ngā Tūpuna:</p> <p>Ngāti Toa’s relationship with Te Awa Kairangi and Wainuiomata Rivers extends back to the Amiowhenua expedition from 1819 and Te Rauparaha’s initial invasion of the Hutt Valley. During that campaign the tauā (war party) marched around the western side of Te Whanganui-a-Tara, defeating the local iwi as they went. When they reached Te Awa Kairangi they constructed rafts which were used to aid them in their invasion of the Hutt Valley. Ngāti Toa’s traditional relationship with each river as important mahinga kai, ara waka, and source of natural resources reflected the wider influence and mana of Ngāti Toa throughout the whole of the Hutt Valley.</p>

Greater Wellington recognises the value and importance of working with mana whenua in their role as kaitiaki in areas within the KNE site. The KNE operational plan activities will:

- Make a small but valuable contribution to the overall expected PNRP outcomes including protecting native vegetation in the Wainuiomata and Orongorongo catchments
- Ensure people working in KNE sites understand the requirements of the Accidental Discovery Protocol
- Endeavour to ensure that Ngāti Toa and Taranaki Whānui values for the site are protected

In addition, Greater Wellington will work on initiatives to achieve mutual benefit including the Internship monitoring programme of the cultural health and wellbeing of KNE sites.

5.4. Stakeholders

Stakeholders in the KNE site are Hutt Valley Tramping Club, Remutaka Conservation Trust, Wellington Botanical Society, and some private ecologists.

Members of Hutt Valley Tramping Club have been assisting in the monitoring of small mammal pests since 2003. The involvement of members of the tramping club was vital in the establishment of this monitoring and remains vital to its continuation.

The Remutaka Conservation Trust operates several lines of predator control traps within the KNE site as part of their project managing a population of North Island brown kiwi (*Apteryx mantelli*) in the adjacent Remutaka Forest Park. Kiwi from this managed population have spread into the KNE site during recent years which has led to the Trust’s predator control aimed at protecting the kiwi being extended into the KNE site. The Trust undertakes monitoring of the kiwi population in the KNE site and the adjacent wider catchments.

The Wellington Botanical Society and some private ecologists have interests in and have studied the KNE site due to its high biodiversity values. Studies have been undertaken and species check-lists produced on the KNE site's flora, mosses and snails.

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 3, below, lists ecological designations at all or part of the Wainuiomata/Orongorongo KNE site.

Table 3: Designations at the Wainuiomata/Orongorongo KNE site

Designation level	Type of designation
Regional	<p>Parts of the Wainuiomata/Orongorongo KNE site are designated under Greater Wellington's Proposed Natural Resources Plan (PNRP) as:</p> <ul style="list-style-type: none"> • River with outstanding indigenous ecosystem values (Schedule A1): Wainuiomata River, upstream of a point 20 metres above the Wainuiomata Water Supply Intake • River with Significant Indigenous Ecosystems - habitat with high macroinvertebrate community health (Schedule F1): Wainuiomata and Orongorongo rivers and all of their tributaries • River with Significant Indigenous Ecosystems - habitat for threatened and at risk fish species (Schedule F1): Wainuiomata and Orongorongo rivers and all of their tributaries • River with Significant Indigenous Ecosystems - habitat for six or more migratory indigenous fish species (Schedule F1): Wainuiomata and Orongorongo rivers and all of their tributaries • Wetland with outstanding indigenous biodiversity values (Schedule A3): Orongorongo Swamp • Identified significant natural wetland (Schedule F3): Skull Gully Wetland and Wainuiomata Waterworks Swamp Lower
District	<p>The entire KNE site is designated within Hutt City Council's District Plan¹² as Significant Natural Resources:</p> <ul style="list-style-type: none"> • SNR 40: Orongorongo Swamp • SNR 46: Remutaka Ranges and Orongorongo and Wainuiomata Catchments (the remainder of the KNE site)
Other	<p>The entire KNE site is set aside and gazetted for water supply and recreation purposes.</p>

6.2. Ecological significance

The Wainuiomata/Orongorongo KNE site is considered to be of regional importance because:

- It contains highly **representative** ecosystems that were 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
- Its **ecological context** is valuable at the landscape scale as it contains a variety of inter-connected habitats and, provides core habitat for threatened indigenous plant and animal species

Representativeness

The vegetation types within the Wainuiomata/Orongorongo KNE site have remained largely unchanged since the time of European settlement so are highly representative of the original vegetation types¹³. The Singers and Rogers (2014)¹⁴ classification of pre-human vegetation indicates that the KNE site contains five forest and four wetland ecosystem types. They are: kāmahī, broadleaf, podocarp forest (MF8); hard beech forest (MF20); red beech, podocarp forest (CLF9); silver beech forest (CLF11-2); silver beech, kāmahī forest (CLF11-3); mānuka, tangle fern scrub/fernland (WL12); flaxland (WL18); raupō reedland (WL19); and coprosma, twiggy tree daisy scrub (WL20). The forest ecosystem type MF20 is considered regionally threatened, as it is estimated that there is now only about 26% of the pre-human extent of this forest type remaining in the Wellington region¹⁵.

The Threatened Environment Classification system¹⁶ indicates that parts the KNE site are classified as Acutely Threatened or At Risk environments. Across New Zealand these environment classes have less than 10% and 20-30% respectively of their original indigenous vegetation cover remaining¹⁷. These areas of threatened environments within the KNE site are located on valley floors and river terraces and mostly have close to their original indigenous vegetation intact (see Appendix 1, Map 2).

Rarity/distinctiveness

Two of the wetlands within the KNE site, the Orongorongo Swamp and the Skull Gully Wetland are in close to their original state. The Orongorongo Swamp is the only montane-alluvial wetland in the region and is considered one of the most pristine wetlands of a significant size in the region¹⁸. Wetlands are now considered an uncommon habitat type in the Wellington Region with less than 3% remaining of their original extent¹⁹.

New Zealand's national threat classification system²⁰ lists one plant, eight bird, two lizard, five freshwater fish and one invertebrate species recorded within the KNE site as Nationally Threatened or At Risk. Nine plant species present have been listed as regionally threatened. Nationally Threatened species are listed in Appendix 2 and regionally threatened species in Appendix 3.

Diversity

The KNE site contains two ecosystem types; forest and wetland. The forest ecosystem is diverse, containing several distinct forest types and two differing river systems.

Ecological context

The KNE site is one of the largest areas of original forest in the Wellington region. It provides core breeding habitat for a large assemblage of native forest bird species including Threatened and At-Risk species, and is refuge for nationally and regionally threatened plant species. The KNE site is contiguous with Remutaka Forest Park and Pākuratahi Forest, other large areas of similar habitat. The KNE site contains all of the headwaters of the Wainuiomata and Orongorongo rivers providing a rare opportunity to carry out management at a catchment scale.

6.3. Ecological features

The two river catchments within the site are both long and narrow with southwest aspects. Altitude rises from 100 metres ASL at the Reservoir Road entrance to the Wainuiomata Recreation Area to 902 metres ASL at Papatahi situated in the Remutaka range.

The Orongorongo catchment, the higher and more rugged of the two catchments, has steep sided V-shaped valleys. Evidence of the many landslides triggered by the 1855 earthquake caused by the movement of the Wairarapa Fault can still be seen on the steep faces of the main range today. The valleys of the Wainuiomata catchment are less deep, with the more U-shaped valley floors of the three main tributaries all being about 250 metres wide²¹.

Yearly rainfall in the KNE site is high, making it ideal for water collection. Annual rainfall is about 2,000mm and 2,500mm in the Wainuiomata and Orongorongo catchments respectively. Snow occasionally covers the main ranges in winter²².

Habitats (inc. vegetation communities and plants)

The Wainuiomata/Orongorongo KNE site contains a number of native forest habitats ranging from lowland broadleaf-podocarp forest, through steep-land beech forest, to sub-alpine scrub. Two river systems including numerous tributary streams are contained within the forest habitats. Three major and one smaller wetland are present, associated with the main river courses or streams.

Vegetation

Most of the KNE site is clothed in much the same vegetation today as it was at the time of European settlement. As elsewhere in the country, introduced pests have altered the species mix of the forest and devastated indigenous fauna, but the largely original forest complete with huge podocarp trees, festooned in epiphytes, is still present. Some logging of the lower Wainuiomata catchment occurred in the late 19th century, especially in the Wainuiomata Recreation Area, but the headwaters were left unmodified.

The Wainuiomata catchment contains one of the largest areas of unlogged lowland podocarp forest in the lower North Island and it is regarded as being nationally

representative of this forest type. Noteworthy elements of the flora are the age and stature of the rimu (*Dacrydium cupressinum*) and the large component of northern rata (*Metrosideros robusta*), important keystone species in the forests of the lower North Island.

On the valley floors in both catchments, the podocarp forest is composed of emergent rimu, miro (*Pumnopitys ferruginea*) and northern rata, towering over a canopy of kamahi (*Weimannia racemosa*), hinau (*Elaeocarpus dentatus*), rewarewa (*Knightia excelsa*) and black maire (*Nestegis cunninghamii*). Closer to the waterways in the Wainuiomata catchment, the forest also contains matai (*Prumnopitys taxifolia*), kahikatea (*Dacrycarpus dacrydioides*) and tawa (*Beilschmiedia tawa*). As altitude increases, the podocarp forest grades into a beech community. Around 500m, silver beech (*Lophozonia menziesii*) becomes dominant over a canopy of kamahi, miro, Hall's totara (*Podocarpus laetus*) and hinau. In some areas in the Wainuiomata catchment, black beech (*Fuscopora solandri*) is the dominant species. Above 600m in both catchments, silver beech forest becomes predominant. *Raukaua edgerlyi* and Kirk's tree daisy (*Brachyglottis kirkii* var. *kirkii*) – very sparsely distributed species in the region - occur in small numbers.

Over 60 fern and allied species have been recorded in the KNE site – about a third of the New Zealand fern and allied species flora. Over 185 moss species have been recorded in the KNE site, 63 of which had not previously been recorded in the southern Tararua District at the time of recording. One moss species found in the KNE site, *Zygodon gracillimus*, has not been recorded anywhere else south of Lake Taupo²³.

