OPERATIONAL PLAN FOR ECOLOGICAL RESTORATION IMPLEMENTATION AT KARIRI POINT, LAKE TARAWERA

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OPERATIONAL PLAN FOR ECOLOGICAL RESTORATION IMPLEMENTATION AT KARIRI POINT, LAKE TARAWERA

Contract Report No. 4152a

February 2017

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1. INTRODUCTION

A group comprising the Lake Tarawera Ratepayers Association, Tarawera Landcare 2115, Tuhourangi, and Ngati Rangitihi, is keen to restore the Lake Tarawera catchment. As a first step towards this larger project, the Ratepayers Association and Tarawera Landcare 2115 identified Kariri Point as a worthwhile site to start physical works and commissioned Wildland Consultants to develop an operational plan for the restoration of Kariri Point. Kariri Point is a small peninsula on the western side of Lake Tarawera, between Rangiuru Bay and 'Boatshed' Bay. It is Māori-owned land, and is of very considerable importance to Tuhourangi, tangata whenua for this area.

This plan describes and maps the current vegetation cover of the project area, identifies locations, densities, and distributions of pest plant species, and appropriate methods of control, provides lists of plants and animals present in the project area, and identifies opportunities for pest animal control and planting, along with post-planting management.

An implementation programme is provided, including timing and costs and outlining an approach to achieve restoration for this area.

2. VISION

To restore Kariri Point to indigenous vegetation free of pest plants and pest animals.

3. PROJECT OBJECTIVES

Various project objectives are set out below:

Indigenous Vegetation

- To maintain indigenous vegetation cover in good condition, with minimal adverse effects from pest plants and animals.

Pest Plants and Animals

- To either eradicate or maintain key invasive/damaging species at very low levels.

4. METHODS

Project vision and objectives were discussed with the client, who obtained landowner permission to work on the site.

A brief review of existing information was undertaken, including ecological context, the ecological significance of the site, and existing information on biodiversity management in the vicinity of Kariri Point.

Site visits were undertaken on 5 October and 8 and 10 November 2016. Vegetation and habitats of the sites were mapped in the field onto aerial imagery at 1:1,500. Checklists of plants and fauna were compiled. Locations, extent and density of pest plant infestations were recorded. Evidence of pest animal presence and/or effects were noted.

A plan was prepared incorporating the above information, and outlining the options, methods, and costs involved in undertaking ecological restoration work at Kariri Point, including pest plant and animal control, and indigenous revegetation.

5. ECOLOGICAL CONTEXT AND HISTORY

Lake Tarawera and surrounds lie within Rotorua Lakes Ecological District. Rotorua Lakes Ecological District covers approximately 139,000 ha from the base of the Rotoma hills in the east, along the northern catchment boundaries of Lakes Rotorua, Rotoehu, and Rotoma, to the Mamaku Plateau in the west, and south to Maungakakaramea (Rainbow Mountain). Altitude ranges from *c*.20 m asl near Kawerau to 1,111 m asl at the summit of Mount Tarawera. Most of the Ecological District landforms are over 280 m asl.

Major lakes within Rotorua Lakes Ecological District - Rotorua, Rotoiti, Rotoehu, Rotoma, Tarawera, Okataina, Okareka, Tikitapu (Blue Lake), and Rotokakahi (Green Lake) - occupy depressions within the calderas of the Rotorua Volcanic Centre and Okataina Volcanic Centre. These calderas, along with the associated lakes, geothermal systems, and distinctively-shaped rhyolite domes, are the distinctive landform features of this Ecological District.

Land cover within Rotorua Lakes Ecological District comprises lakes (16% of total area), pasture-based farmland (27%), exotic plantation forest (21%), and indigenous forest (mainly tawa-dominant) and scrub (30%). Wetland vegetation comprises less than 0.1% of the land cover (Landcover Database Version 3).

Lake Tarawera, formed around 5,000 years ago[1] is one of the three biggest lakes and occupies a large part of the south-western floor of Haroharo Caldera. Lake Tarawera has a surface area of 4,130 ha, and a total catchment area of 14,520 ha. Average depth is 50 metres and the deepest point is 87 metres. The water level is held to 298 metres asl by coalescing lava flows from the Haroharo and Tarawera volcanic complexes, through which the outlet flows at the eastern end of the lake.

Vegetation history is summarised below from Beadel *et al*. (1998), Nicholls (1990), and Beadel *et al*. (2011). Hardy, shrubs, herbs and grasses would have been the main vegetation cover over much of Rotorua Lakes Ecological District and Kaingaroa Ecological District during the harsh, cold and windy climate that prevailed toward the close of the Pleistocene era, *c*.15-20 thousand years before present (BP). Forest may have occupied some relatively mild, well-sheltered sites, below 300 m above sea level (asl), such as in the lower parts of the Tarawera River valley. As the climate warmed,

[1] http://www.rotorualakes.co.nz/tarawera

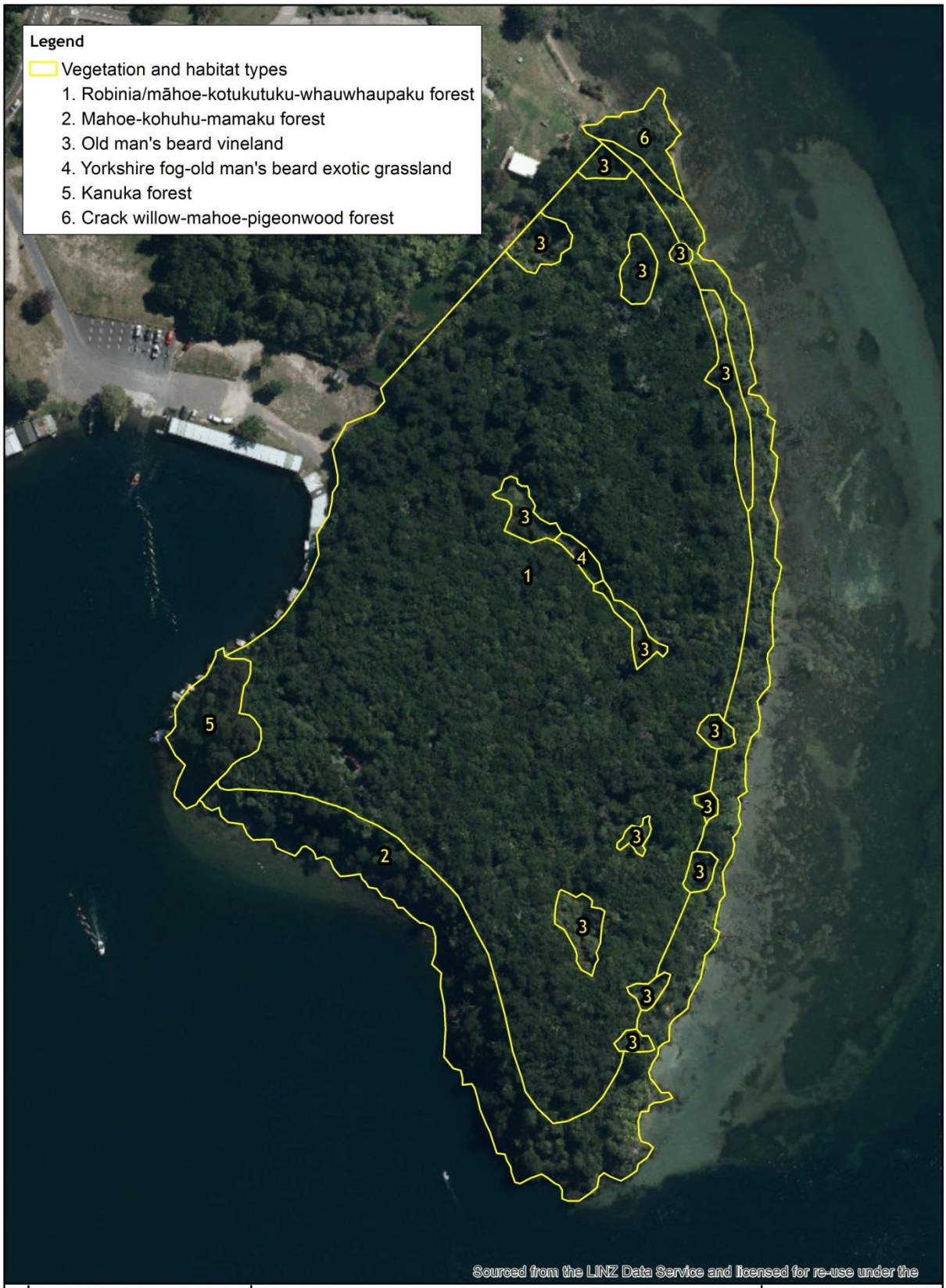
forest cover would have returned to higher sites. Analysis of plant pollens in peat/tephra beds near the eastern shore of Lake Rotorua implies that rimu-dominant podocarp-broadleaved forest was the main vegetation class about Rotorua 3,500 years ago (McGlone, in Kennedy *et al*. 1978). From the time of the Rotorua Tephra eruption (*c*.14 ka BP) until *c*.800 years ago, five major dome building lava flows and accompanying violent pyroclastic eruptions occurred within the Okataina Volcanic Centre, at average intervals of 2,000 years, undoubtedly obliterating or severely damaging vegetation covers. However recovery and colonisation is likely to have been well-advanced within a few decades after each event.

