

Key Native Ecosystem Operational Plan for Taupō Swamp Complex

2020-2025



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1. Purpose

The purpose of the five-year Key Native Ecosystem (KNE) Operational Plan for Taupō Swamp Complex KNE site is to:

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

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

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

2. Policy Context

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

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

Greater Wellington Long Term Plan

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

Proposed Natural Resources Plan

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

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

Greater Wellington Biodiversity Strategy

The Greater Wellington Biodiversity Strategy³ (the Strategy) is an internal document that sets a framework that guides how Greater Wellington protects and manages biodiversity in the Wellington region to work towards the Vision.

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

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

Goal One
Areas of high biodiversity value are protected or restored

3. The Key Native Ecosystem Programme

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

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

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

A site must be identified as ecologically significant using the above criteria and be considered “sustainable” for management in order to be considered for inclusion in the KNE Programme. “Sustainable” for the purposes of the KNE Programme is defined as: a site where the key ecological processes remain intact or continue to influence the site and resilience of the ecosystem is likely under some realistic level of management.

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

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

4. Taupō Swamp Complex Key Native Ecosystem site

The Taupō Swamp Complex KNE site (52.7 ha) is located 3 km north of Plimmerton and 20 km north-northeast of Wellington City (see Appendix 1, Map 1). The main body of Taupō Swamp is confined between State Highway 1 (SH 1) and the North Island Main Trunk (NIMT) railway line. These two linear features have segmented the once continuous swamp network and the Taupō Swamp Complex now comprises of seven individual swamp segments which remain hydrologically connected via groundwater, surface water and culverts.

The KNE site comprises the largest remaining harakeke (*Phormium tenax*) swamp in the Wellington Region⁴ and it is one of only a few lowland topogenous mires in the Wellington Ecological District⁵. The Taupō Swamp Complex is also scheduled as an Outstanding Natural Wetland in Schedule A3 of the Proposed Natural Resources Plan (PNRP)⁶ for its representativeness and rarity.

The KNE site has retained a largely indigenous vegetation cover and contains regionally unique and diverse vegetation communities across different stages of natural succession⁷. The KNE site supports a number of native fauna and flora species, with the wetland interior in particular considered to provide habitat for spotless crane and other threatened wetland bird species⁸.

The large majority of the KNE site is owned and legally protected by the Queen Elizabeth II National Trust (QEII) (see Appendix 1, Map 2). Parts of the KNE site have also been recognised by the Department of Conservation (DOC) as Designated Ecological Sites (see Appendix 1, Map 3).

The Taupō Swamp Complex KNE site is predominantly surrounded by drained farmland and industrial areas with some areas of forestry and scrub. It is also located closely adjacent to areas proposed for extensive urban development. The KNE site is situated within 5 km of a number of other KNE sites, namely Karehana Bay Bush, Whitireia Coast, Battle Hill Bush, Raroa-Pukerua Coast and Paekākāriki Escarpment. These KNE sites are thought to form an important network of habitat linkages within the wider ecological landscape, enabling coastal, wetland and forest birds to forage, breed and disperse throughout the local area.

5. Parties involved

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

5.1 Landowners

The Taupō Swamp Complex KNE site has both private and public landowners:

- QEII own the majority of the main Taupō Swamp complex (~30 ha). This area was afforded full protection by the QEII National Trust under their Act following its purchase in 1986⁹.
- PCC own a total of ~12 ha of the KNE site including; the Whenua Tapu Swamp located at the northern most end of the site and managed by PCC as a cemetery, the southern portion of Taupō Swamp that is situated within the Plimmerton Domain, and a small wetland to the west of the railway line in the Track Reserve (also known as Taupō Swamp West D).
- The New Zealand Transport Authority (NZTA) owns a ~7.5 ha strip of land along the eastern boundary of Taupō Swamp adjacent to SH 1. This land includes the Ara Harakeke pathway and is currently administered by PCC.
- The New Zealand Railways Corporation own a ~3 ha strip of land along the western boundary of the KNE site adjacent to the NIMT railway line. However, this land is currently managed by the railway operators, KiwiRail.
- Paul and Julia Botha, private landowners, own Taupō Swamp West B (0.9 ha), a small wetland located on the western side of the NIMT railway line.

Land ownership boundaries are provided in Appendix 1, Map 4

5.2 Operational delivery

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

QEII deliver and undertake management activities, primarily ecological weed control and revegetation planting, within the QEII owned block of the KNE site. QEII have previously funded ecological monitoring surveys within the KNE site to provide baseline data and inform management activities. QEII and Greater Wellington will meet annually to decide on the priority management actions for the site.

PCC deliver and provide funding towards biodiversity management activities within the KNE site in areas that are PCC owned land in accordance with the Porirua City Draft District Plan¹⁰.

KiwiRail provide funding towards ecological weed control operations undertaken along the western corridor of the KNE site to maintain the KNE boundary and manage weed incursions on to the railway line.

The Friends of Taupō Swamp & Catchment (FOTSC) is an incorporated society comprised of members of the local community. The group works with volunteers and local authorities to restore and enhance the unique ecological values of the Taupō Stream catchment within the PCC owned area of the KNE site. The group undertake regular weed control and planting as well as promoting and coordinating community discussion and support for the protection and restoration of the area.

The Pest Free Plimmerton (PFP) group is a community-led volunteer group established to deliver on the national Predator Free 2050 programme in the local community. The group service parts of the pest animal control network around the KNE site as well as undertaking trapping within the wider Plimmerton landscape.

5.3 Mana whenua partners

Taupō Swamp and Stream is recognised as a site of significance for Ngāti Toa Rangatira (see Table 1) and they are aware that their areas of interest are located on territorial authority and private land. Greater Wellington will provide contact details of landowners to Ngāti Toa Rangatira if they wish to consult directly with landowners about the values at the site.

Areas in close proximity to the KNE site have also been identified as having significant cultural value for Ngāti Toa Rangatira, specifically the Taupō Stream Mouth and the headland to the south of Taupō Swamp which is a significant pā (fortified settlement) site (see Table 1). The cultural values of these areas to iwi and their tupuna (ancestors) include; sites for food gathering (mahinga kai), fresh water supply (wai māori), water supply for healing (wai ora), traditional healing plants (rongoā), and a source of flax for weaving material (puna raranga).

Table 1: Ngāti Toa Rangatira sites of significance within and associated with Taupō Swamp Complex KNE site¹¹

Sites of significance	Mana whenua values
Schedule B - Ngā Taonga Nui a Kiwa: Te Awa me te Kukuwai o Taupō (Taupō Swamp and Stream)	Ngā mahi a ngā Tūpuna, Te Mahi Kai, Te Mana o Te Tangata, Te Manawaroa o te Wai, Te Mana o Te Wai, Wāhi Mahara
Schedule C3 - Taupō pā	pā (Taupō domestic & defensive), ara hikoi, wāhi tapu, tohu tūpuna, taunga waka, Te Ara o Te Rauparaha, tohu ahurea
Schedule C3 - Taupō Stream Mouth	mahinga kai, puna raranga, rongoā, wai māori, wai ora, wāhi tūpuna, wāhi maumahara

5.4 Stakeholders

The Greater Wellington Flood Protection department are responsible for maintaining the capacity of the lower reaches of the Taupō Stream from Plimmerton Domain to the estuary for flood protection services. This primarily requires ensuring a clear channel by removing any blockages and vegetation choking the stream. This work also includes maintaining the stream banks as required within the stream channel. Some revegetation planting within the KNE site has previously been undertaken under this management within Plimmerton Domain.

6. Ecological values

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

6.1 Ecological designations

Table 2, below, lists ecological designations at all or part of the Taupō Swamp Complex KNE site.

Table 2: Designations at the Taupō Swamp Complex KNE site

Designation level	Type of designation
National	<p>Parts of the Taupō Swamp Complex KNE site are designated as a Recreation Reserve under the Reserves Act 1977:</p> <ul style="list-style-type: none"> • Plimmerton Domain - Recreation Reserve, Local Purpose Reserve (Landscape and Environmental Protection) • The Track Reserve - Scientific Reserve, Local Purpose Reserve (Landscape and Environmental Protection) <p>Parts of the Taupō Swamp Complex KNE site have been identified by DOC as a Designated Ecological Site (See Appendix 1, Map 3):</p> <ul style="list-style-type: none"> • 140: Taupō Swamp (41.03 ha) • 432: Whenua Tapu Swamp (1.09 ha) • 365: Taupō Swamp West B (1.46 ha) • 483: Taupō Swamp West D (1.03 ha) • 486: Taupō Swamp East S (1.75 ha)
Regional	<p>Parts of the Taupō Swamp Complex KNE site are scheduled under Greater Wellington's proposed Natural Resources Plan (PNRP)¹² as Ecosystems and Habitats with Significant Indigenous Biodiversity Values:</p> <ul style="list-style-type: none"> • Outstanding Natural Wetland: Taupō Swamp Complex (35.52 ha) (Schedule A3) • River with significant indigenous ecosystems - Habitat for indigenous fish species of conservation interest: Taupō Stream/Catchment (Schedule F1) • River with significant indigenous ecosystems - Habitat for 6 or more migratory indigenous fish species: Taupō Stream and all tributaries (Schedule F1)
District	<p>Part of the Taupō Swamp Complex KNE site has been identified by PCC as an Outstanding Natural Feature:</p> <ul style="list-style-type: none"> • Outstanding Natural Feature: Taupō Swamp (<i>Natural Science Value – Very high; Sensory Factor Value – Very high; Shared and Recognised Value – Very high</i>)
Other	<p>Parts of the Taupō Swamp Complex KNE site are owned and legally protected by QEII (See Appendix 1, Map 2):</p> <ul style="list-style-type: none"> • P22 (29.68 ha) <p>Parts of the Taupō Swamp Complex KNE site are legally protected by a QEII open space covenant and owned by QEII (See Appendix 1, Map 2):</p> <ul style="list-style-type: none"> • 5-07-449 (0.0498 ha) <p>Part of the Taupō Swamp Complex KNE site is designated for cemetery purposes under the Public Works Act:</p> <ul style="list-style-type: none"> • Whenua Tapu Swamp

