

Key Native Ecosystem Plan for Raroa-Pukerua Coast

2015-2018



greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao



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1. Key Native Ecosystem plans

New Zealand's indigenous biodiversity continues to decline nationally, and in the Wellington region. Major reasons for the decline are that native species are preyed on or outcompeted by invasive species and ecosystems and habitats are lost or degraded through human resource use and development. Active management to control threats is required to protect indigenous biodiversity. Regional councils have responsibility to maintain indigenous biodiversity, as well as to protect significant vegetation and habitats of threatened species, under the Resource Management Act 1991 (RMA).

Greater Wellington Regional Council's (GWRC's) vision for biodiversity is:

"The Wellington region contains a full range of naturally occurring habitats and ecosystems that are in a healthy functioning state and supporting indigenous biodiversity"

GWRC's Biodiversity Strategy 2011-21¹ provides a common focus across the council's departments, and guides activities relating to biodiversity. One of its goals is: High value biodiversity areas are protected.

In order to achieve this vision and goal, the Key Native Ecosystem (KNE) programme seeks to protect some of the best examples of ecosystem types in the Wellington region by managing, reducing, or removing threats to their values. Sites with the highest biodiversity values have been identified and then prioritised for management. Active management of KNE sites can involve control of ecological weeds and pest animals, fencing to exclude stock, restoration planting and helping landowners to legally protect these areas.

KNE sites are managed in accordance with three-year KNE plans, such as this one, prepared for each area by the GWRC's Biodiversity department in collaboration with the landowners and other stakeholders. These plans outline the ecological values and threats specific to each KNE site, set out objectives for biodiversity management, and prescribe the operational actions and budget required to work towards achieving the objectives.

Much of the work planned in KNE sites will be carried out by GWRC staff or contractors engaged by GWRC. For example, the Biosecurity department carries out ecological weed and pest animal control to achieve the objectives set out in KNE plans.

GWRC also recognizes that working relationships between the management partners are critical for achieving the objectives for the KNE site. Under the KNE programme, GWRC staff also work with landowners and volunteer community groups involved in protection or restoration work within KNE sites.

KNE plans are reviewed regularly to ensure the activities undertaken to protect and restore the KNE site are informed by experience and improved knowledge about the site.

2. Raroa - Pukerua Coast Key Native Ecosystem

The Raroa - Pukerua Coast KNE site (18.6 ha) is located 11 kilometres north of Porirua City, between Pukerua Bay township and the Tasman Sea (see Appendix 1, Map 1). The Raroa - Pukerua Coast KNE site comprises a narrow coastal platform with a rocky shore; a steep coastal cliff rising from sea-level to about 65 metres above sea level (masl); and two forested gullies that extend further inland for nearly 500 metres.

The Raroa - Pukerua Coast KNE site contains examples of vegetation that represent plant communities that used to be more extensive on Wellington and kapiti escarpments. This includes coastal saltmarsh, coastal scree, vineland, flaxland, scrub and coastal kohekohe-podocarp and kānuka forest.

More than 190 indigenous plant species grow in the KNE site including several At Risk and Regionally Uncommon species (see Appendices 2 and 3), more than 36 species of fern, and seven species of orchid.

Landowner and stakeholders

GWRC works in collaboration with landowners, Te Runanga o Toa Rangatira Inc. and other interested parties (management partners and stakeholders) where appropriate to achieve shared objectives for the site. In preparing this plan GWRC has sought input from landowners and relevant stakeholders, and will continue to involve them as the plan is implemented.

Landowner

The whole KNE site is owned by Porirua City Council (PCC) and is named Raroa Reserve in the PCC Reserves Management Plan. The reserve is classified as a Scenic 'A' Reserve under the New Zealand Reserves Act 1977. The management plan for Raroa Reserve, prepared by PCC, aims to protect and enhance the reserve's natural, recreation and landscape values².

PCC manages Raroa Reserve in three zones³:

- 1) Raroa Bush - west of Rawhiti Road;
- 2) Waimapehi - the forested gully to the east of Rawhiti Road; and
- 3) Raroa Escarpment – south of Pukerua Bay.

Management partners and key stakeholders

The departments within GWRC who manage the site are the Biodiversity department, which coordinates biodiversity advice and management activities and the Biosecurity department, which delivers pest control work at the site.

PCC helps to fund the ecological weed control and pest animal control operations.

The Friends of Mana Island check predator control traps in Raroa Bush and along the bottom and top of Raroa Escarpment. These traps were installed by the Department of Conservation to control pest animals in Pukerua Bay Scientific Reserve.

Utility companies that manage the infrastructure that runs through the KNE site are also stakeholders. Utilities include the sewer line, water supply pipes and stormwater pipes.

Ecological values

Ecological values are a way to describe indigenous biodiversity found at a site, and what makes it special. These ecological values can be various components or attributes of ecosystems that determine how important an area is for maintaining regional biodiversity. For example, some sites provide important habitat for a threatened species, or contain intact remnants of vegetation typical of the ecosystem type. The ecological values of a site are used to prioritise allocation of resources to manage KNE sites within the region.

The KNE site covers two ecological districts. The escarpment (cliff) falls within the Cook Strait Ecological District⁴, and is characterised by very exposed, steep coastal escarpments and screes affected by salt-laden wind and frequent gales. It also experiences a high number of sunshine hours and humid conditions⁵. The forested valleys are included in the Foxton Ecological District⁶. This part of the KNE site is characterised by steep hills with geological faults present, and mild, humid coastal climate⁷. The KNE site has an altitudinal range from sea-level to 135 masl.

The Raroa - Pukerua Coast KNE site is well connected to other sites with high biodiversity value, such as the Pukerua Bay Scientific Reserve and other KNE sites. The Pukerua Bay Scientific Reserve (see Appendix 1, Map 2) is managed by the Department of Conservation to maintain lizard populations⁸. The Scientific Reserve supports the only mainland population of Whitaker's skink (*Oligosoma whitakeri*) which has declined to nearly non-detectable levels over the last 23 years and may become locally extinct⁹. This reserve, and the Raroa Escarpment which falls within this KNE site, are collectively known as Wairaka Wildlife Refuge¹⁰.

The Taupo Valley Wetlands and the Karehana Bay Bush KNE sites are 2.5 km to the south and the Battle Hill Bush KNE site is 4 km to the east. The Paekakariki Escarpment KNE site lies 600 m to the east of the Raroa - Pukerua Coast site. The close proximity of these other sites provides opportunities for seed dispersal by native bird species and corridors for native invertebrates, lizards and birds.

Important ecological values at the Raroa - Pukerua Coast site include:

Naturally uncommon ecosystems: Stony beach ridges and shingle beaches are naturally rare ecosystem types at a national scale¹¹ and are classified as Nationally Endangered ecosystem types¹².

Threatened environments: The Threatened Environment Classification (LENZ)¹³ is a broad classification system which shows how much indigenous vegetation remains within land environments, how much is legally protected and how past vegetation loss and legal protection are distributed across New Zealand's landscape. Classifications for areas within the KNE site are summarised below: (see Appendix 1, Map 3).

- Waimapehi is Chronically Threatened (Environments with 10-20% indigenous cover remaining nationally);
- Raroa Bush is At Risk (Environments with 20-30% indigenous cover remaining nationally);
- Raroa Escarpment is Critically Underprotected (Environments with greater than 30% indigenous cover remaining nationally but less than 10% is legally protected).