With the arrival of Māori in the Bay of Plenty and Rotorua Lakes districts, thought to have been after the Mt Tarawera eruption *c*.1314 AD (www.teara.org.nz), south of Lake Tarawera and down the Tarawera River valley, mānuka and other hardy shrubs predominated on drier ground, and there were freshwater wetlands on the broad valley floors. Pōhutukawa (*Metrosideros excelsa*) forest (including pōhutukawa-northern rata (*Metrosideros robusta*) hybrids) extended from the outlet of Lake Tarawera, some distance down the Tarawera River. Podocarp-rich forest covered the southern and eastern flanks of Mt Tarawera. Submontane Hall's totara (*Podocarpus cunninghamii*)-kamahi (*Weinmannia racemosa*) forest covered the summits of Mt Tarawera, Makatiti Dome, and Haroharo. Rimu-tawa (*Beilschmedia tawa*) forest with scattered northern rata covered the lower slopes of Makatiti Dome and Haroharo, and Maungawhakamana, as well as the surrounding hills.

The Tarawera-Rotomahana volcanic eruption in June 1886 had a drastic effect on vegetation for some distance around, and would have largely obliterated vegetation along the western shoreline of Lake Tarawera including, it can be assumed, Kariri Point, some 8-10 kilometres distant from the eruption vents. Vegetation on the mountain flanks, more scrub than forest, was obliterated, mainly by the more weighty Rotomahana Mud which completely buried large tracts of scrub up to 15 kilometres distant from the source. Further than a few kilometres beyond the craters the rain of ash and lapilli caused only transitory damage. However, within ten years of the eruption the forest was almost wholly recovered and scrub was reclothing the rest of the mud-plastered landscape (Nicholls 1959, 1963). Over the course of the 20th century the western shoreline was modified by rural development and the growth of the bach community along Spencer Road.

6. VEGETATION AND HABITAT TYPES

Six vegetation and habitat types (listed in Table 1) were identified at Kariri Point, covering 5.8 hectares. These are mapped in Figure 1 and described below. Secondary indigenous forest on flat-gentle slopes covers much of the project area. Cliffs and steep slopes extend around the margins of the Point, with exposed rocky bluffs in places. There are several small clearings which have a cover of exotic pest plants.



Data Acknowledgment
Map contains data sourced from LINZ
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Figure 1. Vegetation and Habitats map of Kariri Point

0 50 100 m

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Scale: 1:2,000
Date: 1/12/2016
Cartographer: RPB
Format: A4

Table 1: Vegetation and habitat types of Kariri Point, Lake Tarawera.

Vegetation and Habitat Type	Area (ha)
1. Robinia/māhoe-kotukutuku-whauwhaupaku forest	4.33
2. Māhoe-kohuhu-mamaku forest	0.94
3. Old man's beard vineland	0.31
4. Yorkshire fog-old man's beard exotic grassland	0.01
5. Kānuka forest	0.13
6. Crack willow-māhoe-pigeonwood forest	0.06
Total	**5.78**

1. Robinia/māhoe-kotukutuku-whauwhaupaku forest (4.33ha)

Tall māhoe (*Melicytus ramiflorus*) (12-14 m in height) with scattered emergent kotukutuku (*Fuchsia excorticata*), and whauwhaupaku (*Pseudopanax arboreus*) form a closed canopy and scattered emergent *Robinia pseudoacacia*, with occasional mangeao (*Litsea calicaris*) on the western side of the point.

There is a locally dense cover of ferns up to 1.3 metres tall in parts of the understorey, including *Diplazium australe*, *Pneumatopteris pennigera*, *Lastreopsis hispida*, *Asplenium oblongifolium*, *A. flaccidum*, *Microsorum pustulatum*, and small wheki (*Dicksonia squarrosa*), and wheki ponga (*Dicksonia fibrosa*). The ground cover consists of seedling kawakawa (*Piper excelsum*) and pigeonwood (*Hedycarya arborea*). Elsewhere the understorey is sparse with a scattering of the species mentioned above, along with a patch of tradescantia (*Tradescantia fluminensis*) on the northern edge of the type and around 1% cover of old man's beard (*Clematis vitalba*) and ornamental cherry (*Prunus* sp.) seedlings throughout.

2. Māhoe-kohuhu-mamaku forest (0.94 ha)

Māhoe and kohuhu (*Pittosporum tenuifolium*) form the canopy with scattered mamaku (*Cyathea medullaris*), hangehange (*Geniostoma ligustrifolium*), and kamahi on cliff faces. *Muehlenbeckia australis* is common throughout. The understorey includes rangiora (*Brachyglottis repanda*), *Cotoneaster glaucophyllus*, and locally common old man's beard, gorse (*Ulex europaeus*), and black bamboo (*Phyllostachys nigra*). The ground cover consists of *Microsorum pustulatum*, *Asplenium flaccidum*, and old man's beard seedlings. At the end of the point there is a patch of mānuka (*Leptospermum scoparium*)-gorse scrub. Along the water edge there are patches of crack willow (*Salix fragilis*), harakeke (*Phormium tenax*), kiokio (*Blechnum novae-zelandiae*), karamu (*Coprosma robusta*), and *Carex geminata*, with raupō (*Typha orientalis*) occasionally present in the water.

3. Old man's beard vineland (0.31ha)

This vegetation type comprises old man's beard with locally common patches of jasmine (*Jasminum polyanthum*) and *Muehlenbeckia australis* growing over top of sapling and seedling māhoe, kawakawa, kotukutuku, whauwhaupaku, hangehange, pigeonwood, pate (*Schefflera digitata*) and karamu. Ferns, including *Asplenium oblongifolium*, *Microsorum pustulatum* and *Diplazium*

australe are common. There is climbing spindleberry (*Celastrus orbiculatus*) growing amongst the old man's beard on the northern boundary.