6.2 Ecological significance

The Taupō Swamp Complex KNE site is considered to be of regional importance because:

- It contains highly **representative** ecosystems that were once typical or commonplace in the region
- It contains ecological features that are **rare or distinctive** in the region
- It contains high levels of ecosystem **diversity**, with several ecosystem types represented within the KNE site boundary, including several naturally uncommon ecosystems
- Its **ecological context** is valuable at the landscape scale as it contains a variety of inter-connected habitats and, provides core/seasonal habitat for threatened indigenous plant and animal species within the KNE site

Representativeness

The Threatened Environment Classification system¹³ indicates that the swamp ecosystems found within the KNE site are considered Acutely Threatened with less than 10% indigenous cover remaining and that the habitat is under-protected on a national scale. Small portions of the KNE site associated within the drier, regenerating scrub edges are considered Chronically Threatened with less than 20% indigenous cover remaining on a national scale (see Appendix 1, Map 5).

Wetlands are now considered an uncommon habitat type in the Wellington Region with less than 3% remaining of their original extent¹⁴. The Taupō Swamp Complex is scheduled as an Outstanding Natural Wetland in the PNRP¹⁵ and comprises the largest remaining harakeke swamp in the Wellington Region¹⁶. It is also one of the best remaining examples of a topogenousⁱ lowland freshwater mire that has retained a largely indigenous vegetation cover in the Wellington Region^{17,18}.

Rarity/distinctiveness

The Taupō Swamp Complex KNE site has regionally unique and diverse vegetation across different stages of natural succession¹⁹. The swamp is an example of an unusual type of wetland, having been formed by the uplifting of the seabed during an earthquake. It is one of only a few lowland topogenous mires in the Wellington Ecological District that have retained a largely indigenous vegetation cover²⁰.

New Zealand's national threat classification system²¹ lists four plant, seven bird and four freshwater fish species as Nationally Threatened or At Risk within the KNE site. The Conservation status of indigenous vascular plant species in the Wellington region report 2020²² also lists two plant species as Regionally Threatened within the KNE site. Nationally Threatened species are listed in Appendix 2 and Regionally Threatened species in Appendix 3.

ⁱ A type of bog that forms under climatic conditions of reduced rainfall, with consequent lower humidity and summer drought, which restrict the growth of Sphagnum to areas where precipitation is concentrated (eg, valley bottoms).

Diversity

The Singers and Rogers²³ classification of pre-human ecosystems in New Zealand indicates that three ecosystem types were present within the KNE site. These were comprised of flaxland (WL18) and raupō reedland (WL19) dominant within the swamp areas and kohekohe-tawa forest (MF6) present on the swamp margins. Aspects of these original ecosystems types are still evident within the KNE site today, although in a modified and regenerating condition. The MF6 forest ecosystem type once present within the KNE site has only 16% of its original area remaining in the Wellington region making it a regionally threatened ecosystems²⁴.

The most recent vegetation survey conducted within the Taupō Swamp complex shows that the KNE site is highly diverse with as many as thirty-seven vegetation types, and one aquatic habitat (open water) present²⁵.

Ecological context

The Taupō Swamp Complex KNE site supports a number of plant and wetland bird species, including threatened species²⁶ and also a sizable population of indigenous freshwater fish²⁷. Whilst the Taupō Stream and its tributaries are important habitat for migrating and spawning native fish²⁸.

The KNE site is also located within 5 km of a number of other KNE sites, namely Karehana Bay Bush, Whitireia Coast, Battle Hill Bush, Raroa-Pukerua Coast and Paekākāriki Escarpment. These KNE sites are thought to form an important network of habitat linkages within the wider ecological landscape, enabling coastal, wetland and forest birds to forage, breed and disperse throughout the local area.

6.3 Ecological features

The Taupō Swamp Complex KNE site is located within the Wellington Ecological District²⁹ which is characterised by steep, strongly faulted hills and ranges with typically warm summers and mild winters. The climate is often windy with westerly to north-westerly winds prevailing with frequent gales and an annual rainfall ranging between 900-1400 mm³⁰.

The Taupō Swamp Complex is a relict inlet of the Porirua Harbour which was formed via uplift during the 1855 earthquake^{31,32}. This uplift and subsequent siltation formed a topographical barrier effectively excluding salt water and preventing free and natural drainage. This naturally transformed the area into a topogenous mire, a now rare ecological feature in the Wellington District. The swamp is covered by a silty peat, while the catchment area has a substratum of greywacke and sandstone overlain over much of the area by loess and sand. Water is supplied from a freshwater stream source, the Taupō Stream, which flows through the length of the wetland in a watercourse one to two metres wide and over one metre deep. The natural stream meander appears to have been modified in the past and is now confined to a channel stabilised by flax and other vegetation. The water table in the wetland is generally above the surface of the peat³³.

The construction of SH 1 on the eastern margin and the NIMT railway line on the western margin have segmented the once continuous swamp network. The Taupō

Swamp Complex now comprises seven individual swamp segments which remain hydrologically connected via culverts and groundwater. Four of these segments are included within the KNE site boundary, these are; Taupō Swamp, Taupō Swamp West B, Taupō Swamp West D and Whenua Tapu Swamp. The other three swamp segments are located on the eastern side of SH 1 and comprise; Taupō West Swamp, Taupō Swamp East N and Taupō Swamp. The nearby Plimmerton Swamp East wetland is also considered a significant natural wetland and drains into Taupō Stream below the KNE site boundary.

Vegetation communities and plants

The most recent vegetation survey conducted within the Taupō Swamp Complex indicates that the KNE site is highly diverse with as many as thirty-seven vegetation types and one aquatic habitat (open water) present³⁴. The KNE site has been described below in seven operational areas based on these vegetation communities (See Appendix 1, Map 6).

Whenua Tapu Swamp (Operational area A – 5.2 ha)

Whenua Tapu Swamp is an example of a wetland in the later stages of succession toward regenerating original forest. The swamp comprises predominantly of diverse, seral-broadleaved forest including; kānuka (*Kunzea robusta*), five-finger (*Pseudopanax arboreus*), mānuka (*Leptospermum scoparium*), māhoe (*Melicytus ramiflorus*), lancewood (*Pseudopanax crassifolius*), cabbage tree (*Cordyline australis*), kohekohe (*Dysoxylum spectabile*), tawa (*Beilschmiedia tawa*) and tree fuchsia (*Fuchsia excorticata*). Mixed scrubland and harakeke flax tussockland is also present and includes karamū (*Coprosma robusta*), hangehange (*Geniostoma ligustrifolium var. ligustrifolium*), toetoe (*Austroderia toetoe*), kiokio (*Parablechnum novae-zelandiae*), bracken fern (*Pteridium esculentum*), *Carex* spp. and raupō (*Typha orientalis*)^{35,36}.

Ara Harakeke Walkway (Operational area B – 7.4 ha)

The Ara Harakeke Walkway comprises a fringe of mostly planted mixed indigenous scrub between SH 1 and the eastern edge of Taupō Swamp. The native vegetation composition includes māhoe, karamū and mānuka scrubland with interspersed koromiko (*Veronica stricta var stricta*), five-finger, ngaio (*Myoporum laetum*), lacebark (*Hoheria populnea*), taupata (*Coprosma repens*), kōhūhū (*Pittosporum tenuifolium*), cabbage tree, and karo (*Pittosporum crassifolium*). Regeneration is also occurring in the understorey and mostly comprises of five-finger and young karo seedlings³⁷.

Main Taupō Swamp Complex (Operational area C – 24.5 ha)

The main body of the Taupō Swamp complex comprises the largest harakeke flax swamp in the Wellington Region³⁸. The northern most portion of the swamp complex is largely dominated by harakeke flaxland interspersed with frequent shrubs of karamū, five-finger, koromiko, and mānuka. Occasional toetoe and raupō are also present through the central low lying wetter areas. This vegetation type grades in to dominant homogenous harakeke flaxland with occasional emergent cabbage trees and comprises the majority of the central main Taupō Swamp Complex area. Harakeke flaxland becomes less frequent within the southern portion of QEII Trust land as it

grades into raupō reedland over emergent *Carex* species³⁹. The drier slopes on the eastern and western margin of the main swamp body comprise of kānuka dominant forest, which is likely trending to long term kohekohe forest⁴⁰.