Threatened species: Within the KNE site there are ten Nationally Threatened or At Risk plant species and seven regionally threatened plant species. The site provides habitat for four Threatened and five At Risk bird species. One At Risk lizard species is present. Nationally threatened species are listed in Appendix 2 and regionally threatened species in Appendix 3.

The Singers and Rogers (2014)¹⁴ classification of pre-human vegetation indicates the Raroa - Pukerua Coast KNE site comprised Coprosma, muehlenbeckia shrubland/ herbfield/ rockland (CL3) on parts of Raroa Escarpment, with more sheltered gullies forested with kohekohe, tawa forest (MF6). There is about 15% of the original extent of the MF6 forest type remaining in the Wellington region, making it a regionally Threatened ecosystem type¹⁵.

The KNE site contains a range of habitats including small areas of coastal saltmarsh and herbfield, sparsely vegetated rock and scree slopes, vineland, wharariki (*Phormium cookianum* subsp. *hookeri*) flaxland, scrub, and kohekohe (*Dysoxylum spectabile*) and kānuka (*Kunzea robusta*) forest.

The site is managed by focusing on three separate operational areas based on ecosystem type:

Area A: Raroa Bush

Raroa bush comprises 2.5 ha of coastal broadleaved forest with a kohekohe, ngaio (*Myoporum laetum*), kaikōmako (*Pennantia corymbosa*) canopy on a very rocky substrate. The upper extent of the forested gully is 125 masl with the edge at the top of Raroa Escarpment. Wind shear and salt burden is extreme on this edge resulting in mature trees, such as tītoki (*Alectryon excelsus* subsp. *excelsus*) and kohekohe, which can grow to 20 metres tall, only achieving 5 metres in height. Away from the edge, trees grow much taller. Other forest types within Raroa Bush include karaka forest, kohekohe/ kaikōmako forest, young ngaio-kaikōmako-kohekohe forest and tall kānuka forest.

The KNE site provides habitat for common forest birds including tūī (*Prosthemadera novaeseelandiae*) and grey warbler (*Gerygone igata*)¹⁶

Area B: Raroa Escarpment

This steep escarpment (9.3 ha) is peppered with extensive scree slopes and rocky spurs. Vegetation types include:

- meadow rice grass (*Microlaena stipoides*) and exotic grassland,
- pōhuehue (*Muehlenbeckia complexa*) and *Coprosma propinqua* shrubland,
- wharariki flaxland,
- *Coprosma propinqua*, ngaio, karaka (*Corynocarpus laevigatus*), and kawakawa (*Piper excelsum* subsp. *excelsum*) scrub,
- kohekohe, māhoe (*Melicytus ramiflorus*), and karaka forest
- oioi (*Apodasmia similis*), half-star (*Selliera radicans*), and slender clubbrush (*Isolepis cernua* var. *cernua*) salt marsh on the rock and shingle shore.

Four lizard species known to live on the escarpment are glossy brown skink (*Oligosoma zelandicum*), Raukawa gecko (*Woodworthia maculata*), copper skink (*Oligosoma aeneum*) and northern grass skink (*Oligosoma polychroma*)¹⁷.

The coastal platform is habitat for a wide variety of shore birds including reef heron (*Egretta sacra sacra*), white-faced heron (*Egretta novaehollandiae*), red-billed gull (*Larus novaehollandiae scopulinus*), white-fronted tern (*Sterna striata*), black shag (*Phalacrocorax carbo*), pied shag (*Phalacrocorax varius*), little pied shag (*Phalacrocorax melanoleucos*), black-backed gull (*Larus dominicanus*), variable oystercatcher (*Haematopus unicolor*) and paradise shelduck (*Tadorna variegata*). Local residents at the beach have placed a sign near the road warning of little penguin (*Eudyptula minor*) crossing but there are no official records of them at the site.

Area C: Waimapehi

This area comprises 6.3 ha of tall secondary-growth kānuka with a dense, diverse understory of coastal broadleaf forest species. Canopy species include tree fuchsia (*Fuchsia excorticata*), five-finger (*Pseudopanax arborea*), māpou (*Myrsine australis*), and kaikomako. Whau (*Entelea arborescens*), which is known from a few sites in the eastern Wairarapa, near Paekakariki and Wellington, is also present¹⁸. *Carex* “raotest” occurs in well-lit areas under the canopy. Flaxland occurs near the coast on the north and lower west facing slopes. The Waimapehi bush gully rises to 60 masl and includes a deeply-incised gorge and the Waimapehi Stream. Some notable species occur in the lower gorge in well-lit areas; shore cotula (*Leptinella dioica*), New Zealand sow thistle (*Sonchus kirkii*), shore lobelia (*Lobelia anceps*) and sea primrose (*Samolus repens*).

Forest birds recorded for this area include grey warbler, New Zealand fantail, kererū (*Hemiphaga novaeseelandiae*), silvereye, and tūī¹⁹. A New Zealand falcon (*Falco novaeseelandiae*) has been observed feeding on silvereye on the edge of the KNE site²⁰. The barking gecko (*Naultinus punctatus*) was reported from houses adjacent to Waimapehi bush gully and is likely to occur within the reserve also²¹.

Key threats to ecological values at the site

Ecological values can be threatened by human activities, and by introduced animals and plants, that change the natural balance of native ecosystems. The key to

protecting and restoring biodiversity as part of the KNE site programme is to manage the threats to the ecological values at the site.

A wide range of ecological weed species occur at the site which have the potential to outcompete native species and dominate the KNE site. Plants that spread from local gardens and rubbish dumping can introduce new weeds or new populations of weeds inside the KNE site. Ecological weed species and their priority for control are listed in Appendix 4 and additional weed species may occur in adjacent gardens.

Parts of the KNE site, particularly Raroa Bush, are dominated by the non-local native tree karaka (*Corynocarpus laevigatus*). Karaka is native only to the northern half of the North Island²² but was planted as a food source around areas of occupation by Maori²³. Karaka can be considered a weed outside its natural range because it can displace existing plant communities²⁴.

Indigenous fauna is at risk from predators such as cats (*Felis catus*), rats (*Rattus* spp.), mustelids (*Mustela* spp.) and mice (*Mus musculus*). Indigenous flora has in the past suffered from possum (*Trichosurus vulpecula*) browsing, and grazing by goats (*Capra hircus*) and stock.

Surveys over the past four years have failed to locate any Whitaker's skink in the adjacent scientific reserve, although they may still be present in low numbers²⁵. Copper skinks are also in decline at the site. The main mechanisms thought to be driving the decline of these species are;

- 1) thick grass cover, associated with excluding stock from the area, supports sudden increases of rodent populations and their mustelid and cat predators, all of which also prey on lizards
- 2) increased vegetation with dense and pervasive root systems has decreased the number of cavities which provide refuge for lizards.

Parts of the KNE site have been burned in the past. Fire scars and stormwater outlets, which may contribute to slips, provide opportunities for disturbance and further weed invasion.

While the key threats discussed in this section are recognised as the most significant, a number of other threats to the KNE site have also been identified. Table 1 presents a summary of all known threats to the KNE site (including those discussed above), detailing which operational areas they affect, how the threat impacts on ecological values, and whether they will be addressed by the proposed management activities.

Table 1: Threats to ecological values present at the Raroa - Pukerua Coast KNE site.

The codes alongside each threat correspond to activities listed in the operational plan (Table 2), and are used to ensure that actions taken are targeted to specific threats. A map of operational areas can be found in Appendix 1 (see Map 4).