4. Yorkshire fog-old man's beard exotic grassland (0.01ha)

This vegetation type comprises Yorkshire fog (*Holcus lanatus*), old man's beard, groundsel (*Senecio vulgaris*), inkweed (*Phytolacca octandra*), forget-me-not (*Myosotis sylvatica*), tutsan (*Hypericum androsaemum*), and Californian thistle (*Cirsium arvense*), with *Muehlenbeckia australis* growing on edges.

5. Kānuka forest (0.13ha)

A dense canopy of kānuka (*Kunzea robusta*) forms a forest cover with an understorey of māhoe, mangeao, kohuhu, kotukutuku, pate, and hangehange, with scattered mapou (*Myrsine australis*) seedlings. The groundcover is predominantly *Microsorum pustulatum* with seedling kawakawa. Closer to the water there is crack willow, kiokio, karamuū, *Carex geminata*, and raupō . Old man's beard seedlings are present here in low density.

6. Crack willow-māhoe-pigeonwood forest (0.06ha)

This vegetation type comprises a canopy of crack willow, māhoe, and pigeonwood, with old man's beard climbing amongst. The understorey consists of cotoneaster, blackberry (*Rubus fruticosus*), climbing rose (*Rosa banksiae*), and *Haloragis erecta*, with old man's beard and ornamental cherry seedlings scattered throughout.

7. FLORA

7.1 General

Vascular plant species present on the point are listed in Appendix 1. Sixty-five indigenous species and 52 adventive species were recorded. No threatened or uncommon species were found (as per de Lange *et al*. 2013).

7.2 Abundance and distribution of pest plants

Of the 52 adventive species present, 21 are pest plant species, as listed in Table 2 below. Control of these species will be required to protect, maintain, and enhance the ecological values of the indigenous vegetation on the point, and to help establish any future indigenous plantings.

Table 2: Pest plant species at Kariri Point.

Scientific Name	Common Name
Allium triquestrum	Onion weed
Camellia japonica	Common camellia
Celastrus orbiculatus	Climbing spindleberry
Cestrum elegans	Red cestrum
Clematis vitalba	Old man's beard
Cotoneaster glaucophyllus	Cotoneaster
Dendrobenthamia capitata	Strawberry dogwood
Impatiens sodenii	Shrub balsam
Jasminum polyanthum	Jasmine
Lupinus arboreus	Lupin
Nephrolepis cordifolia	Tuber ladder fern
Phoenix canariensis	Phoenix palm
Phyllostachys nigra	Black bamboo
Prunus sp.	Ornamental cherry
Robinia pseudoacacia	Robinia
Rosa banksiae	Climbing rose
Rubus fruticosus	Blackberry
Salix fragilis	Crack willow
Tradescantia fluminensis	Tradescantia
Ulex europaeus	Gorse

The diversity of pest plant species present in the reserve is relatively low. However, there are several very weedy species that are a high priority for control before they become more established. Some species - such as climbing spindleberry, old man's beard, and tuber ladder fern - will require persistent effort to reduce to low density.

Pest plant distribution is mapped in Figure 2, and the locations of some of infestations are given as GPS points in Appendix 3. A variety of control techniques will be required, including cutting and poisoning, drill and inject, herbicide, physical removal of plant material and knapsack-spraying. See Appendix 2 for control methods. The approach and timing of weed control activities will be critical to ensure that potential impacts on existing indigenous species are minimised, while at the same time ensuring that effective weed control is achieved. The density and distribution of each pest plant species is mapped in Figure 2. Key weed species present are discussed in more detail in Section 7.3.

7.3 Key pest plant species for monitoring and management

- **Black bamboo**

  A dense patch of black bamboo in located on the end of the point (see Figure 2, Area E). Bamboo forms very dense stands that exclude all other plants and that spread outwards by rapid growth of the thick rhizomes. The bamboo should be controlled and the site should be monitored for regrowth from roots and rhizomes. Repeat treatments will be required. This site may require planting once the bamboo is dead.

- **Blackberry**

  Blackberry is locally common, particularly in open areas where the canopy has collapsed and growing on the banks. Blackberry will eventually be out-competed by indigenous regeneration in forest areas, so control in these areas is not a high priority. Blackberry is, however, likely to persist in open areas, and therefore should be high priority for control in such open sites.

- **Climbing spindleberry**

  Climbing spindleberry is present on the northern boundary of the project area. It is a deciduous climber (<12 m high) with suckering roots, woody stems, and young green twigs that often have sharp spines. The finely serrated leaves turn yellow in autumn before falling. It grows rapidly, has a scrambling habit and layering stems become dense, forming impenetrable thickets. The seeds are spread by birds, possums and other mammals and are viable for 2-5 years. The stems strangle the host plant and climb to the top of the canopy, causing it to collapse. Climbing spindleberry is known as a hard to kill weed, as stumps and suckers resprout and dropped stems take root. Climbing spindleberry should be controlled by drilling and injecting, or cutting and stump treating the stems, leaving the remaining vegetation *in situ* to die off. The control of this plant on Kariri Point is of very high priority and regular follow ups (at least twice per annum, in spring and late summer) will be required to successfully control this species.

- **Cotoneaster**

  Cotoneaster seedlings and shrubs are scattered over much of the escarpments around the lake margins. This species is spread by birds and therefore should be controlled. Ongoing monitoring for this species should be maintained to prevent it from becoming more established on the Point.

- **Crack willow**

  Crack willow trees were recorded in Vegetation Types 2 and 5. Locations of these trees are shown in Appendix 4. This species is a high priority for control. These trees should be drilled and injected with herbicide and left *in situ* to die. Physical removal is not appropriate as broken branches and twig fragments can resprout if left on the ground.

- **Gorse**

  Gorse is common at the northern end of the project area in Vegetation Type 2. In this area some of it will eventually be out-competed by indigenous species. Gorse is likely to retain a long-term presence on the point, particularly on open cliff faces. Generally, gorse is not a high priority for control as it is eventually out-competed by indigenous species and is useful as a nurse canopy for indigenous regeneration. Gorse should only be controlled in open areas, around any tracks and viewing areas.