Nationally and Regionally Threatened species have previously been found within the interiors of Taupō Swamp including; swamp nettle (*Urtica perconfusa*; At Risk) and swamp buttercup (*Ranunculus macropus*; Data Deficient)^{41,42,43,44}.

Western Corridor (Operational area D – 8.7 ha)

The Western Corridor comprises a mix of native and exotic scrub on the drier western embankment between the NIMT railway line and the western edge of Taupō Swamp. The northeastern corner comprises predominantly of scrubland dominated by blackberry (*Rubus fruticosus* agg.) with frequent *Carex geminata* present. The area to the south is dominated by more diverse, indigenous scrub and forest comprising predominantly of mature mānuka, māhoe, and five-finger. In more mature areas, māhoe and five-finger dominate the forest canopy with rangiora (*Brachyglottis repanda*), lancewood and kānuka also present. These more mature areas have a relatively diverse understorey including ponga (*Cyathea dealbata*), *Coprosma rhamnoides*, hangehange and groundcover species such as shining spleenwort (*Asplenium oblongifolium*) and bracken fern. Towards the southern end of the KNE site, near the industrial area, two raised fingers extend out from the mānuka dominated edge across the wetland in a southeasterly direction and almost connect to the eastern KNE boundary. The vegetation present mainly comprises coastal broadleaved species, including frequent māhoe, ngaio, mānuka and karo⁴⁵.

Taupō Swamp West D (Operational area E – 1.1 ha)

This small, segmented wetland area is considered a representative and endangered flax-raupō-*Carex* wetland with surrounding scrub and treeland⁴⁶. The wetland comprises predominantly of harakeke flaxland with blackberry and karamū scrub through the middle. Māhoe and hangehange occur occasionally with *Machaerina rubiginosa* in scattered locations, particularly toward the northeastern edge. To the northeast, the vegetation grades in to dominant raupō reedland and harakeke flaxland with scattered swamp coprosma, mānuka and occasional toetoe. A dense thicket of blackberry, gorse (*Ulex europaeus*) and pōhuehue (*Muehlenbeckia complexa*) occur along the western edge of this wetland and *Carex secta* and *Carex geminata* are frequently present in open, wetter areas⁴⁷.

Historical records show some threatened species have previously been observed within this wetland fragment including; marsh willowweed (*Epilobium chionanthum*; Naturally Uncommon) and swamp buttercup⁴⁸, however fire may have affected the presence of these species today.

Taupō Swamp West B (Operational area F – 0.9 ha)

Taupō Swamp West B is another small, segmented wetland area at the southern end of the KNE site comprised of representative flaxland and raupō-*Carex* reedland⁴⁹. The interior, wetter areas are dominated by harakeke flaxland with mānuka, and karamū commonly occurring. The southern portion of the wetland comprises a higher density of shrubs including; swamp coprosma (*Coprosma tenuicaulis*), pōhuehue, frequent

five-finger and hangehange, with occasional koromiko and whekī (*Dicksonia squarrosa*). The understorey comprises frequent, dense *Machaerina rubiginosa* with *Carex virgata* and *Carex secta*. Occasional kiokio and swamp kiokio (*Blechnum minus*) are also present with toetoe occurring in more open areas. Indigenous and exotic scrub, including māhoe, karamū, gorse and blackberry, are dominant on the drier wetland margins⁵⁰.

The Nationally and Regionally Threatened species, swamp buttercup has recently been found in Taupō Swamp West B⁵¹. Historical records show marsh willowweed has also previously been observed within this wetland fragment⁵².

Plimmerton Domain Wetland (Operational area G – 5.0 ha)

The Plimmerton Domain Wetland area comprises the southernmost portion of the KNE site and is bounded by an industrial area on the eastern side. The northern part of this wetland area comprises of scrubland dominated by blackberry and frequent *Carex geminata*. Blackberry-exotic herbs scrub is prevalent along the entire length of the western edge. A number of small areas of open water are present in the wetland interior and are surrounded by *Isolepis prolifera*, *Persicaria decipiens* and *Carex secta*. Central areas characterised by wet, open habitat are largely dominated by a sedgeland mosaic comprising *Carex secta* and *Carex geminata*. This vegetation type grades into a pocket of raupō reedland emergent over *Carex secta* with scattered clumps of *Juncus sarophorus* and *Juncus edgariae* more prominent in the southernmost corner. The southern KNE boundary, adjacent to the mown grassland of Plimmerton Domain, comprises a narrow strip of planted harakeke, tī kōuka, ngaio, māhoe, marbleleaf (*Carpodetus serratus*) and native scrub which separates the amenity area from the wetland⁵³.

Species

Birds

The KNE site is known to provide significant habitat for a range of native wetland bird species, including a number of threatened species. The site is considered to provide seasonal or core habitat⁵⁴ for spotless crane (*Porzana tabuensis*; At Risk-Declining) which has been recorded at the site in recent years^{55,56}. Historic records also indicate Australasian bittern (*Botaurus poiciloptilus*; Nationally Critical), North Island fernbird (*Bowdleria punctata vealeae*; At Risk-Declining) and marsh crane (*Porzana pusilla affinis*; At Risk - Declining) have been known to be present at the site^{57,58,59,60}. Additionally, the variable oystercatcher (*Haematopus unicolor*; At Risk - Recovering), South Island pied oyster catcher (*Haematopus finschi*; At Risk-Declining) and New Zealand falcon (*Falco novaeseelandiae*; At Risk-Recovering) have been recorded within the KNE site^{61,62}.

Other more common bird species known to be present at the KNE site include; swamp harrier (*Circus approximans*), little shag (*Phalacrocorax melanoleucos*), grey warbler (*Gerygone igata*), New Zealand kingfisher (*Todiramphus sanctus vagans*), Spur-winged plover (*Vanellus miles*), pūkeko (*Porphyrio melanotus melanotus*), fantail (*Rhipidura fuliginosa*) and paradise shelduck (*Tadorna variegata*)^{63,64,65}.

A comprehensive list of threatened native bird species recorded within the KNE site are listed in Appendix 2.

Fish and aquatic invertebrates

The Taupō Stream and its tributaries, which traverse the KNE site, provides known habitat of a wide range of freshwater fish species, including a number of threatened species⁶⁶. Four species of fish classified as threatened have previously been recorded in the KNE site and include, giant kōkopu (*Galaxias argenteus*; At Risk-Declining), īnanga (*Galaxias maculatus*; At Risk-Declining), longfin eel (*Anguilla dieffenbachia*; At Risk-Declining) and bluegill bully (*Gobiomorphus hubbsi*; At Risk-Declining)^{67,68,69,70}.

Other non-threatened native fish species known to be present within the KNE site include the shortfin eel (*Anguilla australis*), banded kōkopu (*Galaxias fasciatus*), common bully (*Gobiomorphus cotidianus*), giant bully (*Gobiomorphus gobioides*), redfin bully (*Gobiomorphus huttoni*) and common smelt (*Retropinna retropinna*)^{71,72,73,74}.

A comprehensive list of threatened native fish species recorded within the KNE site are listed in Appendix 2.

Reptiles (herpetofauna)

A lizard survey, funded by QEII, was undertaken in 2016 and found Raukawa gecko (*Woodworthia maculata*) to be present within the KNE site⁷⁵. The barking gecko (*Naultinus punctatus*; At risk-Declining) has also previously been recorded within the vicinity of the KNE site^{76,77,78}.

7. Threats to ecological values at the KNE site

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

7.1 Key threats

The primary threats to the ecological values of the Taupō Swamp Complex KNE site are ecological weed species, pest animals and altered hydrology, sedimentation and degraded vegetation communities resulting from surrounding land use and development activities.

Ecological weeds are widespread throughout the KNE site ranging from exotic climbers such as blackberry, and Japanese honeysuckle (*Lonicera japonica*), ground-covering plants such as montbretia (*Crocsmia × crocosmiiflora*) and arum lily (*Zantedeschia aethiopica*), exotic grasses such as pampas (*Cortaderia selloana/C. jubata*), woody tree species such as grey willow (*Salix cinerea*) and gorse and aquatic weeds such as water celery (*Apium nodiflorum*). The presence of ecological weeds can affect the biodiversity values of a habitat by out-competing and displacing native plants, inhibiting seedling establishment, affecting the structure and composition of ecosystems and altering hydrological conditions that sustain the wetland ecology. This

further hinders the natural regeneration of native vegetation and reduces species diversity and the availability of food resources for native animals. In addition the non-local native species, karo (*Pittosporum crassifolium*) is also considered an ecological weed at the site as it is known to outcompete and/or hybridise with local native species.

Mustelids, such as stoats (*Mustela erminea*), weasels (*Mustela nivalis*) and ferrets (*Mustela furo*), as well as possums (*Trichosurus vulpecula*) and rats (*Rattus* spp.) are the biggest threats to the identified ecological values of the KNE site. These pest species are known to impact native regeneration, compete for food resources and predate native invertebrates and wetland bird species, particularly nesting birds, chicks and eggs. Pest animals are also likely to reinvade from the surrounding landscape and are likely to be an enduring threat to the biodiversity values within the KNE site.