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Ecological weeds		
EW-1	Lizard habitat on the coastal escarpment is being smothered by a range of indigenous and exotic species. The introduced veldt grass (<i>Ehrharta erecta</i>) and other exotic grass species are of particular concern as they reduce underground space that serves as lizard habitat and mass seeding can result in increased rodent and mustelid populations. This increases lizard predation.	Area B
EW-2	Ground-covering, scrambling and climbing weeds have the potential to smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include climbing asparagus (<i>Asparagus scandens</i>), boneseed (<i>Chrysanthemoides monilifera</i>), mile-a-minute vine (<i>Dipogon lignosus</i>), ivy (<i>Hedera helix</i>), blue morning glory (<i>Ipomoea indica</i>), everlasting pea (<i>Lathyrus latifolius</i>), Japanese honeysuckle (<i>Lonicera japonica</i>), banana passionfruit (<i>Passiflora tripartita</i> var. <i>mollissima</i>), Cape ivy (<i>Senecio angulatus</i>), plectranthus, blue spur flower (<i>Plectranthus ciliatus</i>), climbing dock (<i>Rumex sagittatus</i>), sweet pea shrub (<i>Polygala myrtifolia</i>), kahili ginger (<i>Hedychium gardnerianum</i>), kikuyu grass (<i>Pennisetum clandestinum</i>), bear's breaches (<i>Acanthus mollis</i>), pinwheel aeonium (<i>Aeonium haworthii</i>), agapanthus (<i>Agapanthus praecox</i>), ice plant (<i>Carpobrotus edulis</i>), pig's ear (<i>Cotyledon orbiculata</i> var. <i>orbiculata</i>), crassula (<i>Crassula</i> sp.), montbretia (<i>Crocsmia × crocosmiiflora</i>), hen and chicks (<i>Echeveria elegans</i>), scrambling fumitory (<i>Fumaria muralis</i> subsp. <i>muralis</i>), red hot poker (<i>Kniphofia uvaria</i>), purple ragwort (<i>Senecio glastifolius</i>), black nightshade (<i>Solanum nigrum</i>), arum lily (<i>Zantedeschia aethiopica</i>), tradescantia (<i>Tradescantia fluminensis</i>), veldt grass (<i>Ehrharta erecta</i>), and wild turnip (<i>Brassica rapa</i> subsp. <i>sylvestris</i>).	Entire KNE site especially boundaries
EW-3	Woody weed species have the potential to displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include evergreen buckthorn (<i>Rhamnus alaternus</i>), karaka, cotoneaster (<i>Cotoneaster</i> sp.), hydrangea (<i>Hydrangea macrophylla</i>), pōhutukawa (<i>Metrosideros excelsa</i>), brush wattle (<i>Paraserianthes lophantha</i>), ink weed (<i>Phytolacca octandra</i>), karo (<i>Pittosporum crassifolium</i>), and Tasmanian ngaio/boobiolla (<i>Myoporum</i> aff. <i>insulare</i>).	Entire KNE site
EW-4*	Ecological weeds are likely to reinvade from outside the KNE site. They can be carried by wind, birds (native and exotic), other animals, machinery, bikes, stock, and people (including those carrying out management operations).	Entire KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Pest animals		
PA-1*	Cats prey on native birds, lizards and invertebrates, reducing native fauna breeding success and potentially causing local extinctions (e.g. Whitaker's skink).	Entire KNE site especially Area B
PA-2	Mustelids prey on native birds, lizards and invertebrates, reducing breeding success and potentially causing local extinctions (e.g. Whitaker's skink).	Entire KNE site
PA-3	Hedgehogs (<i>Erinaceus europeaeus</i>) prey on native invertebrates, lizards ²⁶ , and the eggs ²⁷ and chicks of ground-nesting birds.	Entire KNE site
PA-4(*)	Rats and mice* browse native fruit, seeds and vegetation. They compete with native fauna for food and, if they eat too many seeds or flowers, can reduce forest regeneration. Rats are also known to predate on invertebrates, lizards and native birds ²⁸ .	Entire KNE site especially Area B
PA-5	Possoms browse palatable canopy vegetation until it can no longer recover ^{29,30} . This destroys the forest's structure, diversity and function. Possoms may also prey on native birds ³¹ and invertebrates.	Entire KNE site
PA-6*	Goats browse native vegetation, preventing regeneration of the most palatable species and reducing species diversity. There are occasional incursions from neighbouring properties.	Entire KNE site
PA-7*	Rabbits (<i>Oryctolagus cuniculus</i>) browse a variety of native plant species. They limit natural regeneration and open up areas to weed invasion ³² .	Area B
PA-8*	Pest animals are likely to reinvade from outside the KNE site. Unmanaged areas of bush and farmland outside the KNE site may act as refuges for pest animals and ecological weeds.	Entire KNE site
Human activities		
HA-1*	Unauthorised collection of lizards may contribute to the demise of populations.	Entire KNE site especially Area B
HA-2	Encroachment and dumping of garden waste can spread weeds into the KNE site (see EW-2, EW-3, EW-4).	Entire KNE site especially residential boundary
HA-3	Creation of new tracks has the potential to introduce weeds to areas that are currently weed-free and create canopy gaps which will allow ecological weeds to establish.	Entire KNE site
HA-4	Human-induced fire can destroy native vegetation opening it up to weed invasion and edge effects.	Entire KNE site especially near residential boundary

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
HA-5	If fences are not maintained, grazing by stock from adjacent properties could inhibit regeneration processes, reducing indigenous plant species richness and in some cases causing local extinctions of palatable indigenous shrubs, terrestrial orchids and ferns ³³ .	Rural boundary of Areas B & C
HA-6*	People accessing the reserve (for recreation, work, or research purposes) can damage native vegetation, disturb native fauna and introduce ecological weed seeds. Places along tracks that are exposed to more light are likely ecological weed reinvasion points.	Entire KNE site
Other threats		
OT-1*	Erosion, slips and scouring caused by storm water outlets may be causing erosion that opens up habitat for invasive weeds and reduces habitat for lizards.	Entire KNE site

*Threats marked with an asterisk are not addressed by actions in the operational plan.

3. Objectives and management activities

Objectives help to ensure that management activities carried out are actually contributing to improving the ecological condition of the site.

Objectives

The following objectives will guide the management activities at Raroa - Pukerua Coast KNE site.

1. To improve the structure* and function† of native plant communities
2. To improve the habitat for native birds
3. To improve the habitat for native lizards
4. To raise community awareness of the ecological values of the KNE site

* The living and non-living physical features of an ecosystem. This includes the size, shape, complexity, condition and the diversity of species and habitats within the ecosystem.

† The biological processes that occur in an ecosystem. This includes seed dispersal, natural regeneration and the provisioning of food and habitat for animal species.

Management activities

Management activities are targeted to work towards the objectives above by responding to the threats outlined in Section 2. The broad approach to management activities is described briefly below, and specific actions, with budget figures attached, are set out in the operational plan (Table 2).

It is important to note that not all threats identified in Section 2 can be adequately addressed. This can be for a number of reasons including financial, legal, or capacity restrictions. This is discussed in the broad management approach.

Ecological weed control

The aim of weed control is to reduce the distribution and density of weeds to maintain native plant dominance and increase native plant regeneration. On the escarpment (Area B), weed control is also undertaken to improve the habitat for ground-dwelling lizards.