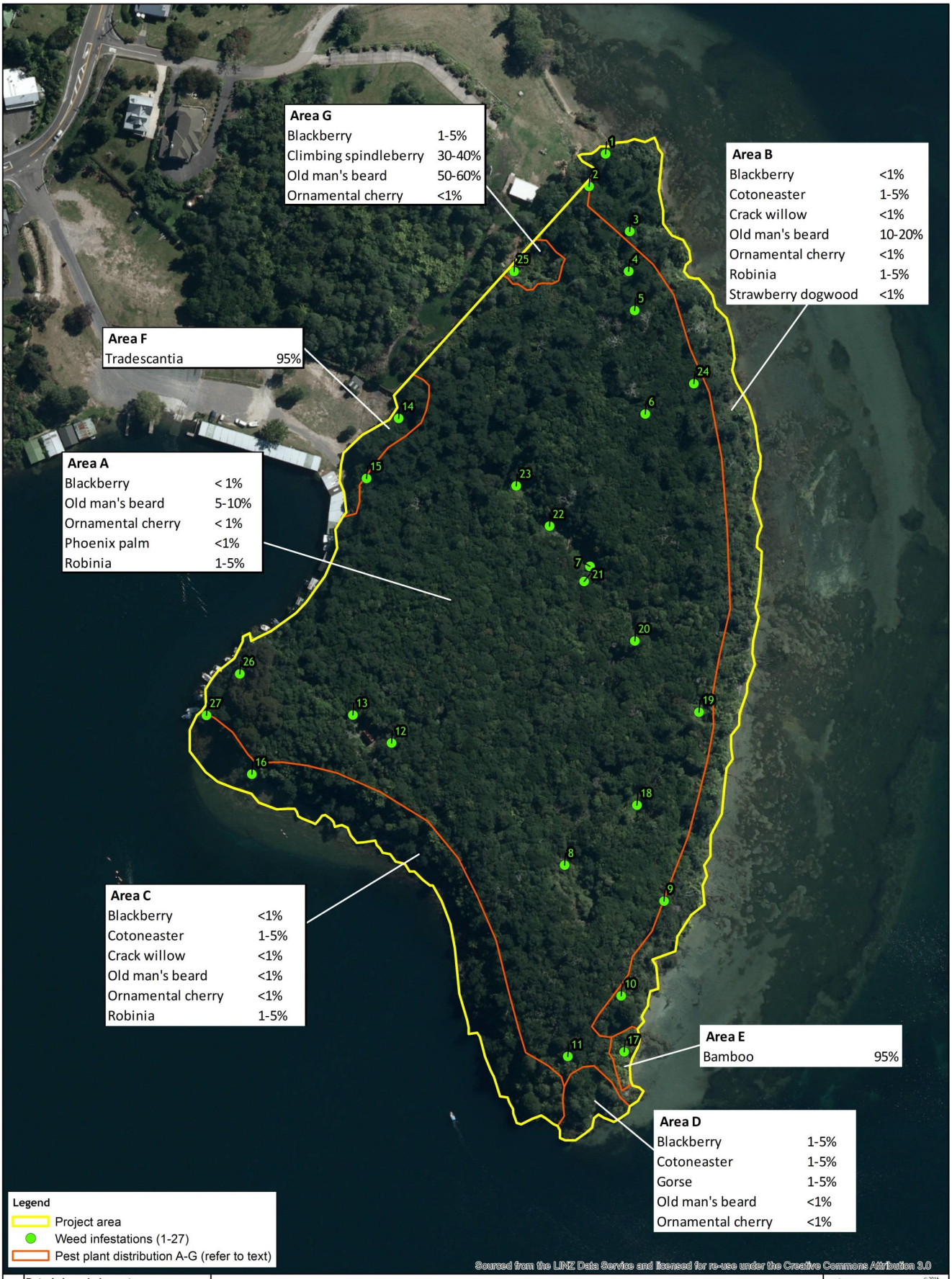

Figure 2. Distribution and abundance of pest plants at Kariri Point

- **Jasmine**

  There is one infestation of jasmine on the Point. It is located on the northern section of the project area in Vegetation Type 3. It is smothering several māhoe trees and along with old man's beard, dominates this area. Jasmine should be controlled, with regular follow up, and monitored to be sure that it has been eradicated from the Point.

- **Old man's beard**

  Old man's beard is the most widespread of all the pest plants on the point and will require the most effort and resources to control. It is a deciduous, climbing, vine with very long, woody stems with six prominent leaf ribs (appear as furrows in older vines) and pale, easily rubbed-off bark. Leaves are arranged in opposite pairs on the stems, and are made up of five widely spaced leaflets that fall in autumn. Flowers are produced from December to May, followed by grey, hairy seeds in dense, fluffy clusters persisting over winter.

  It grows rapidly, forming dense, heavy, masses that dominate the canopy causing it to collapse. The stems layer profusely, and it produces many long-lived seeds, which are spread by water or wind. It grows from both seed and stem fragments, and prevents the establishment of native plant seedlings. The stumps resprout very quickly and cut stems will root at the nodes.

  Control of old man's beard at Kariri Point is a high priority. Ongoing checks for seedlings (at least six-monthly) will need to be undertaken to ensure eradication is complete. GPS records of control sites should be maintained so that known sites can be followed up on and control progress monitored. Some of the areas where old man's beard has been controlled will require replanting promptly to minimise seedling regrowth, while other sites may regenerate naturally.

- **Ornamental cherry**

  Ornamental cherry seedlings were recorded over the entire point. Ornamental cherry is a deciduous tree that can form dense stands in open or disturbed habitats preventing regeneration of native species. Seeds are long-lived and widely dispersed by birds. Therefore controlling this species should be undertaken, along with ongoing monitoring for recolonisation.

- **Phoenix palm**

  Phoenix palm seedlings were recorded around Waypoint 6 (see Appendix 3) in the northeastern part of the project area. Phoenix palms thrive in a variety of habitats and soil types, with seed being spread by birds and water. They displace native trees through sheer size, and the growth of seedlings can produce an impenetrable, long-lived subcanopy. Sharp spines can cause injury to humans and animals. The removal of seedlings is a high priority along with monitoring of the site for germination of seed brought in by birds. If possible, track down and remove the seed source (nearby mature Phoenix palm(s)).

- **Red cestrum**

  Red cestrum is a shrub with hairy leaves which are foul-smelling when bruised (Waypoint 14, see Appendix 3). It has dense clusters of tubular magenta to deep crimson scentless flowers from January to December and produces poisonous berries which are spread by birds, flooding, soil movement and vegetation dumping. It can form dense stands in forest understorey and prevents the establishment of native seedlings. Control of the patch present in the north of the project area should be undertaken, along with six-monthly checks for seedlings and resprouting stems.

- **Robinia**

  Large robinia trees are scattered throughout the project area. Robinia is a deciduous tree; young saplings have smooth, green bark, while older trees have deep, furrowed, shaggy, dark bark with flat-topped ridges. The leaves are made up of 7-21 thin, round leaflets that are dark green above and pale underneath, and attached in pairs along the leaf stalk. Smaller branches have 1 cm long spines at the base of each leaf stalk. Large, drooping clusters of pea-like, fragrant, white to yellow flowers appear from November to January and are followed by shiny, smooth, narrow, flat seed pods (5-10 cm long) containing 4-8 seeds.

  It reproduces vigorously by root suckering and stump sprouting to form groves of trees interconnected by a common root system, and also seeds heavily every 1-2 years, with lesser amounts of seed produced in intervening years. The large, fragrant flowers also compete with native plants for pollinating bees. Controlling this species on the point is a high priority along with follow up control of any regrowth or seedlings.

- **Strawberry dogwood**

  Strawberry dogwood trees are present in Area B (as shown in Figure 2). They are a small, rounded evergreen tree (up to 6-12 m tall) with paired leaves (up to 10 cm long) on short stalks that are paler green underneath with prominent veins. Numerous pale yellow flowers develop in January to February and are followed by almost round fruit (2-4 cm diameter) that ripen to red in March to April. It grows rapidly, matures quickly, and can produce a large number of seeds that are widely dispersed by birds. Control is required, along with follow up treatment of any regrowth from the root system or seedlings.

- **Tuber ladder fern**

  A dense patch of tuber ladder fern is located next to the mausoleum. It grows to 1 m high with small, erect, scaly rhizomes producing many long runners and round, 1-3 cm hairy potato-like tubers. Fronds (40-100 × 5-8 cm) are erect or arching when long, with serrated, divided leaflets. It spreads by spores, runners and tubers, and forms dense, long-lived patches. It crowds out native vegetation and runners and tubers will resprout if not disposed of carefully. This species should be removed.

- **Tradescantia**

  A large patch of tradescantia is present in the north of the project area, and control is a high priority. Tradescantia is a trailing, perennial groundcover with succulent, creeping stems that root at all nodes touching the ground. It has dark green, shiny, smooth and slightly fleshy leaves and small white flowers. It smothers the ground in light to deep shade, preventing the seedlings of native species from establishing, and causes habitats to open and be invaded by exotic shrubs and vines. All remaining stem fragments will resprout, so maintaining a strict weed hygiene regime is essential. This area may require replanting once it is clear of tradescantia.