A number of historical activities have caused significant adverse effects to the ecological values of the KNE site such as the construction of SH 1 and the NIMT railway line, as well as industrial development, which severed the wetland complex into multiple swamps and consequently altered the hydrology. Current surrounding land use poses a number of ecological threats to the site including pollution from agricultural run-off and road usage; stormwater run-off contaminated by waste products from motor vehicles; and rubbish discarded by passing travellers⁷⁹.

Additionally, the current proposal to re-zone Plimmerton Farm (the surrounding land adjacent to SH 1) from agricultural farmland to a large-scale residential development poses significant risk to the Taupō Swamp Complex KNE site. Potential ecological impacts of this development include; increased sedimentation generated from earthworks, increased stormwater run-off and possible stormwater detention and management issues, introduction of additional weed species brought in from machinery introduced to the development site and increased pest animal species including feral cats⁸⁰. These changing activities in the surrounding landscape have the potential to affect the quantity and quality of water draining into the Taupō Swamp Complex, via a direct link with Taupō Stream, and could in turn affect the water table⁸¹. Changes in the water table may alter vegetation communities and composition and eliminate susceptible native flora and fauna species⁸².

A barrier to native fish passage is also present within the KNE site with evidence that migratory access is unavailable in some areas preventing migrating fish from completing their life-cycle.

While the key threats discussed in this section are recognised as the most significant, a number of other threats to the KNE site's values have also been identified. Table 3 presents a summary of all known threats to the Taupō Swamp Complex KNE site (including those discussed above), detailing which operational areas they affect, how each threat impacts on ecological values, and whether they will be addressed by operational activities. A map of operational areas can be found in Appendix 1 (see Map 6).

Table 3: Summary of all threats to ecological values present at the Taupō Swamp Complex KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Ecological weeds		
EW-1	Ground covering ecological weeds smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species for control include: montbretia (<i>Crocsmia × crocosmiiiflora</i>) and Arum lily (<i>Zantedeschia aethiopica</i>) (see full list in Appendix 4)	Entire KNE Site
EW-2	Woody weed species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include: willow species (<i>Salix</i> spp.), gorse (<i>Ulex europaeus</i>) and wattle species (<i>Acacia</i> spp.) (see full list in Appendix 4)	Entire KNE Site
EW-3	Climbing weeds smother and displace native vegetation often causing canopy collapse, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include: and blackberry (<i>Rubus fruticosus</i> agg.), old man's beard (<i>Clematis vitalba</i>) and Japanese honeysuckle (<i>Lonicera japonica</i>) (see full list in Appendix 4)	Entire KNE Site
EW-4	Exotic grass species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include: pampas (<i>Cortaderia selloana/C. jubata</i>) and kikuyu (<i>Pennisetum clandestinum</i>) (see full list in Appendix 4)	Entire KNE Site
EW-5	Aquatic/marginal aquatic weeds out-compete native aquatic species and choke watercourses. Key weed species include: reed sweet grass (<i>Glyceria maxima</i>) and reed canary grass (<i>Phalaris arundinacea</i>) (see full list in Appendix 4)	Taupō Stream and open water areas.
Pest animals		
PA-1	Mustelids (stoats ^{83,84} (<i>Mustela erminea</i>), ferrets ^{85,86} (<i>M. furo</i>) and weasels ^{87,88} (<i>M. nivalis</i>)) prey on native birds, lizards and invertebrates, reducing their breeding success and potentially causing local extinctions	Entire KNE site
PA-2	Possums (<i>Trichosurus vulpecula</i>) browse palatable canopy vegetation until it can no longer recover ^{89,90} . This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates ⁹¹	Entire KNE site
PA-3	Rats (<i>Rattus</i> spp.) browse native fruit, seeds and vegetation. They compete with native fauna for food and can reduce forest regeneration. They also prey on invertebrates, lizards and native birds ^{92,93}	Entire KNE site
PA-4*	Hedgehogs (<i>Erinaceus europaeus</i>) prey on native invertebrates ⁹⁴ , lizards ⁹⁵ and the eggs ⁹⁶ and chicks of ground-nesting birds ⁹⁷	Entire KNE site
PA-5*	House mice (<i>Mus musculus</i>) browse native fruit, seeds and vegetation, and prey on invertebrates. They compete with native fauna for food and can reduce forest regeneration. They also prey on invertebrates, lizards and small eggs and nestlings ^{98,99}	Entire KNE site
PA-6*	Feral, stray and domestic cats (<i>Felis catus</i>) prey on native birds ¹⁰⁰ , lizards ¹⁰¹ and invertebrates ¹⁰² , reducing native fauna breeding success and potentially causing local extinctions ¹⁰³	Entire KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
PA-7*	Rabbits (<i>Oryctolagus cuniculus</i>) and hares (<i>Lepus europaeus</i>) graze on palatable native vegetation and prevent natural regeneration in some environments ¹⁰⁴ . In drier times hares especially, will penetrate into wetland forest areas browsing and reducing regenerating native seedlings	Drier margins of the KNE site
PA-8*	Wasps (<i>Vespula</i> spp.) adversely impact native invertebrates and birds through predation and competition for food resources ¹⁰⁵	Entire KNE site
PA-9*	Brown trout (<i>Salmo trutta</i>) and rainbow trout (<i>Oncorhynchus mykiss</i>) prey on native fish and compete with them for food resources ¹⁰⁶	Taupō Stream and open water areas.
Human activities		
HA-1	A barrier (weir) to native fish passage is present in Taupō Stream within the KNE site preventing migrating fish from completing their life-cycle	G (Taupō Stream)
HA-2*	Garden waste dumping often leads to ecological weed invasions into natural areas. Common weed species introduced at this KNE site include: agapanthus (<i>Agapanthus praecox</i>) and montbretia (<i>Crocsmia × crocosmiflora</i>)	Margins of KNE site
HA-3*	Agricultural practices, particularly grazing livestock can result in pugging soils, grazing native vegetation inhibiting regeneration, wildlife disturbance and increasing nutrient content of soils and watercourses ¹⁰⁷	E
HA-4*	Land use activities that alter the local hydrology, such as development schemes and sub-divisions can affect the water levels that sustain wetland ecosystems. These activities are also known to cause sedimentation and add pollutants to wetlands and watercourses.	Entire KNE site
HA-5*	The industrial area immediately to the south of Taupō Swamp has previously been a source of pollution in the Taupō Stream ¹⁰⁸ . Poor water quality affects a range of species in the stream and wetland. High nutrient levels and contaminants within watercourses are often caused by upstream land management practices and pollution events including development practices, forestry and agricultural practices, road run-off and storm water entering the watercourse, and septic tank leakages	Entire KNE site
HA-6*	Dogs (<i>Canis lupus familiaris</i>), if uncontrolled/unleashed can disturb or kill nesting birds and chicks, and lizards within the KNE site, particularly in close proximity to walking tracks ¹⁰⁹	Entire KNE site
Other threats		
OT-1*	Sea fluctuations and increased rainfall during heavy rainfall days as a result of climate change are likely to have a long-term impact on the hydrological cycle and functioning of the wetland complex and wider catchment over time ¹¹⁰	Entire KNE site

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

8. Vision and objectives

8.1 Vision

The Taupō Swamp Complex KNE site comprises a resilient and interconnected wetland ecosystem dominated by intact, representative native vegetation communities and supporting thriving native wetland bird, fish, lizard and invertebrate populations.

8.2 Objectives

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

The following objectives will guide the operational activities at the Taupō Swamp Complex KNE site.

1. **To protect and maintain the interior swamp flaxland, reedland and open water areas.**
2. **To increase the diversity and regeneration of native plant communities present around the wetland margins.**
3. **To protect and enhance habitat for threatened or regionally rare native wetland bird species.**
4. **To maintain and increase existing populations of ‘Threatened’ native plant species present within the KNE site.**
5. **To enhance the values of native fish habitat within the KNE site.**
6. **To support the community in their restoration objectives for the KNE site.**

9. Operational activities

Operational activities are targeted to work towards the objectives above (Section 8) by responding to the threats outlined in Section 7. The broad approach to operational activities is described briefly below, and specific actions, with budget figures where allocated attached, are set out in the operational delivery schedule (Table 4).

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

The primary management activities undertaken in the KNE site are ecological weed control, pest animal control and ecological monitoring.

For practicality of management, the KNE site has been divided into seven operational areas based on their ecological features (See Appendix 1, Map 6). These are:

- A:** Whenua Tapu Swamp (5.2 ha)
- B:** Ara Harakeke Walkway (7.4 ha)
- C:** Main Taupō Swamp Complex (24.5 ha)
- D:** Western Corridor (8.7 ha)

E: Taupō Swamp West D (1.1 ha)

F: Taupō Swamp West B (0.9 ha)

G: Plimmerton Domain Wetland (5.0 ha)

9.1 Ecological weed control

The aim of weed control at the Taupō Swamp Complex KNE site is to protect the wetland interior by reducing the distribution and density of existing weed populations and preventing the incursion of new weed species. This is expected to increase native plant dominance and facilitate natural regeneration of native plant species, in line with all objectives outlined in this plan.