Weed control in Raroa - Pukerua Coast KNE site has been undertaken since 2006. The proposed management is to follow up previously treated areas within the KNE site as well as working in new areas.

In Raroa Bush (Area A) and Waimapehi (Area C) a follow-up sweep for a range of groundcovers, scramblers and woody weeds will be required until weed species can be eliminated. Weed species (e.g. banana passionfruit, cape ivy and sweet pea shrub) on the "goat track" (in Area B) will be followed up annually until they are eliminated.

Follow-up control of a suite of weed species will continue on the escarpment (Area B) targeting new areas on a rolling front from south to north as resources allow. Control of grass swards (which decrease the spaces between rocky substrate and reduce the cavities where lizards find refuge from predators) will be undertaken annually in a defined area within Area B. Control work will be followed up for a further year to remove the chance of grasses will re-establishing from seeds.

No surfactant will be used when spraying Area B following the results of a short-term study which showed that lizards may be negatively affected when sprayed with polyethoxylated tallow amine (POEA)³⁴. These areas will need to be followed up for a further year to remove the seed bank. The Department of Conservation will be consulted to identify core habitat to inform which areas should be sprayed.

Photopoints will be set up in areas where substantive weed control is undertaken to observe changes in vegetation communities.

Pest animal control

The aim of pest animal control is to reduce predators to maintain populations of ground-dwelling lizards and to reduce browsing mammals that damage the forest canopy.

Bait stations targeting possums and rats were set up in 1999 and are serviced four times annually by GWRC. The Regional Possum Predator Control Programme (RPPCP) is operating in the Porirua area. This is likely to reduce possums in the wider landscape and reduce the possibility of possums reinvading the KNE site.

A network of DOC200 kill traps were installed at 50 metre intervals by the Department of Conservation along the top and bottom of Raroa escarpment (Area B). The traps are checked twice weekly in summer and monthly in winter by the Friends of Mana Island (FOMI)³⁵.

GWRC will investigate ways to reduce mouse and cat populations within Area B where Whitaker's skink populations are most likely to be located.

Fences around the KNE perimeter will be surveyed annually to ensure they are stock proof.

Revegetation

On the Raroa Escarpment (Area B), coastal flax (*Phormium cookianum* subsp. *hookeri*) will be progressively planted just below the top edge to buffer the escarpment from plants spreading from gardens in adjacent properties. Prior to planting the adjacent landowners will be contacted and the area will be spot sprayed. Plants will be provided by the PCC nursery (See Appendix 5, Map 6).

Plantings around the edges of the lizard habitat areas may prevent the re-infestation of these areas by exotic grasses. Once weed species are well controlled in the KNE site consideration will be given to the introduction of native plant species that have been lost from the site including *Melicytus* aff. *obovatus*, thick-leaved mahoe (*Melicytus crassifolius*), white rata (*Metrosideros perforata*), matagouri (*Discaria toumatou*), speargrass (*Aciphylla squarrosa* var. *squarrosa*), and shore spurge (*Euphorbia glauca*) in Area B, and northern rata (*Metrosideros robusta*) in Areas A and C.

Stock exclusion

GWRC will check boundary fences in the course of operations and will inform the adjoining landowners when livestock has accessed the KNE site.

Community awareness

Raising awareness of the KNE site's ecological values may help to protect them.

GWRC will distribute a pamphlet to properties adjacent to the KNE site explaining the threats to the values of the KNE site, including information on plants that may spread from gardens and garden dumping.

GWRC and PCC will publicise values and threats to the KNE site using a joint press release when opportunities arise.

4. Operational plan

The operational plan shows the actions planned to achieve the stated objectives for Rarua - Pukerua Coast KNE site, and their timing and cost over the three-year period from 1 July 2015 to 30 June 2018. The budget for the 2016/17 and 2017/18 years are indicative only and subject to change. A map of operational Areas can be found in Appendix 1 (see Map 4).

Table 2: Three year operational plan for the Rarua - Pukerua Coast KNE site.

Objective	Threat	Activity	Operational area	Delivery	Description/detail	Target	Timetable & resourcing		
							2015/16	2016/17	2017/18
1,3	EW-2	Ecological weed control	B - Rarua Escarpment C - Waimapehi	Biosecurity department	Follow up weed sweep for priority 1 and 2 species targeted in 2014-15.	Reduce distribution and abundance of target species	\$12,250	\$10,150	\$10,150
1,3	EW-2	Ecological weed control	A - Rarua Bush	Biosecurity department	Follow up weed sweep for priority 1 and 2 species targeted in 2014-15.	Reduce distribution and abundance of target species	\$400	\$400	\$400
3	EW-1	Ecological weed control	B - Rarua Escarpment	Biosecurity department	Target exotic grass and broadleaf species in defined area	Reduce distribution and abundance of target species	\$350	\$525	\$525
3	EW-1	Ecological weed control	B - Rarua Escarpment	Biosecurity department	Follow up weed sweep for exotic grass and broadleaf species	Reduce distribution and abundance of target species	Nil	\$250	\$250
2,3	PA-5	Pest animal control	Entire KNE site	Biosecurity department	Bait stations serviced 4 times annually	Possums <5% RTC * Rats < 10% TTI**	\$4,300	\$4,300	\$4,300

Objective	Threat	Activity	Operational area	Delivery	Description/detail	Target	Timetable & resourcing		
							2015/16	2016/17	2017/18
1,2,3	EW-2,3	Revegetation	B – Raroa Escarpment	Biodiversity department	Spot spray and plant 350 coastal flax below the escarpment edge	Spot spraying is completed by 31 March annually	Nil	\$175	\$175
						Planting is completed by 30 June annually	Nil	\$1500	\$1500
1,2,3	EW-3 HA-2	Revegetation	B – Raroa Escarpment	Biodiversity department	Contact landowners who live adjacent to escarpment and discuss replacement of succulents with coastal flax	All landowners to be consulted by 31 March 2016	Nil [‡]	Nil [‡]	Nil [‡]
4	HA-2,	Community awareness	Whole KNE site	Biodiversity department	Joint press release with PCC when opportunities arise to publicise values and threats to the KNE site	At least one press release per year	Nil	Nil	Nil
4	HA-2,3,4	Community awareness	Whole KNE site	Biodiversity department	Letterbox drop of flyer highlighting values threats and pest plants, rubbish dumping and stray cats	Produce leaflets by 30 June 2016	Nil	Nil	Nil
1,3	HA-5	Stock exclusion	Rural fences	Biodiversity department	Check boundary fences of adjacent rural land		Nil	Nil	Nil
Total							\$17,300	\$17,300	\$17,300

[‡]Plants provided by PCC free of charge.

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

**TTI = Tracking Tunnel Index. The control regime has been created to control rats to this level but monitoring will not be undertaken. Experience in the use of this control method indicates this target will be met.

5. Funding summary

GWRC budget

The budget for the 2015/16 and 2016/17 years are indicative only and subject to change.

Table 3: GWRC allocated budget for the Raroa - Pukerua Coast KNE site.

Management activity	Timetable & resourcing		
	2015/16 (\$)	2016/17 (\$)	2017/18 (\$)
Ecological weed control	9,000	7,325	7,325
Pest animal control	3,300	3,300	3,300
Re-vegetation	Nil	1,675	1,675
Total	\$12,300	\$12,300	\$12,300

Other contributions

The budget is subject to confirmation through the PCC long term planning process.

Table 4: Additional allocated budget for Raroa - Pukerua Coast KNE site from Porirua City Council.