Wetlands

Four wetlands are found within the KNE site. The upper Orongorongo valley contains the only montane-alluvial wetland in the region. It is considered one of the most pristine wetlands of a significant size in the region²⁴. Key species found in this wetland include the regionally rare sedge *Baumea* sp. along with *Gahnia xanthocarpa* and manuka (*Leptospermum scoparium*). The second wetland is a manuka fen in Skull Gully Stream, a major tributary of the upper Wainuiomata River. Dominant species present here include kahikatea, *Coprosma tenuicaulis* and *Carex secta*. The remaining two wetlands are located in the Wainuiomata Recreation Area. These are the Wainuiomata Lower Dam wetland and a small sedge/flax wetland in Sledge Track Creek.

Species

Birds

Monitoring of bird populations has been completed annually in the Wainuiomata/Orongorongo KNE site since 1999. Fifteen native bird species have been recorded during monitoring surveys. All of the native forest bird species found naturally in the Wellington region, with the exception of kaka (*Nestor meridionalis*), appear to be resident and breeding in the KNE site. These species include yellow-crowned kakariki (*Cyanoramphus auriceps*), popokatea/whitehead (*Mohoua albilii*), titipounamu/rifleman (*Acanthisitta chloris*), pipiwharuroa/shining cuckoo (*Chrysococcyx lucidus*), koekoea/long-tailed cuckoo (*Eudynamys taitensis*) and karearea/New Zealand falcon (*Falco novaeseelandiae*). The highest bird densities found on Greater Wellington owned or managed land have been recorded in this KNE

site. The most common birds seen or heard are tui (*Prosthemadera novaeseelandiae*), miromiro/tomtit (*Petroica macrocephala*), riroriro/grey warbler (*Gerygone igata*), titipounamu/rifleman and tauhou/silvereye (*Zosterops lateralis*).

Average bird densities have increased notably in the Wainuiomata Mainland Island (the mainland island) portion of the site since intensive pest control began there in 2005. The greatest increases have been seen in populations of kākāriki, tui and rifleman.

North Island brown kiwi have been resident in the KNE site since 2009. The species self-introduced in to the KNE site from the adjacent Turere Stream catchment, part of Remutaka Forest Park. The species was re-introduced to the Turere catchment by the Remutaka Conservation Trust. Since the first birds set up territories in the KNE site the population has doubled. This has been due to further natural migration and successful breeding. It is known that at least two pairs of kiwi have bred successfully within the KNE site.

A translocation of 120 North Island (NI) robins / toutouwai (*Petroica longipes*) into the mainland island from Kāpiti Island was undertaken during 2012 and 2013. Initially the translocation appeared to be successful with 67% of monitored NI robin nests fledging chicks during the first breeding season following the release. However during searches prior to the following breeding season, no pairs of birds could be found, and very few NI robins have been sighted in the mainland island since.

The recorded success of nesting of the NI robins in the first year after release appeared to show that the pest control regime was robust enough to protect the birds from predation. This points to other possible factors leading to the demise of the population, the likely one being dispersal beyond the mainland island boundary. It is thought that with no barriers surrounding the mainland island such as open countryside or coastline, most of the NI robins probably dispersed out of the mainland island into the surrounding contiguous native forest.

Reptiles

Three species of native lizard – northern grass skink (*Oligosoma polychroma*), ngahere gecko (*Mokopirirakau* “southern North Island”) and barking gecko (*Naultinus punctatus*) have been recorded in the KNE site. It is possible that copper skink (*O. aeneum*) is also present, as this species has been recorded nearby in similar habitat²⁵.

Fish

Surveys have been carried out at a variety of sites in both catchments by a number of organisations including Greater Wellington, NIWA, Wellington Fish & Game²⁶, Institute of Natural Resources-Ecology (Joy & Death)²⁷ and Aquanet Consulting Limited²⁸. Seven species of native fish and koura (*Paranephrops planifrons*) have been recorded in the KNE site. Most species of native fish present, apart from dwarf galaxias (*Galaxias* aff. *divergens* “northern”), appear to be in low numbers.

Dwarf galaxias are present in high numbers relative to the rest of the catchments beyond the KNE site boundary. The KNE site and particularly the Wainuiomata River above the Lower Dam spillway could be considered a strong hold for dwarf galaxias in this part of the region. The high abundance of dwarf galaxias here may be due to low

numbers of brown trout (*Salmo trutta*) being present, a known predator of dwarf galaxias. The low numbers of brown trout present is likely to be due to structures in the rivers impeding their passage.

Other native fish species that have been recorded in the KNE site are longfin eel (*Anguilla dieffenbachii*), shortfin eel (*Anguilla australis*), koaro (*Galaxias brevipinnis*), lamprey (*Geotria australis*), redfin bully (*Gobiomorphus huttoni*) and torrentfish (*Cheimarrichthys fosteri*). The Orongorongo catchment is potentially an important area for fish conservation as apart from the water intake weir, which restricts the passage of many fish species, the catchment is otherwise almost entirely unmodified.

Invertebrates

A survey of native land snails undertaken in the KNE site in 2007-09 showed the KNE site contains a very high diversity of native land snail species. 88 species were recorded; more than at any other site surveyed in the Wellington region. Included in the species recorded were seven species that are locally endemic or noteworthy²⁹. The survey was undertaken by entomologists Karen Mahlfeld and David Roscoe.

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 most significant threats to the ecological values of Wainuiomata/Orongorongo KNE site come from a small suite of ecological weeds, browsing and predatory pest animals, barriers to fish passage and the potential impacts of some operational and recreational activities.

A relatively small number of ecological weed species are present in the KNE site and infestations are mostly small and not widespread throughout the site. This is due in large part to the KNE site's early preservation for water supply, but also due to ecological weed control that has been undertaken since at least 2005. Exceptions to this are the widespread infestations of buddleia (*Buddleia davidii*) in the Orongorongo catchment and tradescantia (*Tradescantia fluminensis*) and montbretia (*Crocasmia x crocosmiflora*) in the Wainuiomata Recreation Area. A large emphasis on controlling buddleia in the Wainuiomata River catchment has resulted in the species being mostly eliminated from that catchment. Without this emphasis it is likely that the species would have colonised all of the river terraces, stream beds and slips in the catchment. Despite there being few ecological weeds present in the KNE site, there is still potential for those present to spread and incursions of new weeds to occur which could lead to the highly valued native dominance of the KNE site being progressively compromised.

A number of pest animal species are known to exist within the KNE site. The species considered to pose the greatest threat to the ecological values of the KNE site are rats

(*Rattus* spp.), stoats (*Mustela erminea*), possums (*Trichosurus vulpecula*), feral goats (*Capra hircus*), feral red deer (*Cervus elaphus scoticus*) and feral pigs (*Sus scrofa*).

Of all pest animals present, rats are likely to be having the greatest impact on ecological values. Monitoring has shown that outside of the mainland island rats are present in very high numbers (usually over 75% tracking tunnel index (TTI)). Inside the mainland island where control is ongoing numbers are much lower (usually under 10% TTI). Rat numbers are reduced to extremely low densities immediately after aerial possum control operations are undertaken, but densities increase to pre-control levels within 12 months of operations³⁰. Stoats also appear to be present in high numbers beyond the mainland island and will also be impacting biodiversity values, particularly birdlife.

Possums are generally present in very low numbers due to regular aerial and ground control operations being carried out. If control was not continued it is likely that possums would increase in numbers over time to levels that would significantly impact on forest health and regeneration.

Feral goats, deer and pigs are kept to low numbers through control programmes that have been ongoing since 2005. However there is continuous reinvasion of these species from adjacent Crown and private land meaning that populations would increase very rapidly if control was not maintained.

Two large structures; the spillway of the Wainuiomata Lower Dam in the Wainuiomata River and the Orongorongo water intake weir in the Orongorongo River (see Appendix 1, Map 6) appear to prevent the passage of most native fish species, preventing them from reaching large areas of potential habitat upstream of the structures. Five species of native fish recorded in the Wainuiomata River below the Lower Dam have not been recorded above it and three species of native fish recorded in the Orongorongo River below the Orongorongo water intake weir have not been recorded above it. It appears that the structures are too high and steep for these species of native fish to climb over them. Research has shown that the water intake dam in the Orongorongo River limits the movement of all but two species within the catchment – koaro and longfin eel³¹. However it should be noted that the structures also appear to be an incumbrance to the passage of brown trout (*Salmo trutta*), which provides native fish upstream of the structure with a level of protection from predation by trout. This is likely to be a significant contributing factor in the high abundance of dwarf galaxias above the Wainuiomata Lower Dam spillway. Three smaller weirs located in tributary streams are also likely to be barriers to fish passage into those intermediate stream catchments.

Operational activities such as the installation and maintenance of structures and vehicle and walking tracks have the potential to impact the ecological values of the KNE site if not undertaken in environmentally sensitive ways. Recreational activities such as hunting may also impact native biodiversity by introducing ecological weeds.