Ecological weed control has been undertaken at the site since 1981 however, ongoing work is required to further reduce priority weed infestations and ensure ecological weeds do not regenerate and spread. An aerial drone weed survey conducted in March 2020¹¹¹ found weed infestations are prevalent around the drier margins and through the southern wetland area.

Ecological weed species recorded at the KNE site and a ranking of the potential ecological impact of each are listed in Appendix 4. Both ground and aerial-based control methods may be required within identified operational areas of the KNE site to ensure the biodiversity values present are protected and maintained.

Ground-based weed control

Multi-species weed control

Multi-species ecological weed control within Whenua Tapu Swamp (Operational Area A), Ara Harakeke Walkway (Operational Area B) and the Western Corridor (Operational Area D) will be undertaken on an annual basis. Priority target weed species include but are not limited to; Japanese honeysuckle, blackberry, pampas, cape ivy (*Senecio angulatus*), old man's beard (*Clematis vitalba*), willow (*Salix* spp.), brush wattle (*Paraserianthes lophantha*), sycamore (*Acer pseudoplatanus*) and silver poplar (*Populus alba*). This work will be undertaken by Greater Wellington's Biosecurity department.

Multi-species ecological weed control will also be undertaken within the Main Taupō Swamp Complex (Operational Area C) on an annual basis. Willows located within the interior wetland area will be prioritised for control over the duration of this plan. Willows will be controlled via ground-based methods where access is permissible on foot however, aerial control may be required if conditions persistently constrain access. Other priority target weed species include but are not limited to; Japanese honeysuckle, blackberry, old man's beard and pampas. This work will be undertaken by Greater Wellington's Biosecurity department. In addition, QEII will undertake their own weed control within this area on an annual basis. This work is reviewed annually and subject to change year to year depending on the needs of the site. Greater Wellington and QEII will conduct an annual onsite meeting to review the progress of

weed control and discuss the planned work for the following year. This will ensure that a coordinated approach to weed control is achieved.

Targeted weed control

Fine scaled and targeted ecological weed control will be undertaken around associations of rare plant species within Taupō Swamp West D (Operational Area E) and Taupō Swamp West B (Operational Area F) with the intention of releasing these species from the competitive pressure of climbing and woody weed species. Priority target weed species include but are not limited to; blackberry, Japanese honeysuckle, willow and gorse. This work will be undertaken by Greater Wellington's Biosecurity department. Further detail regarding the management of rare plant species within the site is outlined in Section 9.4.

Ongoing blackberry control will be undertaken within the Plimmerton Domain Wetland area (Operational Area G). Blackberry is prevalent throughout this area and therefore control will be undertaken in a multi-step approach over the duration of this plan. To achieve this, large areas of blackberry will be sprayed and then mulched on an annual basis. This work will be undertaken by Greater Wellington's Biosecurity department (spraying) and PCC (mulching). Any regrowth that occurs between spray and mulch operations will be cut back and spot-sprayed by FOTSC. Revegetation planting will also be undertaken after weed control efforts have been completed to reduce blackberry regrowth and the incursion of other weed species. Further detail regarding revegetation of this area is outlined in Section 9.3.

Other priority weed species to be controlled within the Plimmerton Domain Wetland area (Operational Area G) include but are not limited to; brush wattle, pampas, old man's beard, convolvulus and willows.

Ongoing control of reed sweet grass (*Glyceria maxima*) and reed canary grass (*Phalaris arundinacea*) within the Main Taupō Swamp Complex (Operational Area C) and the Plimmerton Domain Wetland area (Operational Area G) will also be undertaken as required to target new growth and prevent the establishment of large infestations.

Aerial-based weed control

An aerial application of herbicide by helicopter was undertaken in 2016/17 to target willow species, pampas and blackberry within interior wetland areas of the KNE site (Operational Areas C, E, F and G).

The purpose of this aerial operation was to reduce the negative impacts of these weed species which are known to affect the ecological integrity of wetlands as well as to promote natural regeneration of native species over time.

Follow-up aerial control operations may be required within the term of this plan to control any regrowth of these aerially targeted weed species across the KNE site. Resource consent was granted for a 10 year period to allow for this activity (2017-2027). Any follow-up aerial control operation must be agreed by the landowners involved and will only be undertaken if access is not permissible by foot and there is enough regrowth to warrant such an operation. This will be determined by the Greater Wellington's Biodiversity department prior to any aerial control operation being agreed.

Any aerial control operations undertaken within the term of this plan will occur during the drier months of the year (January to March), when the water levels are at their lowest and young native wetland birds have fledged (ie, spotless crane).

9.2 Pest animal control

The aim of pest animal control at the KNE site is to increase native plant regeneration and the abundance of threatened plants through the control of mammalian browsers, and increase populations of native wetland birds through the control of mammalian predators, in line with objectives 1, 2 and 3 of this plan.

Pest animal control has been undertaken around the margins of the KNE site and in a northern buffer zone area since 2006 to protect native birds that utilise the wetland from predation, reduce native foliage browsing pressure and to control pest animal populations that may reinvade the KNE site. At present, 22 DOC 200 kill-traps, and 35 bait-stations are located around the Taupō Swamp margins, whilst 5 DOC 200 kill-traps, and 20 bait-stations are located in the surrounding buffer zone area to target mustelids, hedgehogs, possums and rats (see Appendix 1, Map 7).

Greater Wellington service and maintain the pest animal trapping network around the Taupō Swamp margins and buffer zone area on a quarterly basis. Additionally, PFP service the kill-traps along the Ara Harakeke Walkway (Operational Area B), around the Plimmerton Domain Wetland area (Operational Area G) and within the buffer zone area on a fortnightly basis. PFP have also deployed a number of supplementary kill-traps in those operational areas to further enhance the trapping network. Bait for traps and bait stations is provided by Greater Wellington.

9.3 Revegetation

The aim of revegetation at the Taupō Swamp Complex KNE site is to increase native plant species dominance, increase the resilience, structure and natural function of native plant communities, provide a seed source to aid natural regeneration and to enhance essential habitat for native wetland birds in line with objectives 1, 2 and 3 of this plan. All plants should be eco-sourced from the Wellington Ecological District.

QEII coordinate and fund all revegetation planting across QEII-owned land within the KNE site. The extent of revegetation undertaken by QEII is determined on an annual basis and subject to change year to year depending on the needs of the site.

In addition, FOTSC undertake restoration planting within the Plimmerton Domain Wetland area (Operational Area G) of the KNE site. Revegetation of this area is carried out in accordance with a restoration planting plan^{112,113} prepared annually by FOTSC. Each plan outlines the plant species that will be used for revegetation in this area as well as specifying the number of plants and designated planting locations. Greater Wellington will support FOTSC in the development of subsequent restoration planting plans to assist in the ongoing revegetation of this area.

9.4 Management of 'Threatened' native plant species

Management of specified native plant species classified as 'Threatened' will be undertaken to maintain or increase existing populations present within the KNE site in line with objective 4 of this plan.

Threatened species such as swamp nettle (*Urtica perconfusa*; At Risk)¹¹⁴ and swamp buttercup (*Ranunculus macropus*; Data Deficient)^{115,116,117,118} have been known to occur within Taupō Swamp West D (Operational Area E) and Taupō Swamp West B (Operational Area F) as recently as 2016. A fine scale management approach will be used to undertake weed control in the vicinity of these threatened plant communities to protect their high ecological value and reduce potential non-target exposure to herbicide. Such management methods will include use of selective herbicides only and hand weeding where herbicide use is not appropriate. Threatened plant populations will be monitored annually after weed control works. If these plant populations indicate decline, plantings may be required to sustain their population numbers. Ecological weed control in these areas will be undertaken by Greater Wellington's Biosecurity department.

9.5 Monitoring

QEII have previously funded the delivery of wetland bird and lizard monitoring, weed surveying and vegetation mapping within the Taupō Swamp Complex KNE site to determine the condition of the site, identify trends over time and identify threats to the ecological values present. The QEII regional rep undertakes an annual monitoring visit to the QEII managed site and this work will continue to occur, additional ad-hoc monitoring occurs when the QEII rep is onsite to undertake restoration actions.

Taupō Swamp is connected to Porirua Harbour and has continuous native vegetation cover. As such, the site has the potential to contain a diverse range of indigenous fish species, including species that have not yet been observed. Previous fish surveys undertaken have recorded a number of freshwater fish species present however, much of this data is now considered historical having been collected in the early 1980s. Therefore, a baseline fish survey will be undertaken within the term of this plan to determine the current fish species present. This data will be used to inform future management activities to protect and maintain freshwater fish habitat at the site. This baseline fish survey will be funded by Greater Wellington and undertaken by an approved external contractor.