7.4 Other pest plant species

It is likely that other pest plant species will invade or be discovered in the future on the point. It is therefore important that regular monitoring for pest plant species is undertaken, preferably on at least an annual basis, or more often if resources are available.

8. FAUNA

8.1 Avifauna

A range of common terrestrial bird species is present at Kariri Point, as well as the adjacent section of lakeshore between The Landing and Otumutu Lagoon. Kererū (*Hemiphaga novaeseelandiae*) are common, as are tui (*Prosthemadera novaeseelandiae novaeseelandiae*), and bellbird (*Anthornis melanura melanura*), and this is attributable to the long-running (since 2000) rat control operation undertaken by the Lake Tarawera community. Various waterbird species utilise the lake shore vegetation at Kariri Point for roosting and nesting, including New Zealand dabchick (weweia; *Poliocephalus rufopectus* - Threatened-Nationally Vulnerable), New Zealand scaup (papango; *Aythya novaeseelandiae*), and Australian coot (*Fulica atra australis*). A full list of birds present at Kariri Point is provided in Appendix 6.

8.2 Bats

Long-tailed bats (pekapeka-tou-roa; *Chalinolobus tuberculatus*) are likely to forage around Kariri Point and surrounds. Trees containing cavities may provide roosting sites for bats, although this is less likely given the forest type is comparatively young and small in stature.

8.3 Lizards

There is little information on the current status and distribution of lizard species around Lake Tarawera. However, three sightings of lizard (mokomoko) species have been made in the Lake Tarawera catchment in recent years, comprising forest gecko (*Mokopirirakau granulatus*, At Risk-Declining), green gecko (*Naultinus elegans,* At Risk-Declining), and speckled skink (*Oligosoma infrapunctatum*; At Risk-Declining). One or more of these species may be present at Kariri Point in low numbers.

8.4 Introduced mammals

A wide range of pest animal species will be present at Kariri Point. Possums (*Trichosurus vulpecula*) will be present or continuously invading the peninsula and browsing on palatable tree species such as māhoe and, in conjunction with ship rats (*Rattus rattus*) and possibly Norway rats[1] (*Rattus norvegicus*), consuming fruits and preying on a range of indigenous fauna, including birds, lizards (if present), and invertebrates. Stoats (*Mustela erminea*), weasels (*Mustela nivalis vulgaris*), hedgehogs (*Erinaceus europaeus*), and feral cats (*Felis catus*) are likely to be present at least intermittently, and preying on indigenous fauna. Wallabies (*Macropus* sp.) and rabbits (*Oryctolagus cuniculus cuniculus*) are also present and will be browsing on low-stature groundcover vegetation, and reducing the recruitment of palatable species into the understorey and sub-canopy tiers.

9. ECOLOGICAL VALUES

Māhoe forest at Kariri Point, growing on Rotomahana mud erupted in 1886, is one of the vegetation types inadequately represented in the protected areas of Rotorua Lakes Ecological District. No Threatened or At Risk plants or fauna are known to be present at Kariri, however the mistletoe *Tupeia antarctica* (At Risk-Declining; as per de Lange *et al*. 2013), may be present.

Long-tailed bats probably forage from time to time and possibly roost there, and at least one lizard species may also be present, albeit in low numbers.

Lakeshore vegetation around Kariri Point provides roosting and nesting habitat for waterbirds, including dabchick (Threatened-Nationally Vulnerable).

10. FUTURE MANAGEMENT

Opportunities for active management to retain and enhance the ecological values of the project area are outlined below, including weed control, pest animal control, and opportunities for walking tracks. A work plan showing timing and indicative costs is provided in Section 12.

10.1 Weed control

Ongoing vigilance and monitoring will be required to maintain a low incidence of pest plant species in the reserve in the future. Follow-up control will be required for 3-5 years. Following this, weeds will continue to establish on the site and low-level control will be required on an ongoing basis.

[1] Rat bait stations are present on Kariri Point, part of a long-running community rat control project coordinated by Tarawera Landcare 2115.

Logistical and Practical Considerations

Access to some of the pest plant infestations on the Point will be difficult because of the steep banks on which some of the pest plants are growing. This will affect the cost and time required to undertake weed control works. Some of the control work will need to be undertaken by abseiling.

Weed Hygiene

Where pest plant species are controlled and have seeds or tubers present, or can spread from plant fragments, care should be taken to avoid new infestations establishing. This is particularly important for climbing spindleberry, tuber ladder fern, tradescantia, and old man's beard.

Continued vigilance will also be required around any routes along which plant material has been carried out of the reserve or been transported on shoes or clothing, particularly on tracks.

10.2 Pest animal control

Rat control bait stations are already in place, part of a network of around 500 bait stations along Spencer Road, and are serviced throughout the year. Possums, wallabies, mustelids, hedgehogs and feral cats could be targeted using a small number of kill traps and bait stations that could be serviced on the same schedule as the existing rat bait stations. Another possible measure would be to construct a fence - shoreline to shoreline *c*.230 metres in length, to exclude wallabies and rabbits, which would result in better understorey recovery and recruitment of subcanopy and canopy species. The reduction in trapping/poisoning effort would be offset to some extent by the need to regularly inspect the fence for damage. See Figure 3 for indicative locations of traps/bait stations and fencelines.

10.3 Planting

Planting should be kept to a minimum and native species should be left to regenerate naturally. Areas where intensive weed control has been undertaken should be assessed after three years of weed control to determine if planting is required. If there are gaps where indigenous cover has not regenerated naturally and some planting is needed, species such as māhoe, tree fuchsia, pate, *Coprosma robusta*, hangehange, five finger, pigeonwood, and kawakawa, that already grow on the Point should be used. If the rat control is successful then there should be numerous seedlings that could be transplanted into areas that require planting.

If more plants are required than seedlings available in the Point then plants purchased should preferably be grown from seed or material sourced from the site, however if such stock is not available then plant stock sourced from the Rotorua Lakes Ecological District is acceptable. PB plant stock should be used to give plants a good chance of surviving any pest animal browsing. Plants should be placed at 1.5 metre spacings. All weeds will need to be controlled prior to planting. Follow-up weed control and maintenance of plantings will be required for 2-3 years after planting to ensure that the plants survive.

10.4 Walking track

Unformed marked access tracks around Kariri Point would be appropriate and could be used by locals to enjoy natural areas and bird life, and provide access to viewing areas looking over the lake. They would also be utilised by restoration workers. Wildlands can advise on the most appropriate placement of tracks on site.

10.5 Unauthorised, informal boat moorings

A number of privately-owned small boats are informally moored along the Kariri Point shoreline from immediately south of the boat sheds to the western/inner point. Boat users use informal walking tracks along the shoreline for access. The landowners and Tarawera Landcare 2115 would prefer to see this mooring activity cease.

Figure 3. Indicative locations of pest exclusion fence, traps and bait stations, Kariri Point

11. IMPLEMENTATION PROGRAMME

A work programme showing timing and indicative costs is provided below.

Table 3: Management summary, Kariri Point.