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 Wainuiomata/Orongorongo 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 4: Summary of all threats to ecological values present at the Wainuiomata/Orongorongo KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Ecological weeds		
EW-1	Ground covering ecological weeds smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species for control include tradescantia (<i>Tradescantia fluminensis</i>) and beggars' ticks (<i>Bidens frondosa</i>), (see full list in Appendix 3)	Entire KNE site
EW-2	Woody weed species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species for control include buddleia (<i>Buddleia davidii</i>), Darwin's barberry (<i>Berberis darwinii</i>), holly (<i>Ilex aquifolium</i>) and sycamore (<i>Acer pseudoplatanus</i>), (see full list in Appendix 3)	Entire KNE site
EW-3	Climbing weeds smother and displace native vegetation often causing canopy collapse, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species for control are Japanese honeysuckle (<i>Lonicera japonica</i>) and old man's beard (<i>Clematis vitalba</i>)	Entire KNE site
Pest animals		
PA-1	Possums (<i>Trichosurus vulpecula</i>) browse palatable canopy vegetation until it can no longer recover ^{32,33} . This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates ³⁴	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 ^{35,36}	Entire KNE site
PA-3	Mustelids (stoats ^{37,38} (<i>Mustela erminea</i>), ferrets ^{39,40} (<i>M. furo</i>) and weasels ^{41,42} (<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*	Hedgehogs (<i>Erinaceus europaeus</i>) prey on native invertebrates ⁴³ , lizards ⁴⁴ and the eggs ⁴⁵ and chicks of ground-nesting birds ⁴⁶	Entire KNE site
PA-5*	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 ^{47,48}	Entire KNE site
PA-6	Feral, stray and domestic cats (<i>Felis catus</i>) prey on native birds ⁴⁹ , lizards ⁵⁰ and invertebrates ⁵¹ , reducing native fauna breeding success and potentially causing local extinctions ⁵²	Entire KNE site
PA-7*	Rabbits (<i>Oryctolagus cuniculus</i>) and hares (<i>Lepus europaeus</i>) graze on palatable native vegetation and prevent natural regeneration in some environments ⁵³	Forest edges

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
PA-8*	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 ⁵⁴	Entire KNE site
PA-9	Red deer (<i>Cervus elaphus</i>) browse the forest understory and can significantly change vegetation composition by preferential browsing and preventing regeneration ^{55,56,57}	Entire KNE site
PA-10	Feral pigs (<i>Sus scrofa</i>) root up the soil and eat roots, invertebrates, seeds and native plants preventing forest regeneration ⁵⁸	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 ⁵⁹	Entire KNE site
PA-12*	Brown trout (<i>Salmo trutta</i>) prey on native fish and compete with them for food resources ⁶⁰	Entire KNE site
PA-13*	Eastern rosella (<i>Platycercus eximius</i>) parakeets are known to out-compete native red-crowned parakeets for nest-sites and are a vector of avian diseases ^{61,62}	Entire KNE site
Human activities		
HA-1	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 ⁶³	C
HA-2	Barriers to native fish passage are present in rivers within the KNE site preventing migrating fish from completing their life-cycle	Lower sections of both rivers
HA-3	Management activities such as structure installation, road maintenance, pest control and ecological monitoring can cause the accidental introduction of weed species through the carriage of seeds and plant fragments on machinery, equipment and clothing, and cause damage to native vegetation	Entire KNE site
HA-4	Illegal removal of native plants and animals such as orchids and lizards can cause the local elimination of species	C
Other threats		
OT-1*	A lack of legal protection can leave a site at risk of future development or destruction and resources invested in the site may be wasted. The KNE site has no protection status	Entire KNE site

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

The codes alongside each threat correspond to activities listed in the operational delivery schedule (Table 5), and are used to ensure that actions taken are targeted to specific threats. Maps of operational areas can be found in Appendix 1 (see Maps 3 and 4).

8. Vision and objectives

8.1. Vision

The vision for the Wainuiomata/Orongorongo KNE site is that the integrity of its ecosystems remains intact and continues to flourish. The KNE site continues to provide an excellent source of clean water for public supply. Its native plant communities continue to regenerate and thrive, and an increasingly large range of native birds breed successfully in the mainland island.

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 Wainuiomata/Orongorongo KNE site.

- 1. To improve the condition, native dominance, diversity and natural regeneration of the native plant communities present**
- 2. To maintain a healthy terrestrial ecosystem for achieving optimum water quality and increased resilience to threats**
- 3. To improve the habitat for native birds**
- 4. To provide safe breeding conditions for native birds in the mainland island**
- 5. To improve the habitat in the mainland island for native lizards and invertebrates**
- 6. To improve the passage of native freshwater fish**
- 7. To work in partnership with Remutaka Conservation Trust to protect and expand the range of North Island brown kiwi**
- 8. To raise community awareness of the ecological values of the KNE site**

9. Operational activities

Operational activities are targeted to work towards the objectives above (Section 8) 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.

The operational activities undertaken in Wainuiomata/Orongorongo KNE site focus predominantly on controlling ecological weeds and pest animals. A basic level of control of possums, feral ungulates and ecological weeds is undertaken across the whole site, while more intensive control of these and a range of predatory pest animal species is undertaken within the mainland island. Of secondary concern is minimising the impact that management related activities can pose on biodiversity values.

9.1. Ecological weed control

The first priority of ecological weed control at the KNE site is to protect the more fully intact native forest of the upper catchments of the Wainuiomata and Orongorongo rivers – the Wainuiomata/Orongorongo Water Collection Area (operational areas A and B, Appendix 1, Map 3), which constitute most of the KNE site. The second priority is to control ecological weeds within the more modified lower portion of the Wainuiomata River catchment – the Wainuiomata Recreation Area (operational area C Appendix 1, Map 3), to avoid the spread of weeds from this area into operational areas A and B and to protect this area from further degradation by weed infestation.

Information regarding the historic locations and sizes of ecological weed infestations contained in the pest plant control plans for Wainuiomata/Orongorongo Water Collection Area⁶⁴ and Wainuiomata Recreation Area⁶⁵ serves as baseline data and shows that good progress on controlling infestations has been made since those plans were developed in 2002.

Intensive control of key ecological weed species is undertaken throughout operational areas A and B. This work includes:

- Controlling key ecological weed species listed in Appendix 3 every year prior to them seeding
- Checking and controlling historic sites of ecological weed infestations and areas prone to weed incursions such as slips, river terraces and other disturbed areas, and investigating observations of ecological weeds reported by staff and contractors working in the KNE site
- Undertaking surveillance for incursions and colonisation of new ecological weed species (eg, Darwin's barberry, which has only started appearing in the KNE site in recent years)
- Trialling the control of buddleia in operational area B (the Orongorongo River catchment) using the biological control agent buddleia leaf weevil (*Cleopus japonicas*). Buddleia leaf weevils were released in this area in 2012. The effect that they are having on buddleia plants is monitored annually with recent observations indicating that weevils are significantly impacting the health of buddleia plants and the population has dispersed well beyond the original release area
- Controlling all plants of the aquatic weed species beggars' ticks annually, (beggars' ticks plants are found on the edges of the lower dam wetland)

Less intensive control of key ecological weed species is undertaken throughout operational area C. This work includes:

- Progressively controlling tradescantia. (It is accepted that eliminating infestations of tradescantia completely is very difficult, therefore the focus of this work is to reduce the density of infestations under forest canopy to a point that the species is having little impact on understory regeneration)

- Checking and controlling historic infestation sites of the more invasive ecological weed species present annually (eg, Japanese honeysuckle, holly)
- Searching for and controlling other ecological weed species at three yearly intervals

There are some infestations of ecological weeds within the KNE site that aren't able to be controlled within the resources of the KNE programme. These include areas of blackberry, Spanish heath, gorse and montbretia. If sufficient resources become available in the future, the control of these infestations would be beneficial.

9.2. Pest animal control

The aim of pest animal control undertaken across the Wainuiomata/Orongorongo KNE site as a whole is to reduce browsing pressure on native vegetation. This helps facilitate regeneration of the native forest and increases the abundance of food resources for native forest birds.

More intensive pest animal control is undertaken within the mainland island (operational area D, Appendix 1, Map 4) aiming to improve bird breeding success in that part of the KNE site.

KNE site-wide control

Aerial 1080 possum control

Possums are controlled on a regular basis throughout the KNE site using aerially sown 1080 (sodium fluoroacetate) and a small amount of ground-based trapping and poisoning with the aim of keeping the overall possum population density below 5% residual trap catch (RTC). Control is undertaken when possum population monitoring indicates that possum numbers have grown to around 5% RTC or above, (or the equivalent in bite mark index (BMI)). Past monitoring has shown that control operations are required about every five years to maintain possum numbers below 5% RTC.

An aerial 1080 operation was undertaken across the KNE site in September 2018 by OSPRI. OSPRI undertook this operation as part of their TBfree programme; a national strategy aimed at eradicating bovine tuberculosis from New Zealand. Possums are controlled as part of this programme as they are one of the main vectors of the disease. Although the objectives of the TBfree programme are somewhat different to the biodiversity objectives of this plan, the possum control carried out under the TBfree programme is expected to deliver positive biodiversity outcomes. This operation was wholly funded by OSPRI. OSPRI may not need to or choose to undertake subsequent operations, in which case it is likely that Wellington Water will fund operations when required for achieving water quality objectives. Previous aerial 1080 possum control operations were undertaken by Greater Wellington on behalf of Wellington Water in 1999, 2005 and 2012.

Monitoring after aerial 1080 possum control operations has shown that these operations are also effective at controlling rat and mustelid (ferret, stoat and weasel) populations to very low levels. This control is likely to be short lived, with populations returning to pre-control levels within 18 months⁶⁶. However it is hoped that native

plants and animals will receive some benefit from these periods of reduced threats. Comprehensive ground based rat or mustelid control isn't undertaken over the whole KNE site due to the extreme difficulty and expense of such control.

Feral goat, deer and pig control

Feral goats, deer and pigs are culled annually to reduce population numbers to low levels. Culling utilises a combination of ground-based and aerial hunting methods to target areas most frequented by the different species. About 48 days of ground-based hunting (38 targeting goats and deer, and ten targeting pigs) and two hours of aerial hunting (targeting all three species) are planned to be undertaken annually.

The target for culling operations is to reduce and keep goat/deer/pig populations to levels at which a professional hunter can find no more than one animal per day of hunting on foot, or five animals per hour of hunting by helicopter. It is considered that populations at these levels have a negligible impact on native plant regeneration and survival.

A deer style fence is in place along almost the full length of the western and northern boundaries of the KNE site. The fence was put in place to control the migration of farmed cattle and sheep, and feral deer, goats and pigs into the KNE site from private land to the west and north. It appears that the fence has been very effective in controlling the movement of these animals, as far fewer are now encountered during culling operations in the north-western half of the site compared to prior to the fence being in place and compared to the south-eastern half of the KNE site. However pig numbers continue to build up from time to time in the mainland island (the north-western corner of the KNE site). They appear to come from far away in search of the plentiful native fruit to be found in that area.

Repair and maintenance of the fence is required from time to time. This is due to a number of factors including damage caused by wind-thrown trees, animal caused pressure and deterioration from age. Wellington Water Limited funds surveillance of the fence, which is undertaken by the Wainuiomata/Orongorongo Ranger, and funds repairs and maintenance when these are required.

Wainuiomata Mainland Island intensive control

Possum, rodent, mustelid and feral cat control

Possums are kept to very low levels within the mainland island using a network of Warrior kill-traps. Traps within a 300m inner buffer of the mainland island are positioned in a 150m x 100m grid and traps in the interior of the mainland island are in a 300m x 300m grid.