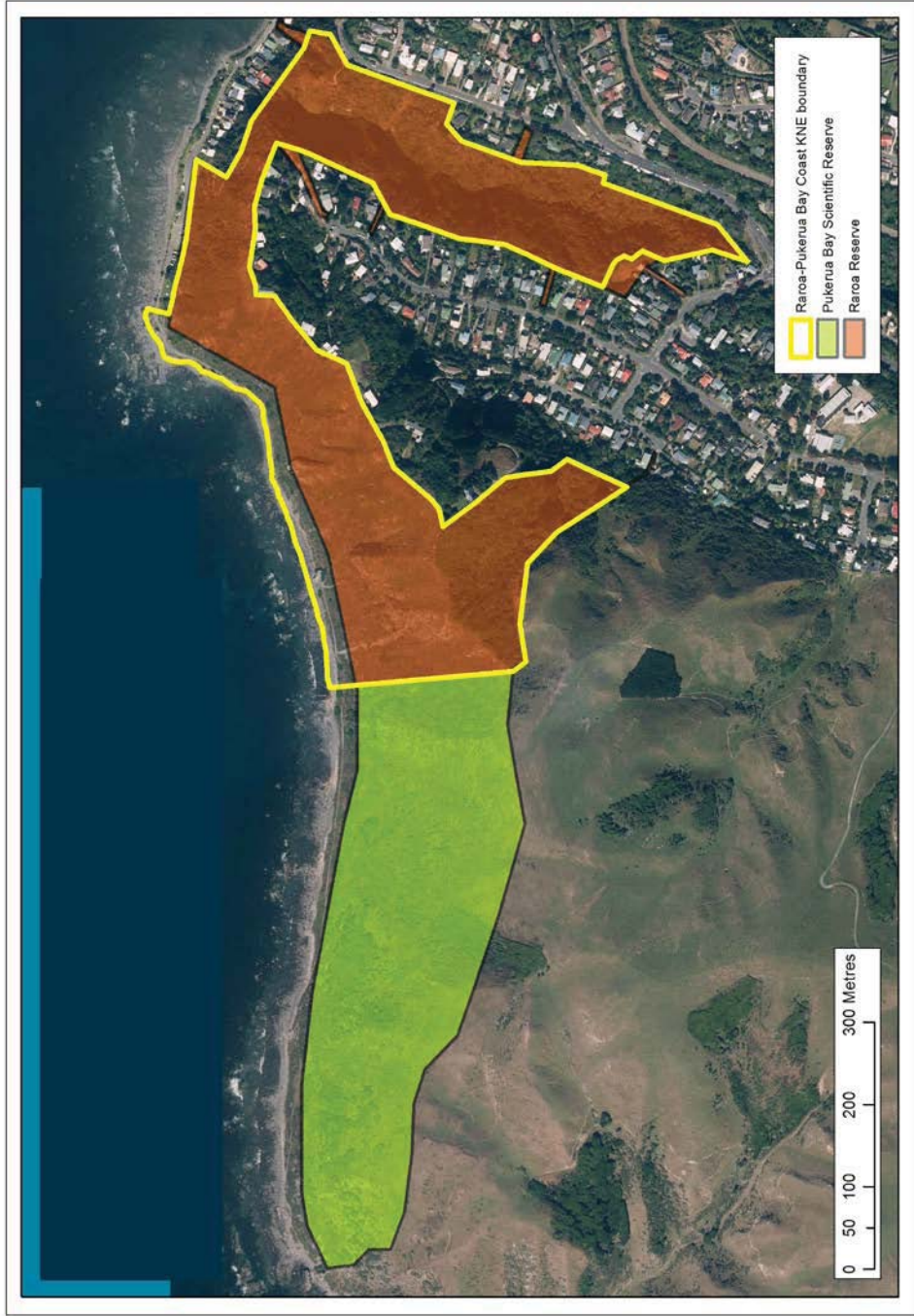
Management activity	Timetable & resourcing		
	2015/16 (\$)	2016/17 (\$)	2017/18 (\$)
Ecological weed control (PCC)	4,000	4,000	4,000
Pest animal control (PCC)	1,000	1,000	1,000
Re-vegetation (PCC)	Nil	350 plants	350 plants
Total	\$5,000	\$5,000	\$5,000

* Funds pest control in Pukerua Scientific Reserve, thus not included in total for Raroa - Pukerua KNE site.