Task	Timing	Indicative Costs[1]
Year 1 (2017)		
Exotic tree control - Robinia, crack willow, and flowering cherry. Poison standing except for areas where weed control is required in the understorey. (These trees will be controlled in Year 3.)	January - March, follow up October - December	3,155.00
Old man's beard and climbing spindleberry control - clear vines away from indigenous plants and spray foliage using a shield to protect native plants.	January - April	11,441.00[2]
Initial weed control in accessible areas. Flowering cherry, blackberry, jasmine, climbing rose, tradescantia, onion weed, camellia, shrub balsam, and red cestrum.	January - April and September - December.	6,938.00
Initial weed control in accessible areas. Strawberry dogwood, cotoneaster, gorse, phoenix palm seedlings, bamboo, and tuber ladder fern.	Year round	14,242.00
Follow-up old man's beard control - spray foliage using a shield to protect native plants, cut and paste vines and hand pull seedlings.	September - December	8,093.00
Total Pest Plant Control - Year 1		**$43,869.00**
Purchase/set up/operate 10-20 traps/bait stations (e.g. DOC 200 and/or Goodnature A24 rat and stoat traps, Timms traps and/or Goodnature A12 possum traps, Philproof bait stations).	Year round	*c.* $750.00-2,000.00[3]
Construct wallaby/rabbit Xcluder fence (*c.*230 m with one pedestrian gate at boatshed bay.		$10,500.00
Total Pest Animal Control - Year 1		**$11,250.00-$12,500.00**
Year 2 (2018)		
Cliff face weed control via abseil.	January- April	18,518.00[4]
Follow-up old man's beard control - spray foliage using a shield to protect native plants, cut and paste vines and hand pull seedlings.	January - April and September - December.	8,093.00
Follow-up weed control in accessible areas. Flowering cherry, blackberry, jasmine, climbing rose, tradescantia, onion weed, camellia, shrub balsam, and red cestrum.	January - April and September - December.	3,469.00
Follow-up weed control in accessible areas. strawberry dogwood, cotoneaster, gorse, phoenix palm seedlings, bamboo, and tuber ladder fern.	Year round	7,121.00
Pest animal control: bait for traps/bait stations, labour for servicing traps/bait stations/fence (all voluntary)		$100.00
Total for Year 2		**$37,301.00**
Year 3 (2019)		
Exotic tree control - Robinia, Poison standing in areas where other weed control has been completed.	January - March, follow up October - December	1,073.00
Identify areas in need of planting and source plants.	January - April	560.00
Follow-up cliff face weed control via abseil.	January- April	9259.00
Follow-up old man's beard control - spray foliage using a shield to protect native plants, cut and paste vines and hand pull seedlings.	January - April and September - December.	8,093.00

[1] All pest plant control indicative costs are GST exclusive and include labour, chemical, equipment, management, and mileage.

[2] Cost estimate only, dependant on true extent of climbing spindleberry and old man's beard present.

[3] Trap/bait station purchase costs only, volunteer labour not costed.

[4] Cost estimate based on contractors being able to complete weed control on bank at 100 metres per day.

Task	Timing	Indicative Costs[1]
Follow-up weed control in accessible areas. Flowering cherry, blackberry, jasmine, climbing rose, tradescantia, onion weed, camellia, shrub balsam, and red cestrum.	January - April and September - December.	3,469.00
Follow-up weed control in accessible areas. strawberry dogwood, cotoneaster, gorse, phoenix palm seedlings, bamboo, and tuber ladder fern.	Year round	5180.00
Plant bare areas were natives are not regenerating naturally.	May - August	Not costed[1]
Pest animal control: bait for traps/bait stations, labour for servicing traps/bait stations/fence (all voluntary)		$100.00
Total for Year 3		**$27,734.00**
Year 4 (2020) Ongoing		
Ongoing low-level weed control all species over entire area.	1-2 visits/ year	Not costed
Maintenance of plantings.	Will be required 2-3 times each year until canopy closure achieved (2-3 years).	Not costed
Pest animal control - bait for traps/bait stations		$100.00

ACKNOWLEDGMENTS

We would like to thank the Lake Tarawera Ratepayers Association, Tarawera Landcare 2115, and Tūhourangi for instigating this project and for providing logistical support. We would also like to thank Libby Fletcher, Peter Fahey, and John McMullen for providing logistical support.

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[1] Costs will be provided in April 2019 after areas to be planted have been identified.

PLANT SPECIES LIST FOR KARIRI POINT 2016

INDIGENOUS SPECIES

Monocot. trees and shrubs

Cordyline australis	tī kōuka, cabbage tree

Dicot. trees and shrubs

Aristotelia serrata	makomako, wineberry
Brachyglottis repanda	rangiora
Coprosma robusta	karamū, kāramuramu
Fuchsia excorticata	kōtukutuku, kōnini
Geniostoma ligustrifolium var. *ligustrifolium*	hangehange
Hebe stricta var. *stricta* (planted)	koromiko, kōkōmuka
Hedycarya arborea	porokaiwhiri, pigeonwood
Kunzea robusta	kānuka
Leptecophylla juniperina var. *juniperina*	prickly mingimingi
Leptospermum scoparium agg.	mānuka
Litsea calicaris	mangeao
Melicytus ramiflorus subsp. *ramiflorus*	māhoe
Myrsine australis	māpou, matipou, māpau
Piper excelsum subsp. *excelsum*	kawakawa
Pittosporum eugenioides (planted)	tarata; lemonwood
Pittosporum tenuifolium	kōhūhū, rautāhiri, rautāwhiri
Pseudopanax arboreus	whauwhaupaku, puahou, five finger
Schefflera digitata	patē
Weinmannia racemosa	kāmahi

Dicot. lianes

Muehlenbeckia australis	puka
Parsonsia capsularis	akakiore
Passiflora tetrandra	kohia, native passionfruit

Ferns

Adiantum cunninghamii	huruhuru tapairu, maidenhair fern
Asplenium bulbiferum	mouku, hen and chicken fern
Asplenium flaccidum	makawe, ngā makawe o Raukatauri
Asplenium oblongifolium	huruhuru whenua
Asplenium polyodon	petako
Blechnum discolor	piupiu, crown fern
Blechnum filiforme	pānako
Blechnum novae-zelandiae	kiokio

Blechnum parrisiae	pukupuku
Cyathea dealbata	ponga, silver fern
Cyathea medullaris	mamaku
Dicksonia fibrosa	whekī-ponga, kurīpākā
Dicksonia squarrosa	whekī
Diplazium australe	
Hypolepis ambigua	
Lastreopsis glabella	
Microsorum pustulatum	kōwaowao, pāraharaha, hound's tongue fern
Paesia scaberula	mātātā
Pneumatopteris pennigera	pākau
Polystichum silvaticum	
Polystichum vestitum	pūniu, prickly shield fern
Pteridium esculentum	rārahu, bracken
Pteris macilenta	titipo, sweet fern
Pteris tremula	turawera, shaking brake
Pyrrosia eleagnifolia	leather-leaf fern

Grasses

Austroderia toetoe (planted)	toetoe
Microlaena stipoides	pātītī, meadow rice grass

Sedges

Carex geminata agg.	rautahi
Carex virgata	pūrei
Cyperus ustulatus f. *ustulatus*	toetoe upoko-tangata
Eleocharis acuta	spike sedge
Schoenoplectus tabernaemontani	kāpūngāwhā
Uncinia scabra	matau
Uncinia uncinata	kamu matau a Maui, kamu

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Phormium tenax	harakeke, flax
Typha orientalis	raupō

Dicot. herbs (other than composites)

Epilobium nummulariifolium	
Haloragis erecta subsp. *erecta*	toatoa
Hydrocotyle moschata	
Lobelia angulata	pānakenake
Oxalis exilis	
Ranunculus reflexus	maruru

NATURALISED AND EXOTIC SPECIES

Monocot. trees and shrubs

Phoenix canariensis	Phoenix palm

Dicot. trees and shrubs

Camellia japonica	common camellia
Cestrum elegans	red cestrum
Cotoneaster glaucophyllus	cotoneaster
Dendrobenthamia capitata	strawberry dogwood
Lupinus arboreus	lupin
Prunus sp.	ornamental cherry
Robinia pseudoacacia	false acacia, black locust, robinia
Rosa banksiae	climbing rose
Rubus sp. (*R. fruticosus* agg.)	blackberry
Salix fragilis	crack willow
Ulex europaeus	gorse