Rodent control is undertaken in the mainland island using bait stations containing anticoagulant bait. Bait stations are positioned in a 150m x 100m grid and at 50m intervals around the mainland island boundary.

Mustelids are controlled in the mainland island using DOC200 type kill-traps. These are spaced at about 300m intervals along lines through the interior of the mainland island that are approximately 1km apart and at 200m intervals around the boundary of the mainland island.

Feral cats are controlled using Timms traps spaced at about 1km intervals.

Bait stations and possum traps around the mainland island boundary and all mustelid and cat traps are serviced about every five weeks. The remaining bait stations and possum traps within the mainland island interior are serviced about every 10 weeks (five times a year). This work is undertaken by Greater Wellington staff and contractors and the control regime has been ongoing since its inception in 2005.

Rat control following seed masting events

An aerial 1080 operation is planned to be undertaken in the mainland island and a surrounding buffer zone (operational area E; Appendix 1, Map 4) in August 2019 to control rats which are expected to sharply increase in numbers as a result of recent masting; the unusually vigorous seeding of a wide range of native tree species. It is believed that this masting event was more pronounced than any in the previous 20 years, and it is therefore considered that the only method of control likely to reduce the predicted resulting high rat population adequately is aerially sown 1080.

Alternative baiting approaches have been used in the mainland island in past attempts to control sharp increases in rat numbers that have occurred as a result of masting events. These have included the use of loose brodifacoum pellets, cholecalciferol paste and hand laid 1080 cereal pellet bait. These means have not always been adequate in reducing rat numbers as much or as quickly as desired. Consequently, and in view of the importance of predator control in the protection of nesting native birds in the mainland island, provisional approval⁶⁷ has been granted by Wellington Water for aerially sown 1080 being used to bring large increases in rat numbers under control. Aerial 1080 operations undertaken for this purpose will only be carried out across the mainland island and the buffer zone and only if the operation won't significantly impact water supply at the time.

Feral pig control

Feral pig control is undertaken in the mainland island annually to combat the large numbers of feral pigs that appear to be attracted to the mainland island by the large amount of fruit that the forest is producing as a result of low numbers of possums and rats. Culling is undertaken by experienced and proven professional hunters using hunting dogs to locate and flush pigs out of hiding. About 60 person days of pig culling will be undertaken in the mainland island annually.

Resources allocated to feral pig culling may be used for trialing alternative control methods such as trapping and poisoning.

Control targeted at protecting specific native species

Mustelid control to protect kiwi

Mustelids are controlled in parts of the KNE site south of the mainland island by members of the Rimutaka Conservation Trust to help protect NI brown kiwi that have spread from a managed population in the Turere Valley south of the KNE site. Control is undertaken using DOC200 and Good Nature A24 kill-traps positioned at 100m intervals along main ridgelines and spurs. These traps form part of a corridor of protection for kiwi between the Turere Valley and the mainland island.

Predator control to protect water fowl

Seven DOC200 traps and four Timms traps contained in wooden boxes are positioned around the lower dam wetland (operational area F; Appendix1, Map 4) to protect native wetland birds from predation by mustelids and cats. These traps are serviced by the Park Ranger and bait is funded by the Biodiversity department.

9.3. Ecological monitoring

A number of ecological monitoring projects are undertaken in the KNE site to either:

1. measure the effectiveness of the KNE programme's biodiversity management activities at the site, or
2. assess the ecological health of the site as a water collection area.

The first project listed below (small mammal monitoring) is funded by Greater Wellington Biodiversity department, while the remainder are either funded by Greater Wellington Environmental Science department or Wellington Water Limited. All projects are undertaken by the Greater Wellington Environmental Science department.

Ecological monitoring projects undertaken in the Wainuiomata/Orongorongo KNE site are:

- Small mammal monitoring - undertaken to assess whether control targets for rats and mustelids are being achieved in the mainland island, and to provide information about hedgehog and mouse populations
- Possum monitoring – undertaken to assess whether the control target for possums is being achieved
- Bird monitoring (using five minute bird count method) – undertaken to measure whether bird population numbers within the mainland island are improving, stable or declining
- Fruit fall monitoring - undertaken to measure the amounts of hinau and tawa consumed by rats and possums to indicate the impact that these pests may be having on fruit availability for re-seeding of the forest and for birds
- Ungulate browse monitoring - undertaken to indicate whether levels of goats and deer are low enough to allow forest understory regeneration
- Vegetation plot monitoring – undertaken to assess the growth of the forest and change in forest structure over time and to determine if forest understory regeneration is improving, stable or declining
- Rata tree health monitoring – undertaken to assess the health of rata trees as an indicator of possum damage to the forest canopy

Other one off surveys may be undertaken by the Environmental Science department, such as for North Island brown kiwi, bats or snails. Research into pest animal dynamics and behaviour which could assist in management decisions may also be undertaken.

North Island (NI) robin monitoring

Staff and contractors undertaking biodiversity management and other activities within the KNE site, and other adjacent KNE sites, will continue to keep a look out for NI

robins in order to gain knowledge of any surviving population within the KNE site. Two translocations of the species into the mainland island were undertaken in 2012 and 2013.

If a NI robin is sighted, an expert in NI robin identification will be engaged to survey the immediate area of the sighting in an attempt to re-locate the bird and ascertain whether it is banded or not, whether it is a juvenile or adult, and whether it is alone or mated. This information will help indicate whether any translocated NI robins or their off-spring are surviving in the mainland island or wider KNE site.

9.4. Revegetation

The aim of revegetation work in Wainuiomata/Orongorongo KNE site is to revegetate areas from which weeds have been removed and encourage community engagement in the Wainuiomata Recreation Area.

Several areas on river flats adjacent to the Wainuiomata River within the Wainuiomata Recreation Area (operational area C; Appendix 1, Map 3) and above the Morton Dam (immediately north of operational area C) have been cleared of dense blackberry infestations recently. Some of these areas were planted with colonising native plant species in the winter of 2018 and planting of other areas may be undertaken in the future. This work is funded and undertaken by the Parks department.

Planting may also be undertaken from time to time in the Wainuiomata Recreation Area to make areas more attractive and pleasant for visitors. Numbers of plants to be planted each year will be determined by the Parks department as planning evolves.

Only native plants of appropriate species for the site and eco-sourced from the Tararua Ecological Region will be used for revegetation or amenity planting. Exceptions to this are likely to be allowed in the case of local iwi planting rongoā (traditional Māori medicine) species or pā harakeke (plantings of a variety of harakeke/flax species chosen for their fibre or weaving properties). The Greater Wellington Parks department is currently working with local iwi in exploring the development of a project for these purposes.

9.5. Remediation of fish passage

Biodiversity and Parks staff will explore practical options for improving the passage of native fish over or around the two structures currently presenting major barriers to fish passage in the KNE site (the spillway of the Wainuiomata Lower dam and the Orongorongo water intake weir), (see Appendix 1, Map 6). Actions will initially consist of just scoping and enquiry, but funding may be sought from other programmes or budgets to implement solutions if affordable solutions can be found.

The report produced for Greater Wellington in 2002 on the potential for enhancement of fish communities of a fish pass on the Orongorongo water intake weir⁶⁸ will provide a good starting reference point for the first step of this process. This report showed that providing passage around the Orongorongo water intake weir for redfin bully and shortjaw kokopu which are present below but not above the weir would double the number of native fish that would have access to a full range of habitat within that catchment. Shortjaw kokopu are classified as threatened species and therefore

increasing the potential habitat for this species would be an important positive conservation outcome.

While solutions to improving the passage of native fish will be sought, it will be important to consider the impedance that the structures currently pose to the passage of trout and the benefit that this provides to the important population of dwarf galaxias present. No solution that would be at all likely to result in a dis-benefit to the dwarf galaxias population will be implemented.

9.6. Community engagement

The purpose of Greater Wellington's community engagement is to increase the interest in and, value placed on native biodiversity by the public.

Greater Wellington engages with members of the public and informs them of the ecological values and the management undertaken through the KNE programme. This is undertaken in the following ways:

- Public guided walks lead by the Park Ranger
- Community planting events
- Occasional press articles

9.7. Park management

Greater Wellington undertakes biodiversity operational activities at the KNE site. This includes using best practice methods when undertaking ecological weed and pest animal control, and undertaking the following activities that help to control the natural resources of the site.

Environmental care

Greater Wellington and Wellington Water operational staff follow procedures to identify and avoid damage to biodiversity values such as plant and animal communities. Procedures may include undertaking assessments of environmental effects of planned works. This limits the risks to these values that could occur while carrying out the construction and maintenance of assets, and when permitting the use of the KNE site by other users.

Biosecurity guidelines⁶⁹ are used by all Greater Wellington and Wellington Water personnel when entering and working in the KNE site. These guidelines involve checking for and removing seeds and plant fragments from vehicles, equipment and clothing before entering the site. All vehicles entering the water collection area are required to use the wheel washing facility provided for the purpose of washing dirt and debris off vehicles entering the water collection area. This reduces the risk of seeds and fragments of ecological weeds being transported into the site on vehicles.

Instructional information on how to avoid introducing ecological weeds and damage to ecological values are included in the conditions contained in permits issued to visiting researchers, private hunters and members of the public attending guided walks within the KNE site.

Research and the collection of natural materials

Research activities and the collection of native plants and animals in the KNE site is managed by a permit system run by the Environmental Science department. However, illegal collection of native plants and animals has occurred occasionally in regional parks and forests. This has included the collection of native orchids which are sought after by collectors and the removal of native trees for use as firewood. The Park Ranger keeps a look out for such activities while carrying out normal duties within the Park.

Dog control

Greater Wellington's dog control policies for the Wainuiomata Recreation Area help to protect North Island brown kiwi that are present in the KNE site and reduce the disturbance of water fowl at the lower dam wetland. Dogs are required to be kept on lead in all the Wainuiomata Recreation Area and are not permitted near the Lower Dam wetland. The adjacent Hutt City Council managed Richard Prouse Park being designated an off lead area can make enforcement a challenge.

Dogs are also not permitted beyond the Wainuiomata Recreation Area into the water collection area where public access is controlled. Exceptions to this policy are granted to Remutaka Conservation Trust using approved kiwi-finding dogs and to Greater Wellington's contracted hunters using kiwi-aversion trained hunting dogs.

10. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Wainuiomata/Orongorongo KNE site, and their timing and cost over the three-year period from 1 July 2018 to 30 June 2021. The budget for the 2019/20 and 2020/21 years are indicative only and subject to change. Maps of operational areas can be found in Appendix 1 (see Maps 3 and 4).

Table 5: Three-year operational plan for the Wainuiomata/Orongorongo KNE site

Objective	Activity	Operational area	The actions: description/detail/comments	Intended outcome	Implementing party	Timetable and resourcing		
						2018/19	2019/20	2020/21
1, 2	Ecological weed control	A	Control buddleia : <ul style="list-style-type: none"> • Checking areas of previous control • Searching areas prone to new infestation – slips, stream beds, river terraces • Controlling all plants prior to them flowering 	All plants are controlled annually	Greater Wellington Biosecurity department	\$5,000 ⁱ	\$5,000 ⁱ	\$3,160 ⁱ
1, 2	Ecological weed control	A, B	Control all other key ecological weeds (not buddleia in operational area B)	All plants are controlled annually	Greater Wellington Biosecurity department	\$3,000 ⁱ	\$3,000 ⁱ	\$5,000 ⁱ
1, 2	Ecological weed control	B	Monitor the effects of buddleia leaf weevil on buddleia plants	The leaf weevil is reducing the distribution and density of buddleia	Greater Wellington Biosecurity department	Nil (staff time only)	Nil (staff time only)	Nil (staff time only)

Objective	Activity	Operational area	The actions: description/detail/comments	Intended outcome	Implementing party	Timetable and resourcing		
						2018/19	2019/20	2020/21
1	Ecological weed control	C	Control tradescantia	Tradescantia is having negligible impact on understory regeneration	Greater Wellington Biosecurity department	\$8,000	\$7,000	\$6,000
1	Ecological weed control	C	Control other key ecological weeds including beggars' ticks	Ecological weed species are reduced to being only a very minor component of the plant community	Greater Wellington Biosecurity department	\$2,000	\$2,000	\$3,000
1, 2, 3	Pest animal control	Whole KNE site	Control possums using aerial 1080, bait stations and traps		OSPRI	Funded by OSPRI	—	—
1, 2, 3	Pest animal control	Whole KNE site	Control goats and deer, focusing on preferred habitats, using ground-based and aerial methods (~ 38 days ground hunting and two hours helicopter hunting annually)	Goat and deer control operations result in an average of less than 1 animal culled per hunter-day or 5 animals per helicopter-hunting hour	Greater Wellington Biosecurity department	\$20,200 ⁱ	\$21,080 ⁱ	\$21,592 ⁱ
1, 2, 3	Pest animal control	Whole KNE site apart from D	Control pigs using ground-based hunting focusing on preferred habitats; (~10 days ground hunting annually)	Pig control operations result in an average of less than 1 animal culled per hunter-day	Greater Wellington Biosecurity department	\$4,500 ⁱ	\$4,500 ⁱ	\$4,500 ⁱ

Objective	Activity	Operational area	The actions: description/detail/comments	Intended outcome	Implementing party	Timetable and resourcing		
						2018/19	2019/20	2020/21
1, 2, 3	Pest animal control – fence maintenance	Whole KNE site	Control neighbouring stock and feral deer, goats and pigs by maintaining the fence along Moores Ridge Park Ranger to check fence for damage regularly (about four times per year), plus after heavy weather events. Wellington Water Ltd to arrange repairs	The fence remains secure to stock and feral deer, goats and pigs	Greater Wellington Parks department and Wellington Water Limited	\$1,400 ⁱⁱ	\$1,400 ⁱⁱ	\$1,400 ⁱⁱ
1, 2, 3, 4, 5	Pest animal control	D (mainland island)	Control possums, rats, mustelids and cats by: <ul style="list-style-type: none"> • Checking and re-baiting all mustelid and cat traps, and all bait stations and possum traps on the boundary, every 5 weeks • Checking and re-baiting all other bait stations and possum traps every 10 weeks 	Populations are maintained to: Possums <2% RTC* Rats <5% TTI** Mustelids <2% TTI**	Greater Wellington Biosecurity department	\$99,750	\$99,750	\$99,750
1, 2, 3, 5	Pest animal control	D (mainland island)	Control pigs using ground-based hunting; (~57 days ground hunting annually)	Pig control operations result in an average of less than 1 animal culled per hunter-day	Greater Wellington Biosecurity department	\$25,000	\$25,000	\$25,000

Objective	Activity	Operational area	The actions: description/detail/comments	Intended outcome	Implementing party	Timetable and resourcing		
						2018/19	2019/20	2020/21
1, 2, 3, 4, 5	Pest animal control	D, E (mainland island & adjacent buffer zone)	Control rats during seed masting event using aerial 1080	Rat population is maintained to below 5% TTI**	Greater Wellington Biosecurity department	\$45,000 ⁱⁱⁱ	\$37,000 ⁱⁱⁱ	—
3, 4, 7	Pest animal control	See RFPT traps on map 5 – Appendix 1	Control mustelids in a corridor between the Turere Valley and the mainland island by trapping	Reduced mustelid population	Rimutaka Forest Park Trust (NI brown kiwi project)	Funded by Rimutaka Forest Park Trust	Funded by Rimutaka Forest Park Trust	Funded by Rimutaka Forest Park Trust
3	Pest animal control	F	Control mustelids and feral cats around the lower dam wetland by trapping	Reduced mustelid and feral cat population	Greater Wellington Parks department	\$150 (bait only)	\$150 (bait only)	\$150 (bait only)
1, 2, 3	Monitoring	Whole KNE site	Undertake monitoring of the possum population to assess the effectiveness of OSPRI's possum control operation	Possum monitoring undertaken and reported	Greater Wellington Environmental Science department	\$20,000 ⁱ	—	—
4, 5	Monitoring	D, E (mainland island & non-treatment area)	Undertake monitoring of small mammal populations	Small mammal monitoring undertaken and reported every 3 months	Greater Wellington Environmental Science department	\$20,700	\$20,700	\$20,700

Objective	Activity	Operational area	The actions: description/detail/comments	Intended outcome	Implementing party	Timetable and resourcing		
						2018/19	2019/20	2020/21
4	Monitoring	Entire KNE site	Ensure all staff and contractors keep a look out for North Island robins Survey the location of any observed North Island robins to obtain information about individual birds and the population	Vigilance for North Island robins is maintained All observations are investigated	Greater Wellington Biodiversity and Environmental Science departments	—	\$1,000 ^{iv}	\$1,000 ^{iv}
1, 2, 3	Monitoring	Various locations across the KNE site	Undertake other environmental monitoring; birds, fruit-fall, ungulate browse, vegetation health and rata tree health	Monitoring undertaken and reported	Greater Wellington Environmental Science department	Funded by Environmental Science department and Wellington Water Ltd	Funded by Environmental Science department and Wellington Water Ltd	Funded by Environmental Science department and Wellington Water Ltd
1, 3, 8	Revegetation	C	Plant areas where weeds have been removed and un-utilised open areas with appropriate native plant species	Increased or enhanced native habitat	Greater Wellington Parks department	Funded by Parks department – costs not known at this time	Funded by Parks department – costs not known at this time	Funded by Parks department – costs not known at this time
3, 7, 8	Park Management	C	Continue to communicate and enforce the dog control policy through the park brochure, signage and surveillance	No harm or disturbance of native birds by dogs occurs	Greater Wellington Parks department	Nil (staff time only)	Nil (staff time only)	Nil (staff time only)

Objective	Activity	Operational area	The actions: description/detail/comments	Intended outcome	Implementing party	Timetable and resourcing		
						2018/19	2019/20	2020/21
1, 2, 3	Park Management	Entire KNE site	Adhere to Greater Wellington best practice guidelines and policies aimed at protecting the natural environment while undertaking operational activities and managing recreational and commercial activities in the KNE site	Minimal impacts are imposed on biodiversity values by operational, recreational and commercial activities	Greater Wellington Parks, Biodiversity, Biosecurity & Environmental Science departments, and Wellington Water Limited	Nil (staff time and attention only)	Nil (staff time and attention only)	Nil (staff time and attention only)
1	Park Management	Entire KNE site	The Park Ranger keeps a look out for the illegal collection of native plants and animals	No illegal collection occurs	Greater Wellington Parks department	Nil (staff time only)	Nil (staff time only)	Nil (staff time only)
6	Fish passage	Major spillways and weirs	Explore practical solutions to improving fish passage	Solutions are explored and conclusions are settled on	Greater Wellington Biodiversity and Parks departments	Nil (staff time only)	Nil (staff time only)	Nil (staff time only)
Totals						\$254,700	\$226,700	\$189,700

ⁱ Funded by Wellington Water Limited.

ⁱⁱ Funding for monitoring the fence condition only, not for repairs which cannot be predicted at this time. Funded by Wellington Water Limited.

ⁱⁱⁱ Funding held in reserve by the Biodiversity department and therefore doesn't appear in annual KNE programme budget.

^{iv} If this funding is not required for this activity in any given financial year it will be re-allocated to ecological weed control towards the end of that year.

*RTC = Residual Trap Catch. The control regime has been designed to control possums to this level but monitoring will not be undertaken to measure output of control in the mainland island. Experience in the use of this control method indicates this target will be met.

**TTI = Tracking Tunnel Index.

11. Funding contributions

11.1. Budget allocated by Greater Wellington

The budget for the 2020/21 year is indicative only and subject to change.

Table 6: Greater Wellington allocated budget for the Wainuiomata/Orongorongo KNE site

Management activity	Timetable and resourcing		
	2018/19	2019/20	2020/21
Ecological weed control	\$10,000	\$9,000	\$9,000
Pest animal control	\$169,900 [‡]	\$161,900 [‡]	\$124,900
Monitoring	\$20,700	\$21,700	\$21,700
Total	\$200,600	\$192,600	\$155,600

[‡] Includes funding of seed masting event response from funding held in reserve by the Biodiversity department which therefore doesn't appear in annual KNE programme budgets (see Table 5 for amount details). Additional funding may be required for pest animal control in subsequent years in the event of further seed masting events.

11.2. Budget allocated by Wellington Water Limited

The budget is subject to confirmation through Wellington Water Limited's ten-year planning process.