A series of nine photopoint monitoring sites were set up within the Taupō Swamp Complex KNE site during the development of this plan. The photopoint locations comprise of both aerial (via drone) and ground-based sites to provide a complete and accurate depiction of the entire site (see Appendix 1, Map 1). Photos will be taken annually by the Greater Wellington Biodiversity Advisor for the KNE site at each photopoint location to provide a visual record of changes in native and exotic vegetation composition in response to management activities undertaken and natural ecological processes that are occurring. This visual record over time will be used to monitor existing management effectiveness and help guide future management actions at the KNE site.

Additionally, the Taupō Swamp Complex KNE site is part of Greater Wellington's Wetland Health State of the Environment (SoE) monitoring programme that is undertaken by the Environmental Science department on a five-yearly basis at key wetland sites in the region. The Taupō Swamp Complex KNE site was first surveyed in 2018/2019 and will be surveyed again in 2023/2024. As part of this survey the vegetation composition, soil condition, plant nutrient status, wetland condition and wetland pressure index is recorded from four plots throughout the complex. An indicator wetland bird survey is also undertaken surveying for Australasian bittern and spotless and marsh crake. The follow-up survey in 2023/2024 will be used to identify trends in wetland health and areas for improvement to guide management activities at the KNE site. The SoE monitoring results are provided to all KNE landowners once completed.

9.6 Remediating fish passage

The Taupō Swamp Complex KNE site comprises a continuous water level monitoring station located within Operational Area D as part of Greater Wellington's Hydrology State of the Environment monitoring programme. The monitoring station has required the damming of the stream system and a "V" notch outfall which consequently impeded fish passage. To remedy this, a fish pass structure was installed.

Two fish passage assessments have since been undertaken at the site including, a fish survey in 2005¹¹⁹ and more recently a visual assessment in 2019¹²⁰ using the National Institute of Water and Atmospheric Research (NIWA) Fish Passage Assessment Survey mobile application based on the New Zealand Fish Passage Guidelines¹²¹. Both assessments found that the fish pass structure still poses a considerable risk to fish passage. Therefore, a fish passage remediation action plan will be prepared and implemented based on these findings by the Greater Wellington Biodiversity Advisor for the KNE site within the term of this plan.

9.7 Community engagement

The purpose of community engagement at the Taupō Swamp Complex KNE site is to support existing groups engaging in biodiversity projects and to raise awareness of the site's ecological and cultural values within the community to protect those values in line with objective 6 of this plan.

Greater Wellington support FOTSC in undertaking restoration activities within the Plimmerton Domain Wetland area (Operational Area G) in accordance with their 'Taupō Swamp Restoration Project 2019-2023'. Restoration activities FOTSC undertake in the area include; weed control, revegetation planting and ongoing pest animal control through PFP. Greater Wellington will continue to support FOTSC and provide advice as required to assist in the ongoing protection of the values in this area.

10. Future management and mitigation opportunities

There are numerous potential opportunities for Greater Wellington, landowners, iwi, community groups, and/or other agencies to explore and be involved in the biodiversity management of the site. Greater Wellington would welcome and support future involvement in any identified activities within this KNE plan from such parties. Some future opportunities include;

- Targeted control of karo throughout the KNE site to reduce competition and/or hybridisation with local native species.
- Investigation and implementation of a cape pondweed (*Aponogeton distachyos*) eradication or management plan to target infestations located within the Taupō stream south of the KNE site. Investigation should include consultation with PCC, the Biosecurity department, the Flood Protection department, FOTSC and industry experts on various eradication and management methods.
- Undertake a follow-up bird monitoring survey. A baseline survey of wetland birds present within the KNE site was undertaken by QEII in 2015 and found spotless crane to be present indicating that this is a possible refuge site for the species. A follow-up bird survey would allow us to reconfirm the presence of spotless crane as well as other threatened bird species that have been historically observed. Furthermore, continued follow-up monitoring will enable a comprehensive dataset to be compiled over time which will be used to inform future management activities, particularly pest animal control, to better protect wetland bird species present at the site.

11. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Taupō Swamp Complex KNE site, and their timing and cost where allocated over the five-year period from 1 July 2020 to 30 June 2025. The budget for years 2021/22 to 2024/25 are indicative only and subject to change. A map of operational areas can be found in Appendix 1 (see Map 6).

Table 4: Five-year operational plan for the Taupō Swamp Complex KNE site

Objective	Management activity	Operational area	The Actions: Description/detail	Intended 5 year outcomes	Delivery	Frequency and funding where allocated				
						2020/21	2021/22	2022/23	2023/24	2024/25
1, 2, 3	Ecological weed control	A, B, D	Control of priority ecological weed species.	Suppression of priority weed species in marginal areas to prevent any new weed incursions in to the wetland proper.	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2, 3	Ecological weed control	C	Control of priority ecological weed species.	Suppression of priority weed species within the wetland proper; existing willow infestations are subject to ongoing control and new willow growth is controlled annually as it is discovered.	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2, 3	Ecological weed control	C	Control of priority ecological weed species.	Reduction in distribution and abundance of priority weed species on QEII owned land.	QEII	✓ [†]	✓ [†]	✓ [†]	✓ [†]	✓ [†]
1, 2, 3, 6	Ecological weed control	G	Ongoing blackberry control via ground-based control methods	Large infestations of blackberry are significantly reduced and new growth is controlled annually as it is discovered.	GWRC Biosecurity department	✓	✓	✓	✓	✓

Objective	Management activity	Operational area	The Actions: Description/detail	Intended 5 year outcomes	Delivery	Frequency and funding where allocated				
						2020/21	2021/22	2022/23	2023/24	2024/25
1, 2, 3	Ecological weed control	G	Mulching of blackberry following control via ground-based control methods	Controlled blackberry is cleared from the site annually to promote the success of revegetation planting.	PCC	✓	✓	✓	✓	✓
1, 2, 3	Ecological weed control	G	Follow-up spot spraying and cutting of blackberry after control and mulching to target regrowth	No regeneration of blackberry infestations within previously controlled and mulched areas.	FOTSC	✓	✓	✓	✓	✓
1, 2, 3, 5	Ecological weed control	C, G	Control of reed sweet grass and reed canary grass as required.	Native aquatic margin vegetation dominance and fish habitat is maintained.	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2, 3	Ecological weed control	C, E, F, G	Annual monitoring of willow regrowth with follow-up aerial control if required. The need for follow-up control will be confirmed by the Biodiversity Advisor.	No regeneration of previously controlled willow infestations.	GWRC Biosecurity department	TBC^	TBC^	TBC^	TBC^	TBC^
1, 2, 3	Pest animal control	Entire KNE site and buffer zone	Traps and bait stations serviced on a three monthly basis and annual audit.	Browsing pest animal populations are maintained to: possums <5% RTC*; rats <10% TTI**; mustelids <2% TTI** to facilitate native vegetation growth and protect wetland bird species.	GWRC Biosecurity department	✓ \$4,500	✓ \$4,500	✓ \$4,500	✓ \$4,500	✓ \$4,500

Objective	Management activity	Operational area	The Actions: Description/detail	Intended 5 year outcomes	Delivery	Frequency and funding where allocated				
						2020/21	2021/22	2022/23	2023/24	2024/25
1, 2, 3, 6	Pest animal control	B, G	Traps serviced on a fortnightly basis.	Browsing pest animal populations are maintained to: possums <5% RTC*; rats <10% TTI**; mustelids <2% TTI** to facilitate native vegetation growth and protect wetland bird species.	PFP	✓	✓	✓	✓	✓
1, 2, 3, 6	Revegetation	G	Revegetation planting of areas where blackberry control and mulching efforts have been completed.	Significant reduction in blackberry regrowth and an increase in the diversity and regeneration of native plant communities.	FOTSC	✓	✓	✓	✓	✓
1, 2, 3	Revegetation	C	Revegetation planting of 'fire site' and other interior wetland areas as determined on an annual basis.	Increase in the diversity and regeneration of native plant communities.	QEII	✓	✓	✓	✓	✓
4	Management of threatened native plant species	E, F	Fine scale ecological weed control around threatened plant species	Existing populations of 'threatened' plant species are maintained and there is an increase in their distribution across the site.	GWRC Biosecurity department	✓	✓	✓	✓	✓
5	Monitoring	Entire KNE site	Wetland and stream fish survey	Baseline information on the current fish species present is determined and the management requirements are identified.	GWRC Biodiversity department		✓ ⁺⁺			

Objective	Management activity	Operational area	The Actions: Description/detail	Intended 5 year outcomes	Delivery	Frequency and funding where allocated				
						2020/21	2021/22	2022/23	2023/24	2024/25
1, 2, 3, 4	Monitoring	Entire KNE site	Aerial and ground-based photopoint photos taken at specified locations at the KNE site.	Changes in native and exotic vegetation composition overtime are determined and is being used to inform management.	GWRC Biodiversity department	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)
1, 2, 3, 4	Monitoring	Entire KNE site	SOE wetland health monitoring of vegetation and birds.	Trends in wetland health are quantified and areas for improvement are identified.	GWRC Environmental Science department				✓	
5	Fish passage remediation	G	Development and implementation of a fish passage remedial action plan.	Native fish habitat and linkages are supported and migration is unimpeded.	GWRC Biodiversity department	✓ ⁺⁺				
6	Community engagement	Entire KNE site	Effectively support community groups undertaking biodiversity projects/management activities within the KNE site.	Community groups are well supported, feel valued and continue to engage in protecting the values of the KNE site.	GWRC Biodiversity department	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)

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

⁺ = This work is reviewed annually and subject to change year to year depending on the needs of the site.