Dicot. lianes

Celastrus orbiculatus	climbing spindleberry
Clematis vitalba	old man's beard
Jasminum polyanthum	jasmine

Ferns

Nephrolepis cordifolia	tuber ladder fern

Grasses

Anthoxanthum odoratum	sweet vernal
Dactylis glomerata	cocksfoot
Ehrharta erecta	veldt grass
Holcus lanatus	Yorkshire fog
Phyllostachys nigra var. *nigra*	black bamboo
Poa annua	annual poa
Schedonorus arundinaceus	tall fescue
Sporobolus africanus	ratstail

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Allium triquetrum	onion weed

Composite herbs

Bellis perennis	lawn daisy
Cirsium arvense	California thistle
Cirsium vulgare	Scotch thistle

Conyza sumatrensis	broad-leaved fleabane
Lactuca serriola	prickly lettuce
Mycelis muralis	wall lettuce
Sonchus asper	prickly puha
Sonchus oleraceus	puha, sow thistle

Dicot. herbs (other than composites)

Cardamine sp.	
Digitalis purpurea	foxglove
Euphorbia peplus	milkweed
Fumaria muralis	scrambling fumitory
Galium aparine	cleavers
Geranium molle	dovesfoot cranesbill
Impatiens sodenii	shrub balsam
Lotus pedunculatus	lotus
Mentha ×piperita	peppermint
Myosotis sylvatica	garden forget-me-not
Physalis peruviana	cape gooseberry
Phytolacca octandra	inkweed
Plantago lanceolata	narrow-leaved plantain
Prunella vulgaris	selfheal
Ranunculus repens	creeping buttercup
Rumex obtusifolius	broad-leaved dock
Solanum nigrum	black nightshade
Veronica arvensis	field speedwell
Vicia sativa	vetch

WEED CONTROL METHODS

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
Black bamboo (*Phyllostachys nigra*)	Cut and treat stump	Glyphosate 360	250ml/1 litre water	Year round	Mulch cut canes or stack tidily. Follow up control will be required.
	Foliar spray regrowth	Activated Amitrole	30ml/1 litre water	Year round	
Blackberry (*Rubus fruticosus*)	Knapsack - foliar spray	Metsulfuron	5g/10 litres water	December-April	
	Knapsack - foliar spray	Triclopyr	60ml/10 litres water	December-April	
Broom (*Cytisus scoparius*)	Hand pull seedlings/small plants			Year round	
	Knapsack - foliar spray	Metsulfuron	5g/10 litres water	November-February	Do not spray if seed pods have turned brown.
Camellia (*Camellia japonica*)	Cut and treat stumps	Triclopyr	60ml/1 litre water	October-April	
Climbing rose (*Rosa banksiae*)	Foliar spray	Metsulfuron	5g/10 litres water	Year round	
Climbing spindleberry (*Celastrus orbiculatus*)	Knapsack - foliar spray	Triclopyr	60ml/10 litres water	December-April	
	Cut and treat stems	Metsulfuron	5g/10 litres water	December-April	Do not pull vegetation from host plant.
Cotoneaster (*Cotoneaster glaucophyllus*)	Hand pull seedlings/small plants			Year round	
	Cut and treat stumps	Metsulfuron	5g/1 litre water, plus 2 ml surfactant	October-April	
	Drill and inject/frill and spray	Metsulfuron	5g/1 litre water, plus 2 ml surfactant	October-April	
Crack willow (*Salix fragilis*)	Cut and treat stumps	Metsulfuron	10g/1 litre water, plus 2 ml surfactant	October-April	
	Drill and inject/frill and spray	Metsulfuron	10g/1 litre water, plus 2 ml surfactant	October-April	Preferred option as leaving the tree standing avoids broken twigs/branches resprouting on ground.
Gorse (*Ulex europaeus*)	Knapsack - foliar spray	Metsulfuron	5g/10 litres water plus 10ml Pulse	November-March	
	Cut and treat stumps	Triclopyr	60ml/1 litre water	October-March	
Jasmine (*Jasminum polyanthum*)	Cut and treat stems	Triclopyr	60ml/1 litre water	October-March	Do not pull cut vegetation from host plant.
	Where practical foliar spray	Glyphosate 360	20ml/litre water and 20ml	October-March	Pull away from non-target

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
			surfactant with clean water		species before spraying. Pull vines trailing along ground and pile up (spray pile) or remove from site.
Lupin (*Lupinus arboreus*)	Hand pull seedlings/small plants			Year round	
	Cut and treat stump	Metsulfuron	5g/1 litre water	Year round	
Old man's beard (*Clematis vitalba*)	Introduce biological control agents if possible			Year round	
	Cut and treat stumps (cut at 1m above, and at ground level to prevent aerial roots attaching from hanging stems)	Metsulfuron	5g/litre water, plus 2ml surfactant	November-March	Leave stems in air to die.
	Vial treatment - pull up as many stems as possible and treat remainder.	Metsulfuron	1g/20ml water	November-March	Leave stems in air to die.
	Foliar spray	Clopyralid or Triclopyr	70ml Clopyralid/10 litre water, plus 2ml surfactant, or 60mlTriclopyr/10L water plus 2ml surfactant.	November-March	
Onion weed (*Allium triquetrum*)	Knapsack - foliar spray	Triclopyr	60ml/10 litres water	September - December	
Ornamental cherry (*Prunus* sp.)	Hand pull seedlings/small plants			November-March	
	Cut and treat stumps	Triclopyr	60ml/10 litres water	November-March	Cut and treat stumps
	Drill and inject, frill and spray	Metsulfuron	5g/1 litre water, plus 2 ml surfactant	November-March	
Phoenix palm (*Phoenix canariensis*)	Hand pull seedlings/small plants. Fell larger palms			Year round	
	Foliar spray	Metsulfuron	5g/10 litres water	Year round	
Red cestrum (*Cestrum elegans*)	Cut and treat stumps	Triclopyr	60ml/10 litres water	November-March	
Robinia (*Robinia pseudoacacia*)	Cut and treat stumps	Triclopyr	60ml/10 litres water	November-March	Cut and treat stumps
	Drill and inject, frill and spray	Metsulfuron	5g/1 litre water, plus 2 ml surfactant	November-March	For safety reasons it will be best not to poison trees in areas where other weed control will be happening underneath, these trees can be poisoned in Year 3 or 4.