Table 7: Wellington Water Limited allocated budget for the Wainuiomata/Orongorongo KNE site

Management activity	Timetable and resourcing		
	2018/19	2019/20	2020/21
Ecological weed control	\$8,000	\$8,000	\$8,160
Pest animal control	\$24,700	\$25,580	\$26,092
Fence maintenance	\$1,400 [‡]	\$1,400 [‡]	\$1,400 [‡]
Monitoring	\$20,000	—	—
Total	\$54,100	\$34,980	\$35,652

[‡] Funding for monitoring the fence condition only, not for repairs which cannot be predicted at this time.

12. Future opportunities

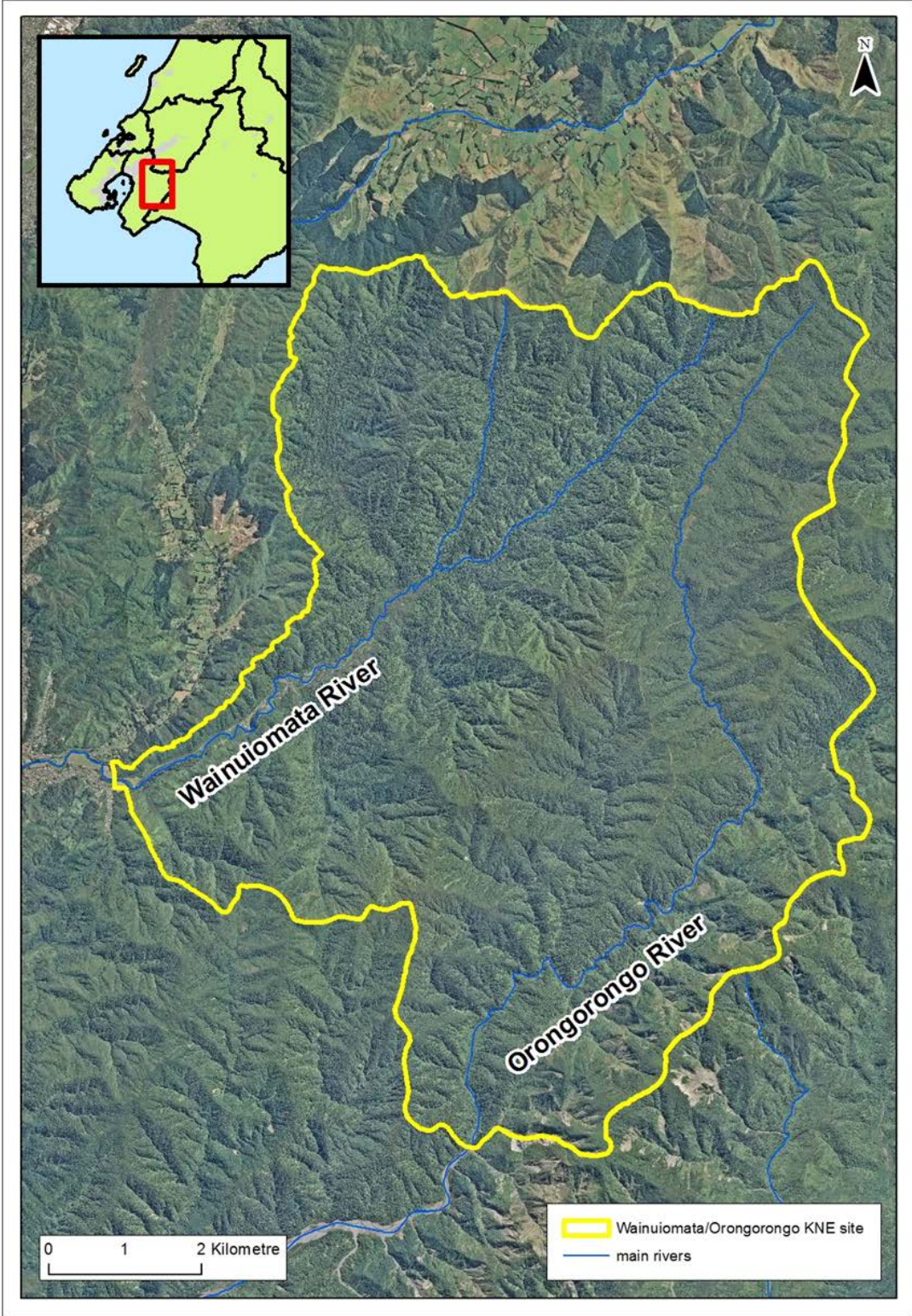
12.1. Translocations of native species

It is possible that Greater Wellington may be approached by ecological restoration projects to either source native animal species from the KNE site for translocation to other sites, or to translocate species to the KNE site (particularly the mainland island). The Wainuiomata/Orongorongo KNE site may be favoured as a source or receiving site due to its particularly rich native biodiversity, the level of biodiversity management undertaken at the KNE site (particularly in the mainland island), and the knowledge of the native bird populations present that Greater Wellington holds as a result of many years of monitoring.

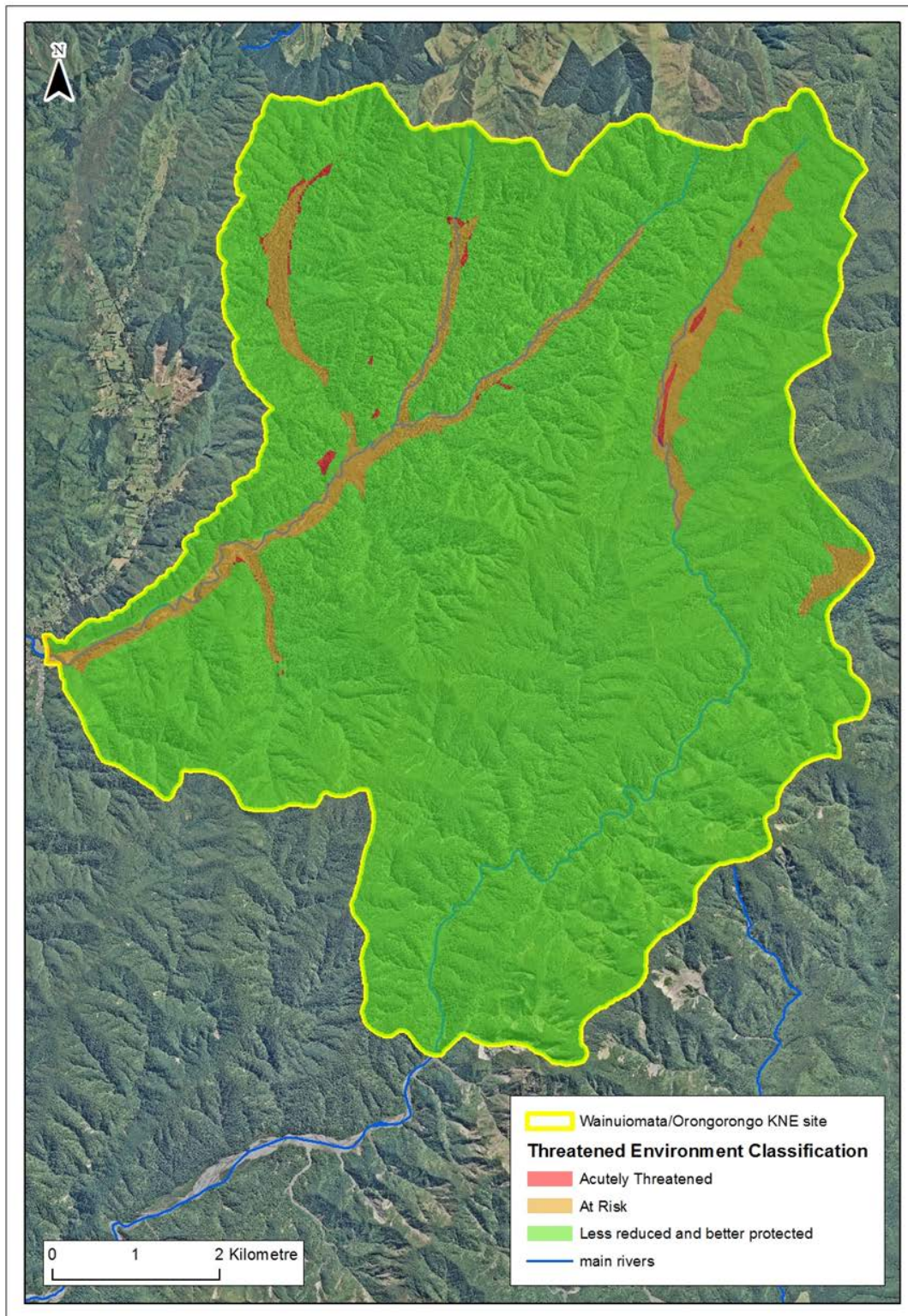
Any application to translocate native species from or to the KNE site will be managed according to the internal Greater Wellington process developed for the purpose. This process will include an assessment of the appropriateness of the translocation in regards to the benefits/impacts on the biodiversity of the KNE site, and the benefit to the receiving/source site involved, the broader landscape and species conservation. Greater Wellington will support and may apply some staff resource to approved translocations but is unlikely to lead or fund a translocation.

Zealandia Ecosanctuary undertook a translocation of North Island rifleman from the mainland island to Zealandia in March-April 2019. This translocation was approved through the above process and permitted by the Department of Conservation.