[^] = The need for an aerial operation within the term of this plan will be determined and confirmed by the Biodiversity Advisor.

⁺⁺ = The timeframe for this action is indicative only and may be undertaken at any time over the duration of this plan.

12. Funding contributions

12.1 Budget allocated by Greater Wellington

The budget for the years 2021/22 to 2024/25 are indicative only and subject to change.

Table 5: Greater Wellington allocated budget for the Taupō Swamp Complex KNE site

Management activity	Timetable and resourcing				
	2020/21	2021/22	2022/23	2023/24	2024/25
Ecological weed control	\$11,000	\$6,000	\$11,000	\$11,000	\$11,000
Pest animal control	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500
Monitoring	-	\$5,000	-	-	-
Total	\$15,500	\$15,500	\$15,500	\$15,500	\$15,500

12.2 Budget allocated by PCC

The budget for the years 2021/22 to 2024/25 are indicative only and subject to change.

Table 6: PCC allocated budget for the Taupō Swamp Complex KNE site

Management activity	Timetable and resourcing				
	2020/21	2021/22	2022/23	2023/24	2024/25
Ecological weed control	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
Total	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000

12.3 Budget allocated by QEII National Trust

The budget has not been accounted for in the operational plan as it is indicative only and subject to change and to an annual management review of site monitoring requirements.

Table 7: QEII National Trust allocated budget for the Taupō Swamp Complex KNE site

Management activity	Timetable and resourcing				
	2020/21	2021/22	2022/23	2023/24	2024/25
Ecological weed control	\$6,000^	\$6,000^	\$6,000^	\$6,000^	6,000^
Revegetation					
Monitoring	\$1,000^	\$1,000^	\$1,000^	\$1,000^	\$1,000^
Total	\$7,000	\$7,000	\$7,000	\$7,000	\$7,000

^Funding is subject to annual management review and the final sum allocated is subject to change.

12.4 Budget allocated by KiwiRail

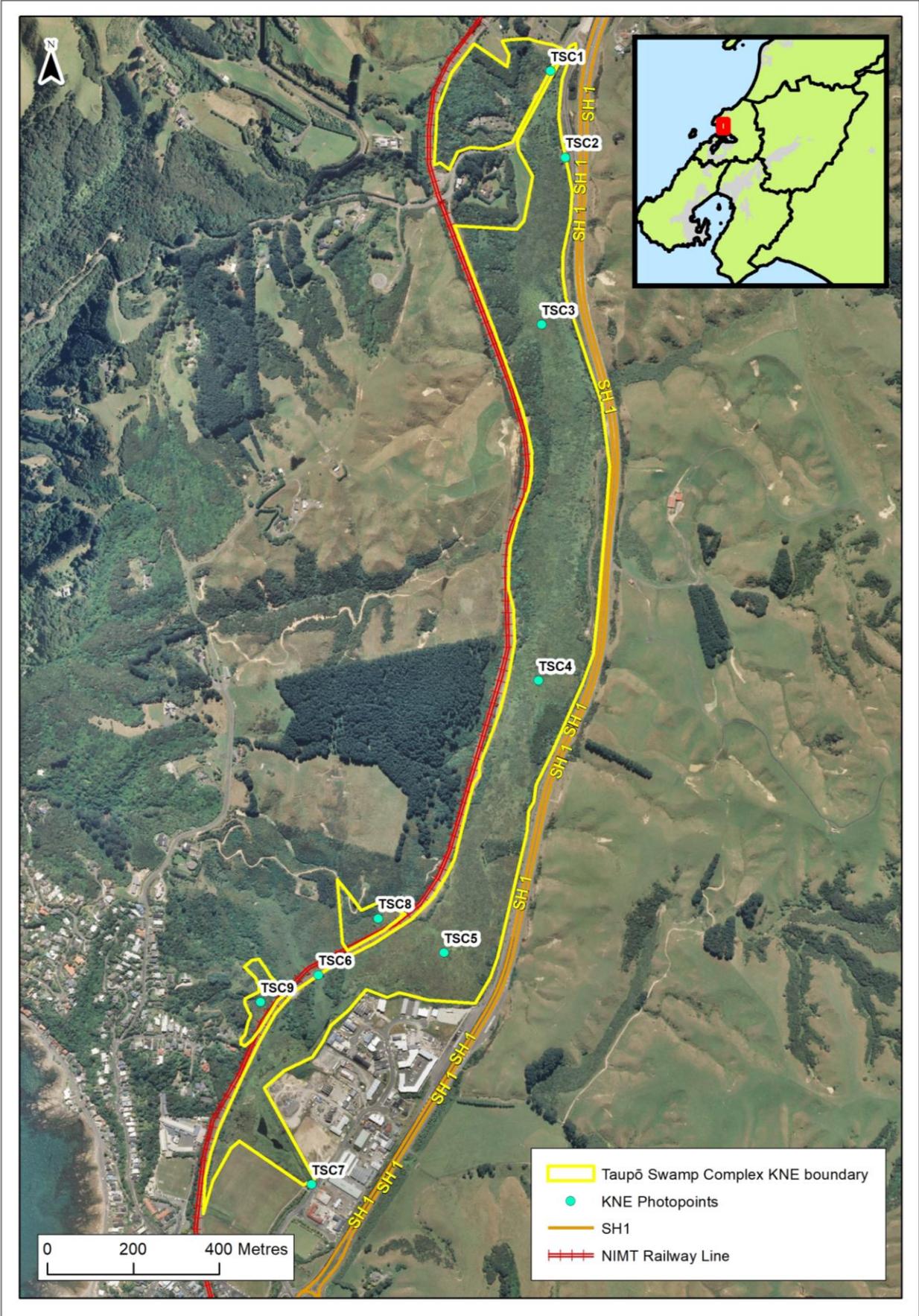
The budget for the years 2021/22 to 2024/25 are indicative only and subject to change.

Table 8: KiwiRail allocated budget for the Taupō Swamp Complex KNE site

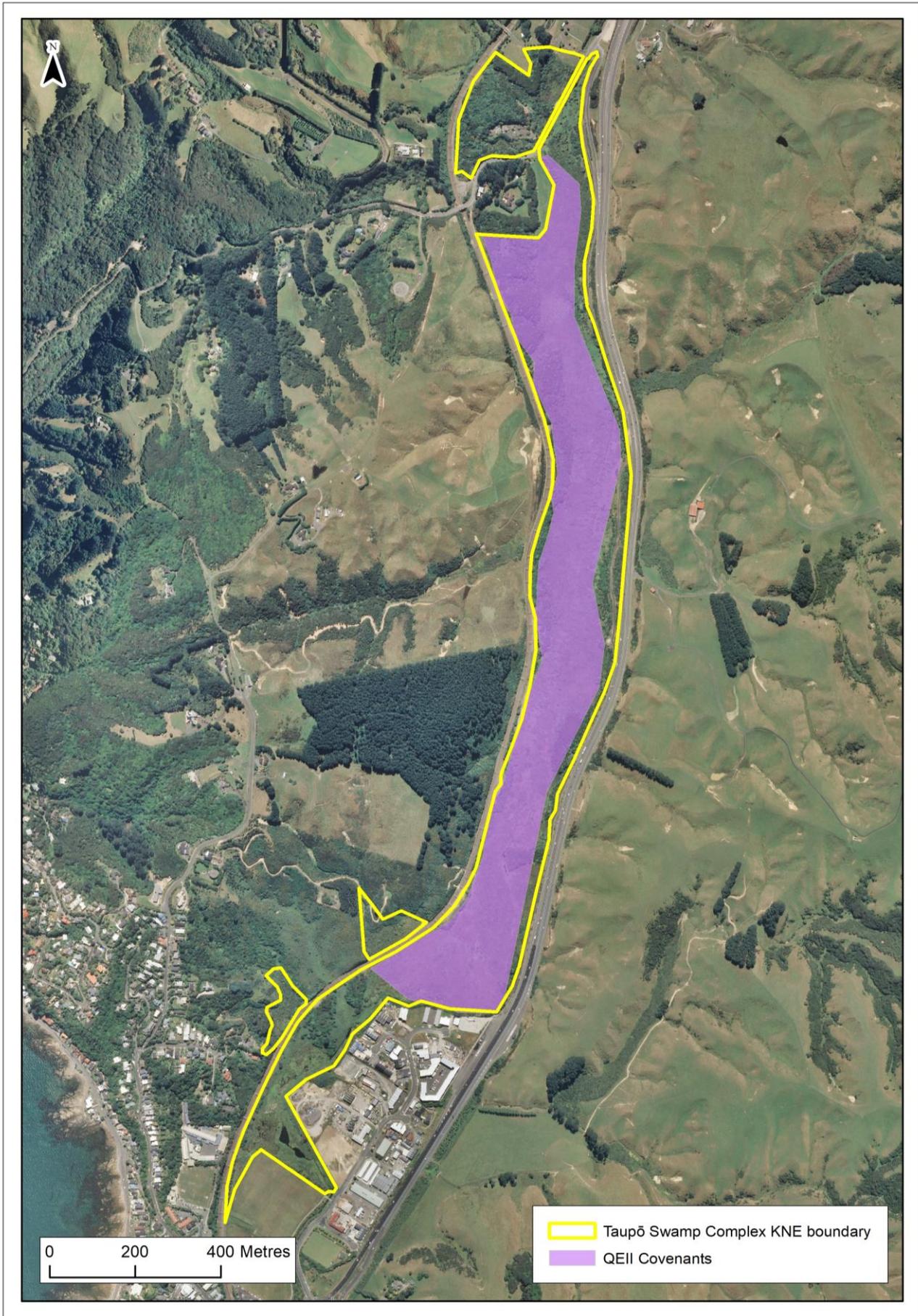
Management activity	Timetable and resourcing				
	2020/21	2021/22	2022/23	2023/24	2024/25
Ecological weed control	\$5,000*	\$5,000*	\$5,000*	\$5,000*	\$5,000*
Total	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000

*Funding is allocated annually by KiwiRail and is subject to annual review. The final sum allocated is subject to change.