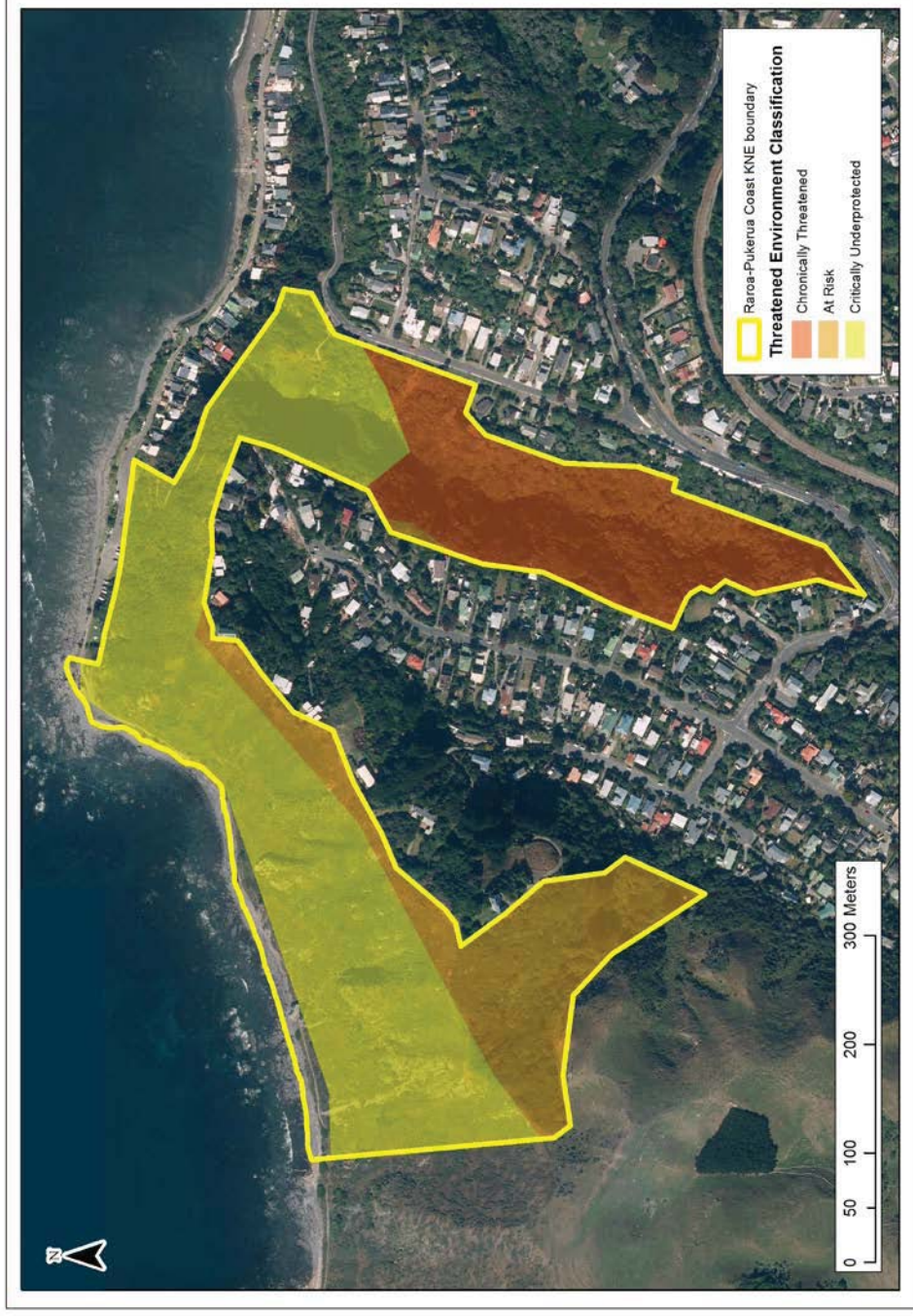
Appendix 1: Site maps



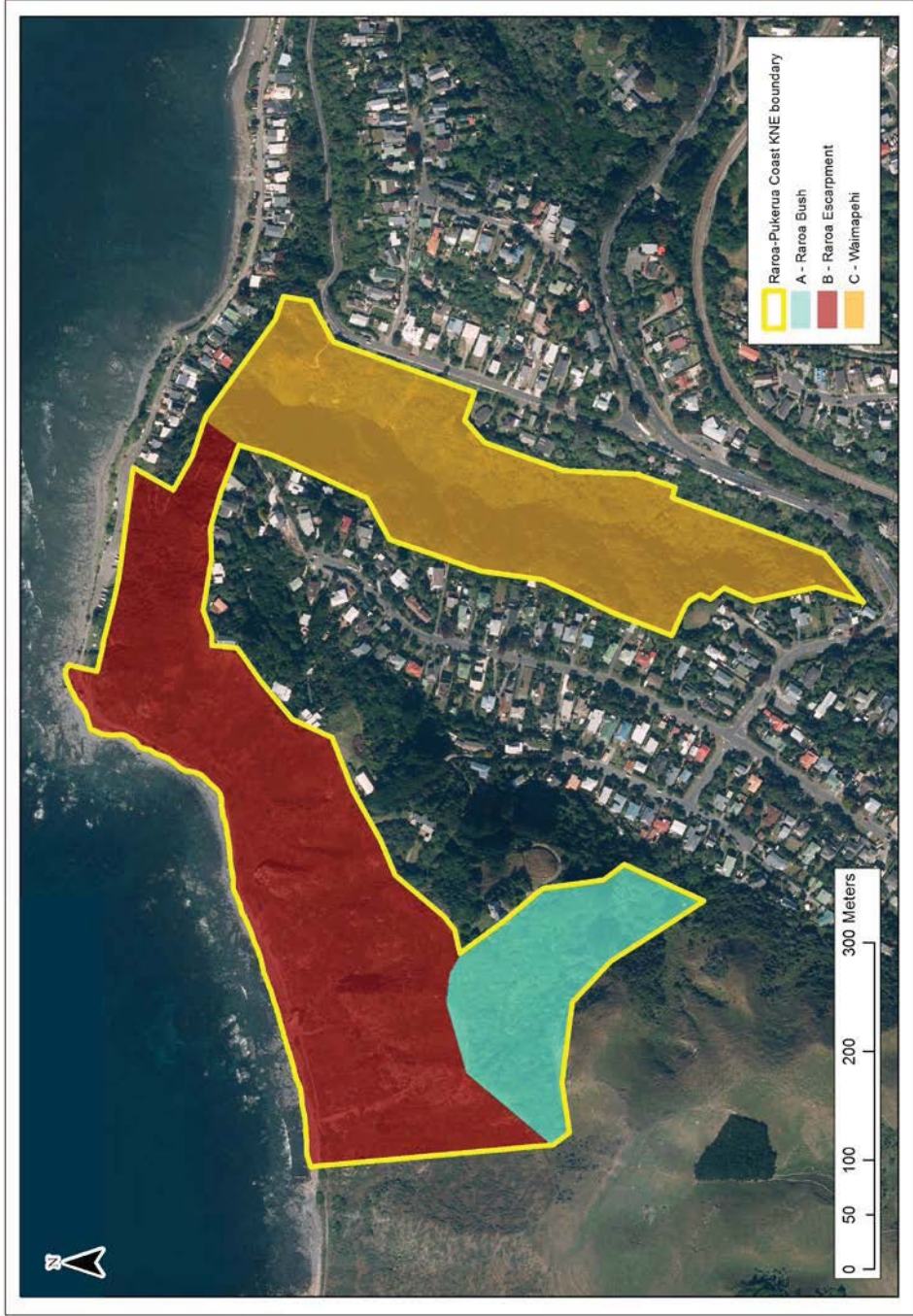
Map 1: The Raroa - Pukerua Coast KNE site boundary.



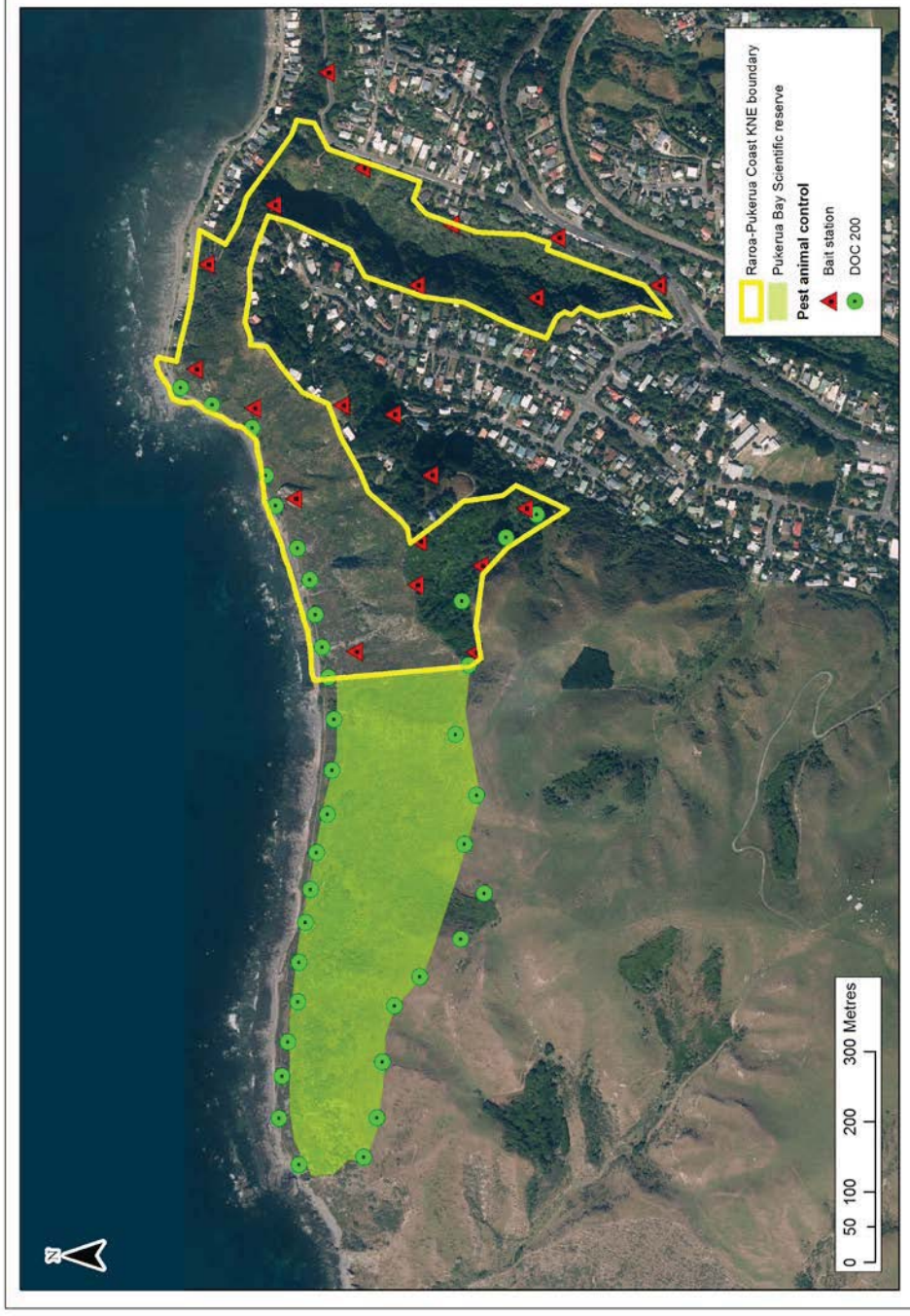
Map 2: The Raroa - Pukerua Coast KNE site boundary with adjacent Pukerua Bay Scientific Reserve.