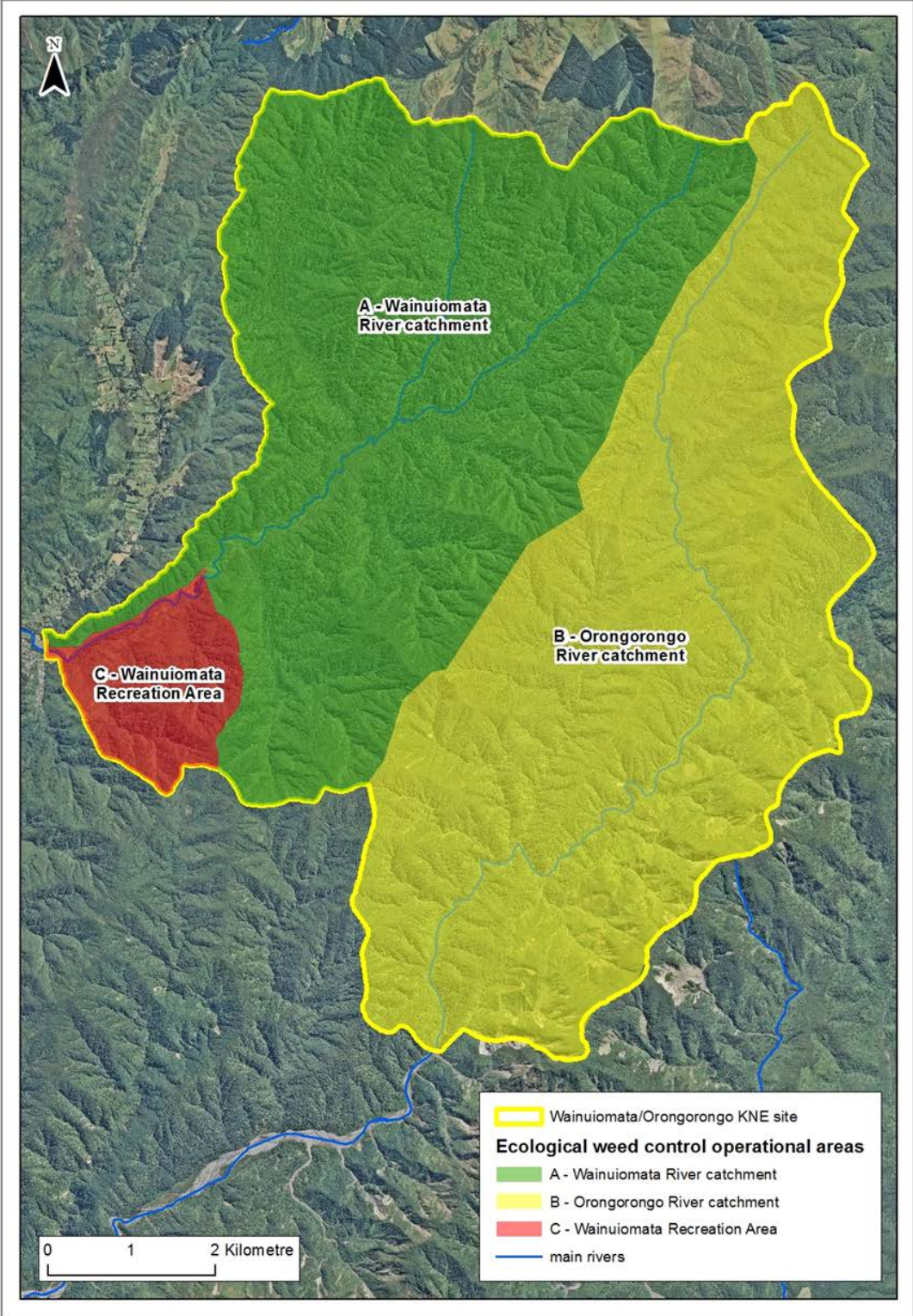
Appendix 1: Site maps



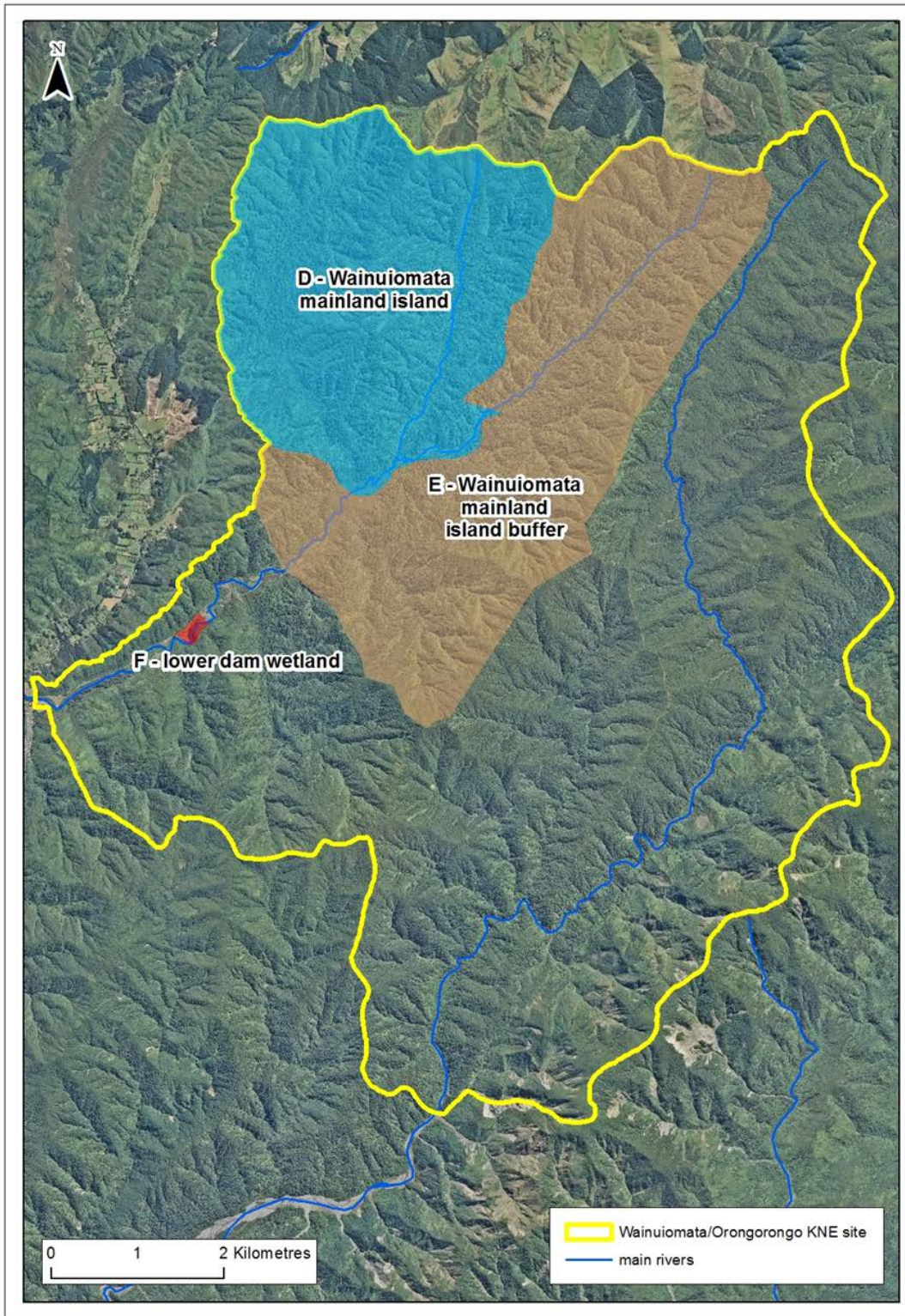
Map 1: The Wainuiomata/Orongorongo KNE site boundary



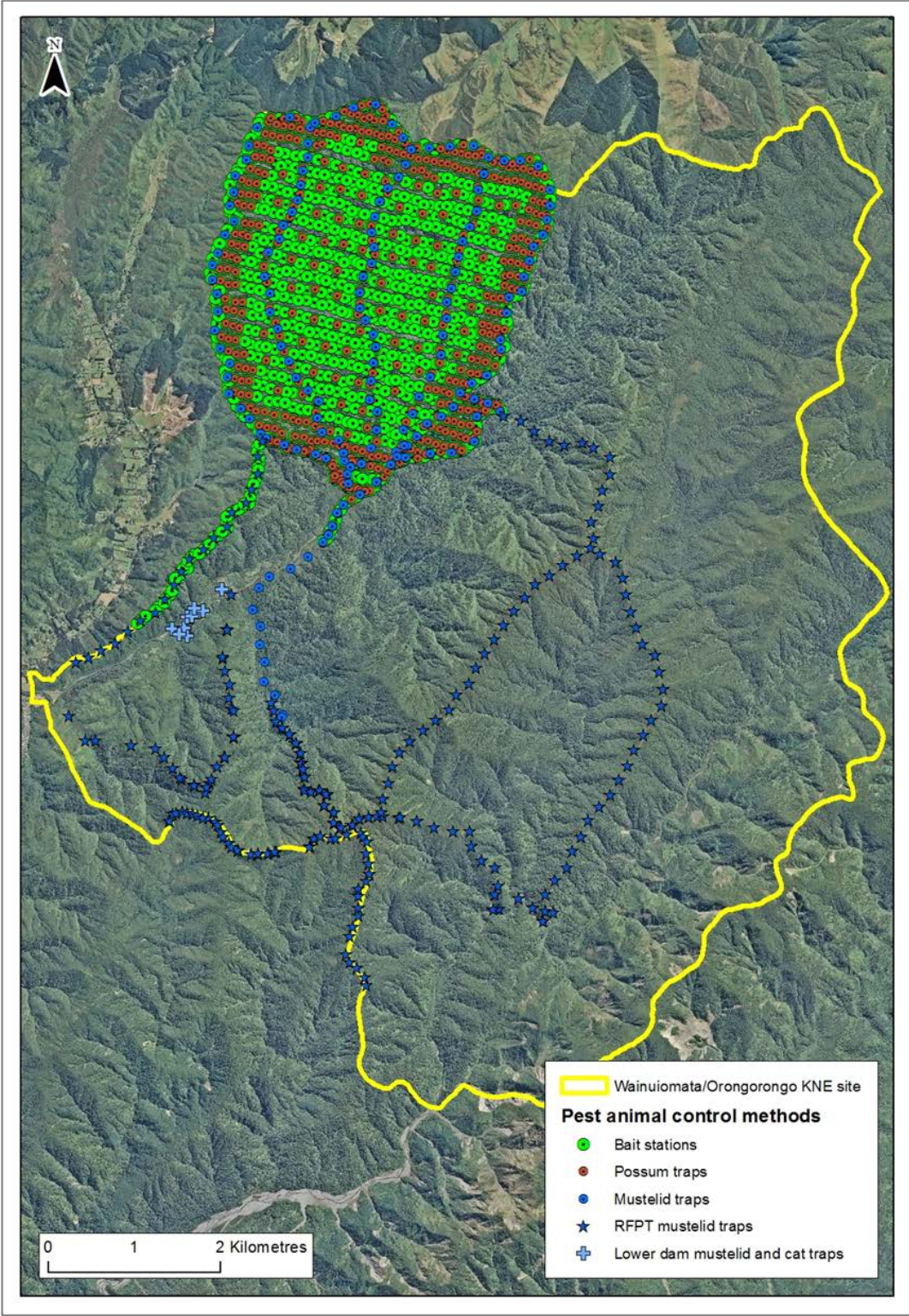
Map 2: Land Environment New Zealand threat classifications for the Wainuiomata/Orongorongo KNE site