Pest Plant	Control Method(s)	Chemical(s)	Application Rate	Timing	Remarks
Shrub balsam (*Impatiens sodenii*)	Foliar spray	Metsulfuron	5g/10 litres water	Year round	
Strawberry dogwood (*Dendrobenthamia capitata*)	Hand pull seedlings/small plants			Year round	
	Cut and treat stumps	Triclopyr	60ml/1 litre water	November-March	
	Drill and inject	Metsulfuron	20g/litre water, plus 2ml surfactant	November-March	
Taiwan cherry (*Prunus companulata*)	Hand pull seedlings/small plants			November-March	
	Cut and treat stumps	Triclopyr	60ml/10 litres water	November-March	Cut and treat stumps
	Drill and inject, frill and spray	Metsulfuron	5g/1 litre water, plus 2 ml surfactant	November-March	
Tradescantia (*Tradescantia fluminensis*)	Knapsack - foliar spray	Triclopyr	60ml/10 litre water	November-March	Pull away from non-target species before spraying.
Tuber ladder fern (*Nephrolepis cordifolia*)	Initial spraying of foliage	Metsulfuron-methyl	5g/10 litres water	Year round	Wait 4-5 months to allow herbicide to translocate to tubers.
	Mow any remaining foliage back to ground level with scrub bar. Dig up tubers.				Either carry out and dispose of tubers and runners at a refuse transfer station, burn or bury (0.5m deep) Another option is to pile tubers up and leave to rot down onsite, with regular spraying of the pile with herbicide.
	Follow up spraying of any regrowth with herbicide every 3-4 months or hand pull and dispose of tubers as above.	Metsulfuron-methyl	5g/10 litres water	Year round	

APPENDIX 3

LOCATIONS (NZTM) FOR SELECTED PEST PLANT INFESTATIONS RECORDED ON KARIRI POINT

Number	East	North	Pest Plant Infestation
001	1897379	5766982	Crack willow, cotoneaster, old man's beard large vines and seedlings, cherry, blackberry, climbing rose
002	1897372	5766968	Old man's beard
003	1897389	5766949	Old man's beard growing over edge of bank
004	1897389	5766932	Old man's beard and jasmine; extent of infestation: 8 ×12m; canopy collapsed
005	1897391	5766915	Old man's beard
006	1897396	5766871	Phoenix palm seedlings
007	1897372	5766805	Old man's beard on the edges of a grassy clearing
008	1897361	5766676	Old man's beard; extent: 30 × 20m
009	1897404	5766661	Old man's beard, robinia, cotoneaster
010	1897386	5766620	Old man's beard vines and scattered seedlings; cotoneaster on cliff face
011	1897363	5766594	Gorse growing on end of point
012	1897287	5766729	Old man's beard and camellia
013	1897270	5766741	Ladder fern, shrub balsam and onion weed.
014	1897290	5766869	Red cestrum
015	1897276	5766843	Tradescantia; extends over an area 1-4m, well below the canopy between the boat sheds and the ponga fence
016	1897227	5766716	Cotoneaster
017	1897387	5766596	Dense patch of bamboo on cliff face
018	1897392	5766702	Old man's beard
019	1897419	5766742	Old man's beard
020	1897392	5766773	Old man's beard; extent: 10 × 7m
021	1897370	5766799	Old man's beard; extent: 20 × 10m
022	1897355	5766822	Old man's beard
023	1897341	5766840	Old man's beard; extent 10 × 15m
024	1897417	5766884	Old man's beard growing over edge of bank for 50m
025	1897340	5766932	Climbing spindleberry and old man's beard, dense patch 30 × 40m; canopy collapsed.
026	1897222	5766759	Old man's beard
027	1897207	5766741	Crack willow

SITE PHOTOGRAPHS

Plate 1: Cherry tree on lake edge.

Plate 2: Old man's beard infestation.

Plate 3: Old man's beard infestation.

Plate 4: Robinia.

Plate 5: Old man's beard shoots under canopy.

Plate 6: Fresh possum pellets.

Plate 7: Bare understorey and groundcover predominates.

Plate 8: Major old man's beard infestation in one of the clearings.

Plate 9: Locally dense understorey of ferns.

Plate 10: Open understorey and ground cover adjacent to boat sheds.

KARIRI POINT - EXTRACT FROM ROTORUA DISTRICT NATURAL HERITAGE REPORT[1]

RAP No. 103
PNAP Survey No. (1996/97) 169
Area 7.0 ha
Altitudinal Range 300 - 320 m
Grid Reference NZMS 260 U16 075284
Landform Unit Low terraces
Status Partially protected

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM
Lowland	1. Robinia/māhoe-kotukutuku-whauwhaupaku-kohuhu forest. 2. Rarahu fernland.	hillslopes

Vegetation Secondary forest developed following the Tarawera eruption.

Flora *Doodia media*, which occurs only locally in the Rotorua Lakes Ecological District (Ecroyd *et al*. 1990) is present in this RAP. Northern rata is also present along the lake margins.

Fauna Common forest birds are present; wetland birds, including dabchick, little shag and scaup, utilise the margins of this site.

Threat/Modification Subdivision and development for housing poses the greatest threat to this site.

Justification This RAP comprises indigenous forest on low terraces in the lowland bioclimatic zone. This ecological unit is under represented in the existing reserve system. Clarkson and King (1987) identified māhoe forest on Rotomahana mud erupted in 1886 at Kariri Point as one of the vegetation types inadequately represented in the protected areas of the ecological district in 1987.

Notes Kariri Point is visually prominent, giving it significant landscape value.

References Beadel 1992e; Clarkson and King (1987).

[1] Wildland Consultants 1998

FAUNA SPECIES LIST FOR KARIRI POINT

New Zealand Threat Classifications are given for all species classified as 'Threatened' or 'At Risk' (Bats - O'Donnell *et al*. 2013; birds - Robertson *et al*. 2013; lizards - Hitchmough *et al*. 2013).

Key

P Observed during field work in 2016.
* Likely to be present, or potentially present, either permanently or occasionally, given known local distribution.

MAMMALS

Indigenous

Chalinolobus tuberculatus "North Island" (Threatened-Nationally Vulnerable)*	pekapeka; long-tailed bat (North Island)

Introduced (feral)

*Erinaceus europaeus**	European hedgehog
*Felis catus**	cat
*Macropus eugenii**	dama wallaby
*Mus musculus**	kiore-iti; house mouse
*Mustela erminea**	stoat
*Mustela furo**	ferret
*Mustela nivalis vulgaris**	weasel
*Oryctolagus cuniculus cuniculus**	European rabbit
*Rattus norvegicus**	pouhawaiki; Norway rat
*Rattus rattus**	ship rat
Trichosurus vulpecula (P)	brushtail possum

BIRDS

Indigenous

Anthornis melanura melanura (P)	korimako; makomako; bellbird
Aythya novaeseelandiae (P)	pāpango; New Zealand scaup
*Chrysococcyx lucidus lucidus**	pīpīwharauroa; shining cuckoo
*Circus approximans**	kāhu; swamp harrier
*Eudynamys taitensis** (At Risk-Naturally Uncommon)	koekoeā; long-tailed cuckoo;
Falco novaeseelandiae "bush"* (Threatened-Nationally Vulnerable)	bush falcon
Fulica atra australis (P)	Australian coot

Gerygone igata (P)	riroriro; grey warbler
Hemiphaga novaeseelandiae (P)	kererū; kūkupa; New Zealand pigeon
*Hirundo neoxena neoxena**	welcome swallow
*Mohoua albicilla**	pōpokatea; whitehead
*Ninox novaeseelandiae novaeseelandiae**	ruru; morepork
*Petroica macrocephala toitoi**	miromiro; pied tomtit
Poliocephalus rufopectus (Threatened-Nationally Vulnerable)	weweia; New Zealand dabchick
Prosthemadera novaeseelandiae novaeseelandiae (P)	tūī
Rhipidura fuliginosa placabilis (P)	pīwakawaka; North Island fantail
*Tadorna variegata**	pūtangitangi; pari; paradise shelduck
Todiramphus sanctus vagans (P)	kōtare sacred kingfisher; New Zealand kingfisher
Zosterops lateralis lateralis (P)	silvereye; tauhou

Introduced

Fringilla coelebs (P)	chaffinch
Passer domesticus (P)	house sparrow
Platycercus eximius (P)	eastern rosella
Turdus merula (P)	Eurasian blackbird

REPTILES/MOKOMOKO

Mokomoko is the general Māori name for skink and gecko

Gecko

*Mokopirirakau granulatus** (At Risk-Declining)	forest gecko
Naultinus elegans (At Risk-Declining)*	Auckland green gecko
Oligosoma infrapunctatum (At Risk-Declining) *	speckled skink

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