Map 3: Land Environment New Zealand threat classification map for the Raroa - Pukerua Coast KNE site.



Map 4: Operational areas in the Raroa - Pukerua Coast KNE site.



Map 5: Pest animal control in the Raroa - Pukerua Coast KNE site. The Friends of Mana Island service the DOC200 traps in both the KNE site and the Pukerua Bay Scientific Reserve.

Appendix 2: 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 three-year cycle³⁶ with the exception of birds that are assessed on a five-year cycle³⁷. 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 Raroa - Pukerua Coast KNE site.

Table 5: Nationally threatened and At Risk species at the Raroa - Pukerua Coast KNE site.

Scientific name	Common name	Threat status	Observation
Plants(vascular)³⁸			
<i>Craspedia uniflora</i> var. <i>maritima</i>	Woollyhead	At Risk - Declining	Ogle 1980
<i>Drymoanthus flavus</i>	Little spotted moa, epiphytic orchid	At Risk – Naturally Uncommon	NZPCN website ³⁹
<i>Euphorbia glauca</i>	Shore spurge, sea spurge, waiū atua	At Risk - Declining	NZPCN website ⁴⁰
<i>Melicytus crassifolius</i>	Thick-leaved māhoe	At Risk - Declining	Planted from seed sourced from Titahi Bay, Ogle 1987 ⁴¹
<i>Sonchus kirkii</i>	Shore pūhā, New Zealand sow thistle	At Risk - Declining	Ogle 1980 ⁴²
<i>Streblus banksii</i>	Large-leaved milk tree, tūrepo	At Risk – Relict	DOC ecological site inventory 2013
<i>Trisetum antarcticum</i>	Coastal grass species	At Risk - Declining	Ogle 1980
Birds⁴³			
<i>Anthus novaeseelandiae</i>	New Zealand pipit	At Risk – Declining	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Egretta sacra sacra</i>	Reef heron	Nationally Endangered	http://ebird.org/content/newzealand/ (accessed 22/01/2014). Known to nest here ⁴⁴
<i>Falco novaeseelandiae</i> sensu stricto	New Zealand bush falcon, kārearea	Nationally Vulnerable	Bell 2014 ⁴⁵
<i>Haematopus unicolor</i>	Variable oystercatcher	At Risk – Recovering	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Hydroprogne caspia</i>	Caspian tern	Nationally Vulnerable	http://ebird.org/content/newzealand/ (accessed 15/05/2015)

Scientific name	Common name	Threat status	Observation
<i>Larus novaehollandiae scopulinus</i>	Red-billed gull	Nationally Vulnerable	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)
<i>Phalacrocorax varius</i>	Pied shag	Nationally Vulnerable	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
<i>Sterna striata</i>	White-fronted tern	At Risk – Declining	http://ebird.org/content/newzealand/ (accessed 22/01/2014)
Reptiles⁴⁶			
<i>Oligosoma zelandicum</i>	Glossy brown skink	At Risk - Declining	Department of Conservation 2014
Invertebrates: (Araneae – spiders)⁴⁷			
<i>Latrodectus katipo</i>	Katipō spider	At Risk - Declining	Pukerua Bay Management Plan 2003 ⁴⁸

Appendix 3: Regionally threatened plant species list

The following table lists regionally threatened plant species that have been recorded in the Raroa - Pukerua Coast KNE site. The regional threat status of plant species is listed in the Plant Conservation Strategy for Wellington Conservancy 2004-2010⁴⁹.

Table 6: Regionally threatened plant species recorded in the Raroa - Pukerua Coast KNE site.

Scientific name	Common name	Threat status	Source
Plants ⁵⁰			
<i>Aciphylla squarrosa</i> var. <i>squarrosa</i>	Taramea, speargrass	Regionally vulnerable	Ogle 1980 ⁵¹
<i>Carex</i> "raotest"	none	Regionally uncommon	Robyn Smith, GWRC, pers. obs 2014
<i>Cheilanthes distans</i>	Woolly cloak fern	Regionally Sparse	Ogle 1980
<i>Hypolepis distans</i>	none	Regionally Sparse	Ogle 1980
<i>Pellaea calidrupium</i>	none	Regionally Sparse	Ogle 1980
<i>Raoulia hookeri</i> var. <i>hookeri</i>	Scabweed, scabweed mat daisy	Regionally Gradual Decline	Ogle 1980
<i>Vittadinia australis</i>	White fuzzweed	Regionally endangered	Ogle 1980

Appendix 4: Ecological weeds

The table below shows key ecological weeds within the Raroa - Pukerua Coast KNE site. Plant species are listed in order of priority for control as identified in Schedule 2 of the 2015/16 weed contracts for the site.

Area: A - Raroa Bush

Area: B - Raroa Escarpment

Area: C - Waimapehi

Table 7: Environmental weeds within the Raroa - Pukerua Coast KNE site.

Scientific Name	Common Name	Priority	Observation
<i>Aeonium haworthii</i>	Pinwheel Aeonium	1	Area: B, C.
<i>Asparagus scandens</i>	Climbing asparagus	1	Area: C
<i>Chrysanthemoides monilifera</i>	Boneseed	1	Area: B, C. Seeds are dispersed by gravity birds, possums and cattle
<i>Cotyledon orbiculata</i> var. <i>orbiculata</i>	Pig's ear	1	Area: C. Succulent
<i>Crassula multicava</i> subsp. <i>multicava</i>	Fairy Crassula	1	Area: B, C
<i>Dipogon lignosus</i>	Mile-a-minute vine	1	Area: C
<i>Echeveria secunda</i>	Mexican gem, hen and chicks	1	Area: C. Succulent
<i>Ehrharta erecta</i>	Veldt grass	1	Area: B. Forms dense swards and occupies lizard habitat
<i>Hedera helix</i>	Ivy	1	Area: B, C.
<i>Lathyrus latifolius</i>	Everlasting pea	1	Area: B, C. Especially important to remove from skink habitat
<i>Lonicera japonica</i>	Japanese honeysuckle	1	Area: A, C.
<i>Passiflora tripartita</i> var. <i>mollissima</i>	Banana passionfruit	1	Area: B, C. Short term goal: prevent flowering and seed set of all plants
<i>Pennisetum clandestinum</i>	Kikuyu grass	1	Forms dense swards and occupies lizard habitat
<i>Polygala myrtifolia</i>	Sweet pea shrub	1	Area: B, C.
<i>Senecio angulatus</i>	Cape ivy	1	Area: B, C.
<i>Tradescantia fluminensis</i>	Tradescantia	1	Area: C
<i>Acanthus mollis</i>	Bear's breaches	2	Area: C
<i>Agapanthus praecox</i>	Agapanthus	2	Area: B, C. Wind dispersed seed, can become locally dominant
<i>Carpobrotus edulis</i>	Ice plant	2	Area: B, C.
<i>Corynocarpus laevigatus</i>	Karaka	2	Area: B. Target saplings. Can form dense stands that excludes other species
<i>Cotoneaster</i> sp.	Cotoneaster	2	Area: B, C.
<i>Crocsmia × crocosmiiflora</i>	Montbretia	2	Area: C
<i>Kniphofia uvaria</i>	Red hot poker	2	Area: C. Spread through dumping of garden waste and incursion from gardens
<i>Metrosideros excelsa</i>	Pōhutukawa	2	Area: B, C. Not indigenous to Wellington. Can out-compete other species on coastal escarpment