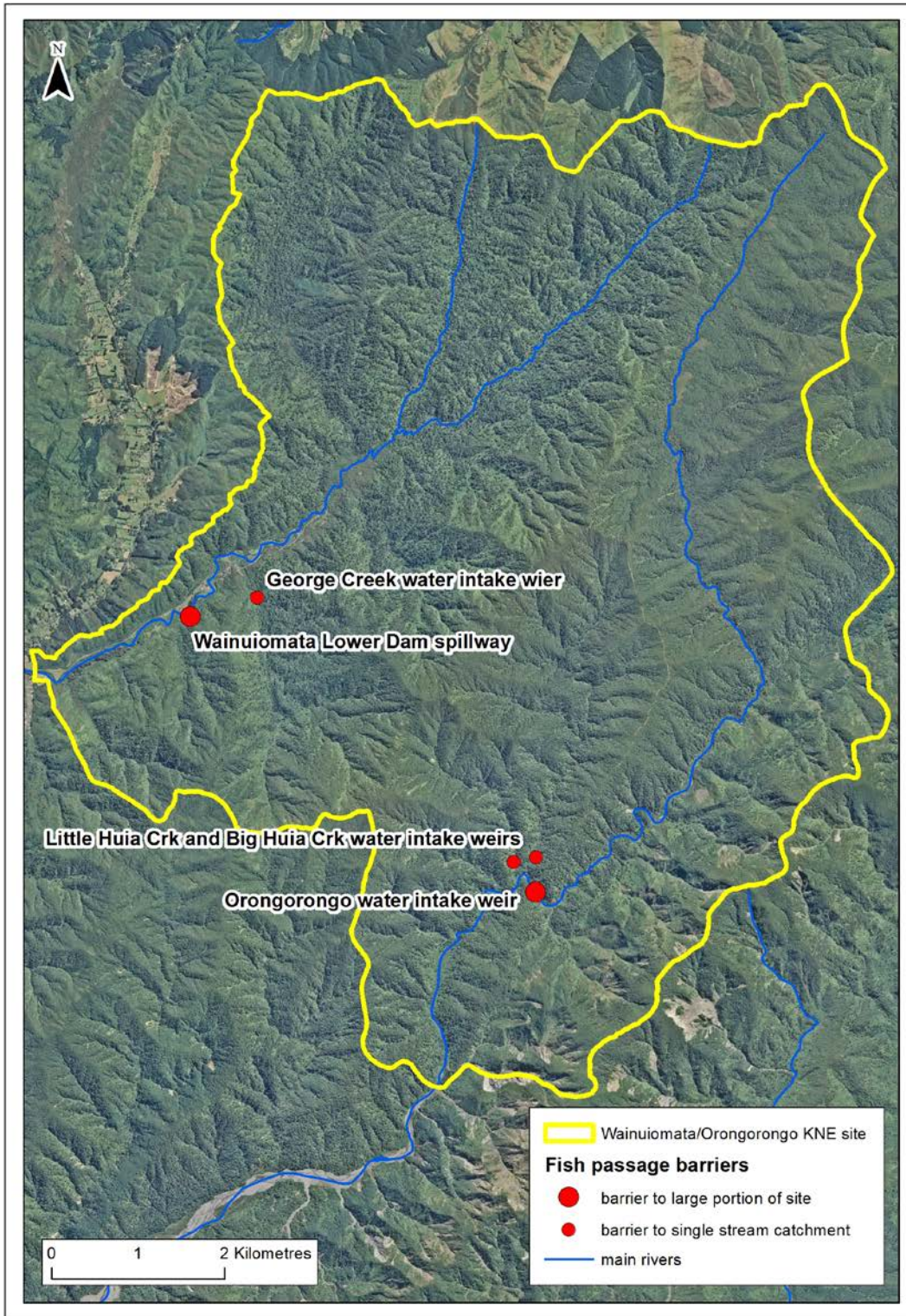
Map 3: Operational areas for ecological weed control in the Wainuiomata/Orongorongo KNE site



Map 4: Operational areas for pest animal control in the Wainuiomata/Orongorongo KNE site



Map 5: Pest animal control methods in the Wainuiomata/Orongorongo KNE site



Map 6: Barriers to fish passage in the Wainuiomata/Orongorongo KNE 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 cycle⁷⁰. 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. The following table lists Threatened and At Risk species that are resident in, or regular visitors to, the Wainuiomata/Orongorongo KNE site.

Table 8: Threatened and At Risk species at the Wainuiomata/Orongorongo KNE site

Scientific name	Common name	Threat status	Observation
Plants(vascular) ⁷¹			
<i>Brachyglottis kirkii</i> var. <i>kirkii</i>	Kirk's daisy	At Risk - Declining	Greater Wellington 2008 ⁷²
Birds ⁷³			
<i>Acanthisitta chloris</i>	North Island rifleman	At Risk - Declining	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Anthus novaeseelandiae</i>	New Zealand pipit	At Risk - Declining	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Apteryx mantelli</i>	North Island brown kiwi	Threatened - Nationally Vulnerable	Rimutaka Forest Park Trust, unpublished data.
<i>Cyanoramphus novaeseelandiae</i>	Red-crowned parakeet	At Risk - Relict	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Eudynamis taitensis</i>	Long-tailed cuckoo	At Risk - Naturally uncommon	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Falco novaeseelandiae ferox</i>	Bush falcon	At Risk - Recovering	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Mohoua albicilla</i>	Whitehead	At Risk - Reclining	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Phalacrocorax carbo</i>	Black shag	At Risk - Naturally Uncommon	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
Reptiles ⁷⁴			
<i>Mokopirakau</i> "southern North Island"	Ngahere gecko	At Risk - Declining	DoC Reptile distribution database (accessed 2018)

Scientific name	Common name	Threat status	Observation
<i>Naultinus punctatus</i>	Barking gecko	At Risk - Declining	DoC Reptile distribution database (accessed 2018)
Freshwater fish ⁷⁵			
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	Aquanet Consulting Limited ⁷⁶
<i>Cheimarrichthys fosteri</i>	Torrent fish	At Risk - Declining	Aquanet Consulting Limited
<i>Galaxias brevipinnis</i>	Kōaro	At Risk - Declining	Aquanet Consulting Limited
<i>Galaxias divergens</i>	Dwarf galaxias (West Coast)	At Risk - Declining	Aquanet Consulting Limited
<i>Gobiomorphus huttoni</i>	Redfin bully	At Risk - Declining	Aquanet Consulting Limited
<i>Geotria australis</i>	Lamprey	Threatened – Nationally Vulnerable	NIWA Freshwater fish database (accessed 2017)
Freshwater invertebrates ⁷⁷			
<i>Paranephrops planifrons</i>	Northern kōura	At Risk - Declining	Greater Wellington 2008

Appendix 3: Regionally threatened plant species list

The following table lists regionally threatened species that have been recorded in the Wainuiomata/Orongorongo KNE site. Native plant species have been identified in the Plant Conservation Strategy, Wellington Conservancy 2004-2010⁷⁸.

Table 9: Regionally threatened plant species recorded in the Wainuiomata/Orongorongo KNE site

Scientific name	Common name	Threat status	Observation
Plants			
<i>Brachyglottis kirkii</i> var. <i>kirkii</i>	Kirk's daisy	Regionally Critical	GWRC 2008 ⁷⁹
<i>Craspedia minor</i>	Woolly head	Regionally Data Deficient	GWRC 2008
<i>Cyathea cunninghamii</i>	Gully tree fern	Regionally Sparse	GWRC 2008
<i>Epilobium insulare</i>	Willow herb	Regionally Sparse	GWRC 2008
<i>Epilobium pallidiflorum</i>	Swamp willow herb	Regionally Sparse	GWRC 2008
<i>Nertera scapanioides</i>		Regionally Data Deficient	GWRC 2008
<i>Pittosporum cornifolium</i>	Tawhirikaro	Regionally Sparse	GWRC 2008
<i>Plumatochilus tasmanica</i>	Greenhood orchid	Regionally Critical	GWRC 2008
<i>Raukawa edgerleyi</i>	Raukawa	Regionally Sparse	GWRC 2008

Appendix 4: Ecological weed species

The following table lists key ecological weed species that have been recorded in the Wainuiomata/Orongorongo KNE site.

Table 10: Key ecological weed species recorded in the Wainuiomata/Orongorongo KNE site

Scientific name	Common name	Weed type	Notes
<i>Acer pseudoplatanus</i>	Sycamore	Woody	
<i>Berberis darwinii</i>	Darwin's barberry	Woody	
<i>Berberis glaucarpa</i>	Barberry	Woody	
<i>Bidens frondosa</i>	Beggars' ticks	Ground cover	
<i>Buddleia davidii</i>	Buddleia	Woody	
<i>Cardiocrinum giganteum</i>	Giant Himalayan lily	Ground cover	
<i>Clematis vitalba</i>	Old man's beard	Climber	
<i>Cortaderia selloana</i>	Pampas	Ground cover	
<i>Crocasmia x crocosmiflora</i>	Montbretia	Ground cover	
<i>Ilex aquifolium</i>	Holly	Woody	
<i>Lonicera japonica</i>	Japanese honeysuckle	Climber	
<i>Pinus radiata</i>	Wilding pine	Woody	
<i>Tradescantia fluminensis</i>	Tradescantia	Ground cover	
<i>Ulex europaeus</i>	Gorse	Woody	Only isolated plants are controlled

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Greater Wellington Regional Council:

Wellington office
PO Box 11646
Manners Street
Wellington 6142

T 04 384 5708
F 04 385 6960

Upper Hutt office
PO Box 40847
Upper Hutt 5018

T 04 526 4133
F 04 526 4171

Masterton office
PO Box 41
Masterton 5840

T 06 378 2484
F 06 378 2146

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Regional Council



info@gw.govt.nz
www.gw.govt.nz

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