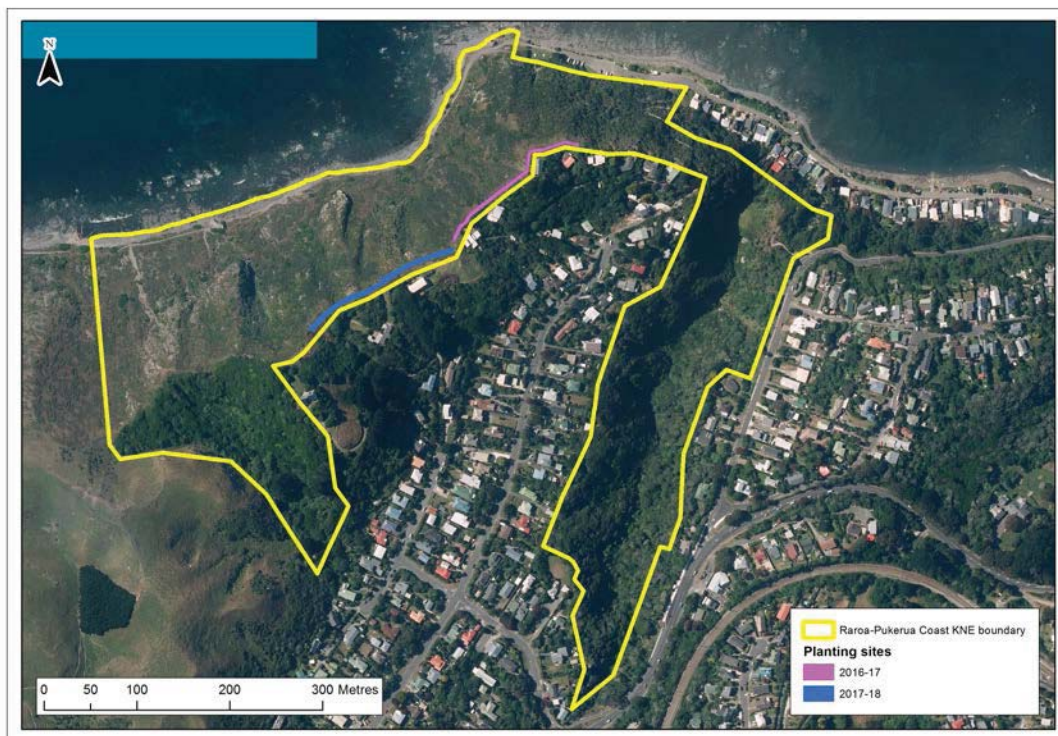
Scientific Name	Common Name	Priority	Observation
<i>Myoporum aff. insulare</i>	Tasmanian ngaio, boobialla	2	Area: C. Hybridises with native ngaio
<i>Paraserianthes lophantha</i>	Brush wattle	2	Area: B, C
<i>Parietaria judaica</i>	Pellitory of the wall, Asthma weed	2	Area: A, B, C
<i>Pittosporum crassifolium</i>	Karo	2	Area: B, C. Can quickly dominate coastal escarpment and germinates in shade in forest
<i>Plectranthus ciliatus</i>	Plectranthus, Blue spur flower	2	Area: C. Becomes a dense groundcover
<i>Rumex sagittatus</i>	Climbing dock	2	Area: B
<i>Senecio glastifolius</i>	Purple ragwort	2	Area: A, C. Can develop dense stands, and is prolific seed producer.
<i>Zantedeschia aethiopica</i>	Arum lily	2	Area: C
<i>Allium triquetrum</i>	Onion weed	3	Forms dense groundcover, excludes other species
<i>Calystegia silvatica</i>	Greater bindweed	3	Easily confused with indigenous bindweed species
<i>Cortaderia selloana</i>	Pampas	3	Area B, C
<i>Cytisus scoparius</i>	Broom	3	Area: A, B, C
<i>Fumaria muralis</i> subsp. <i>muralis</i>	Scrambling fumitory	3	Area: C
<i>Gazania rigens</i>	Gazania	3	Area: B.
<i>Genista monspessulana</i>	Montpellier broom	3	Area: B.
<i>Hydrangea macrophylla</i>	Hydrangea	3	Area: C. Spread through dumping of garden waste and incursion from gardens
<i>Melianthus major</i>	Cape honey flower	3	Area: B.
<i>Rubus</i> sp. (<i>R. fruticosus</i> agg.)	Blackberry	3	Area: C
<i>Sambucus nigra</i>	Elderberry	3	Seed is dispersed by birds
<i>Selaginella kraussiana</i>	Creeping clubmoss, selaginella	3	Area: C. Forms dense groundcover, excludes other species, hard to get rid of
<i>Artemisia absinthium</i>	Wormwood	4	Area: B. Spread through dumping of garden waste and incursion from gardens
<i>Brassica rapa sylvestris</i>	Wild turnip	4	Area B
<i>Foeniculum vulgare</i>	Fennel	4	Area: B
<i>Opuntia monacantha</i>	Drooping prickly pear	4	Area: B. Spread through dumping of garden waste and incursion from gardens
<i>Phytolacca octandra</i>	Ink weed	4	Area: B & C
<i>Rhaphiolepis umbellata</i>	Sexton's bride	4	Area: B. Spread through dumping of garden waste and incursion from gardens
<i>Solanum nigrum</i>	black nightshade	4	Area: C
<i>Tropaeolum majus</i>	Nasturtium	4	Spread through dumping of garden waste and incursion from gardens.
<i>Ulex europaeus</i>	Gorse	4	Meet RPMS requirements for boundary control

Appendix 5: Planting plan

Below are the details of the revegetation work that will be undertaken in the Raroa-Pukerua Coast KNE site. Plant species to be used are listed and the table identifies numbers of plants that will be used and all costs associated with the planting programme. Map 5 shows the areas to be planted.

Table 8: Planting plan for area B.

Plant (scientific name)	2016/17		2017/18	
	Number	Total (\$)	Number	Total (\$)
<i>Phormium cookianum</i> subsp. <i>hookeri</i>	350	0	350	0
Site preparation spray		175		175
Planting labour		1,500		1,500
Total		1,675		1,675



Map 6: Planting areas in the Raroa-Pukerua Coast KNE site.

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