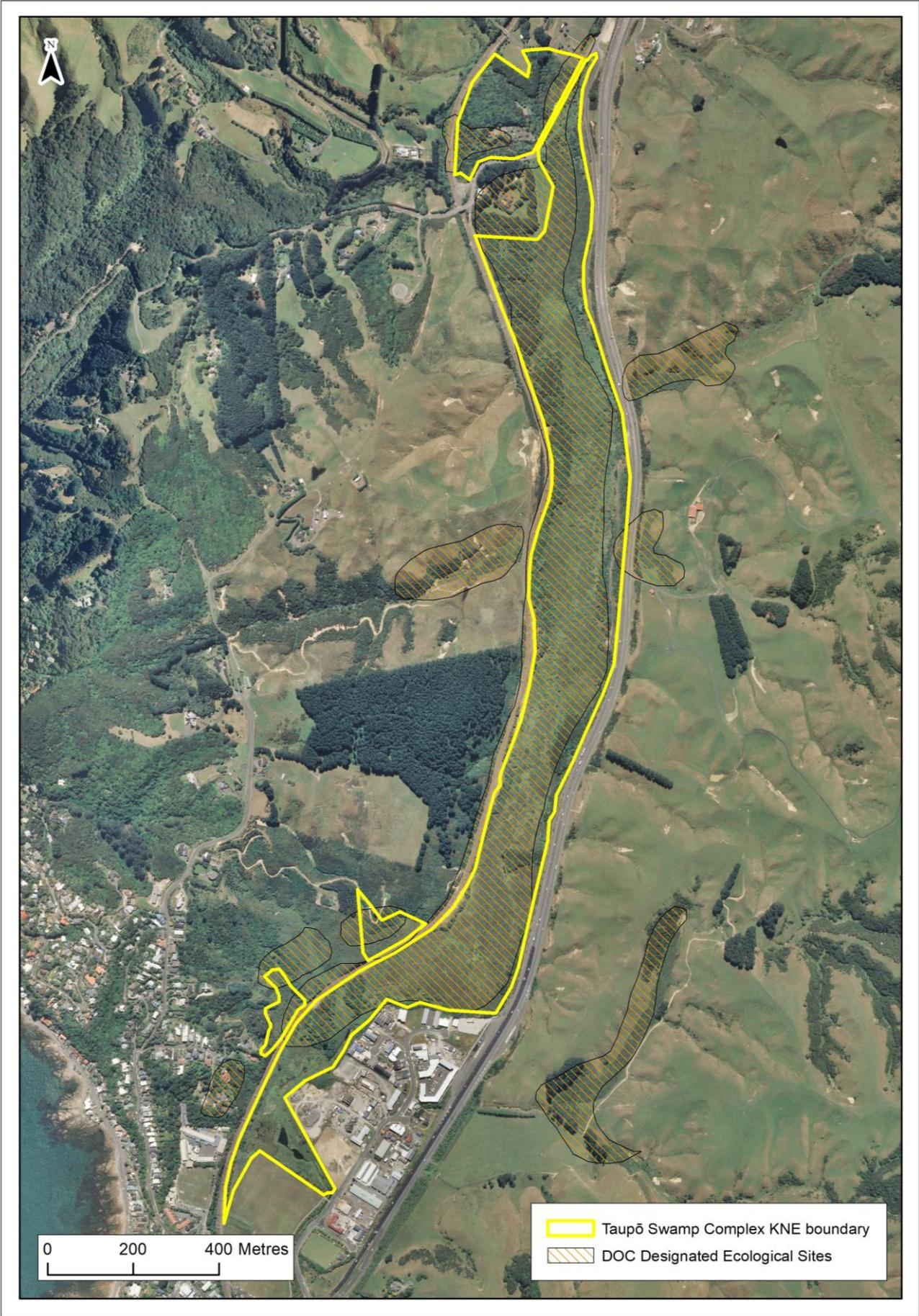
Appendix 1: Site maps



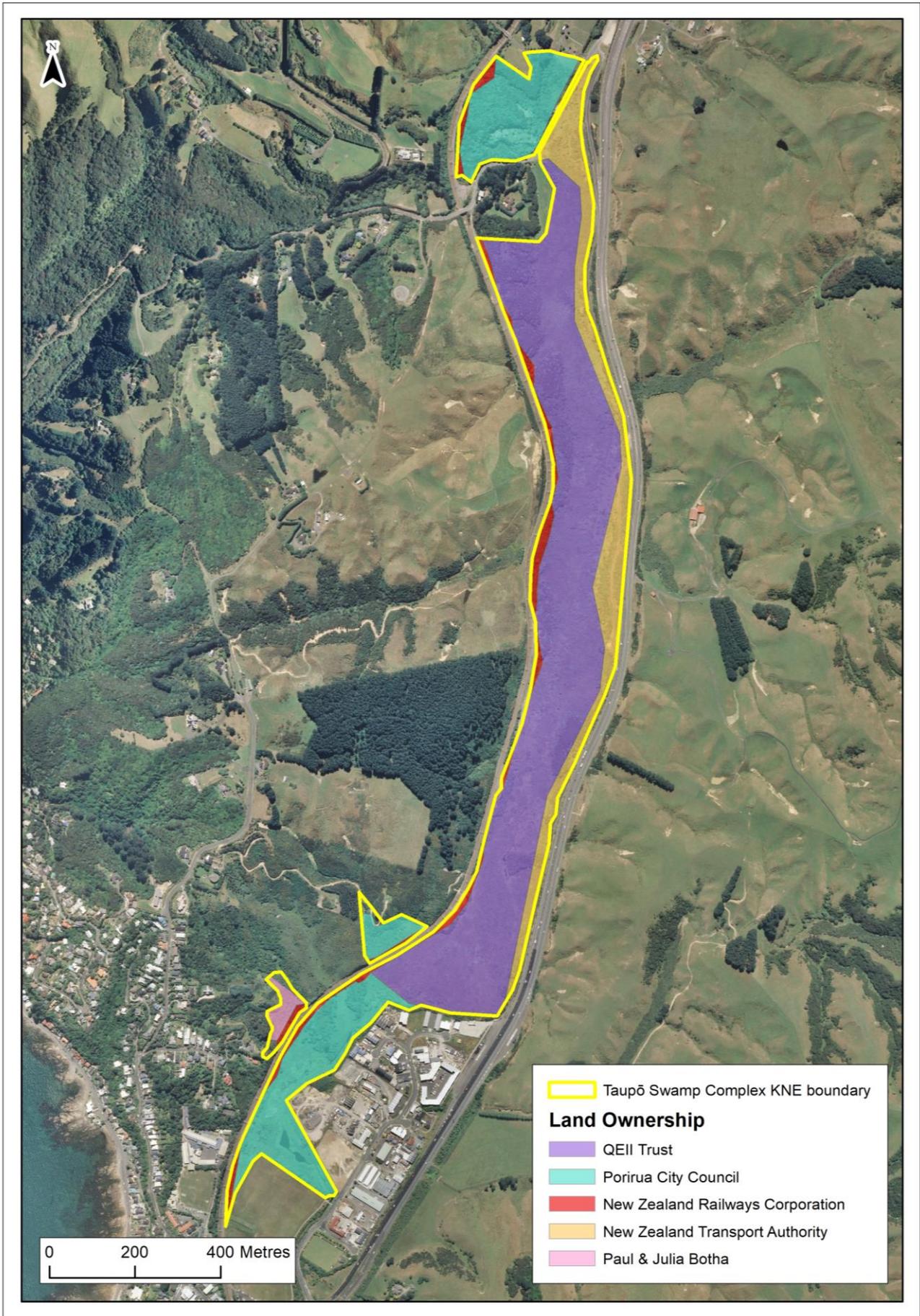
Map 1: The Taupō Swamp Complex KNE site within the context of the wider landscape



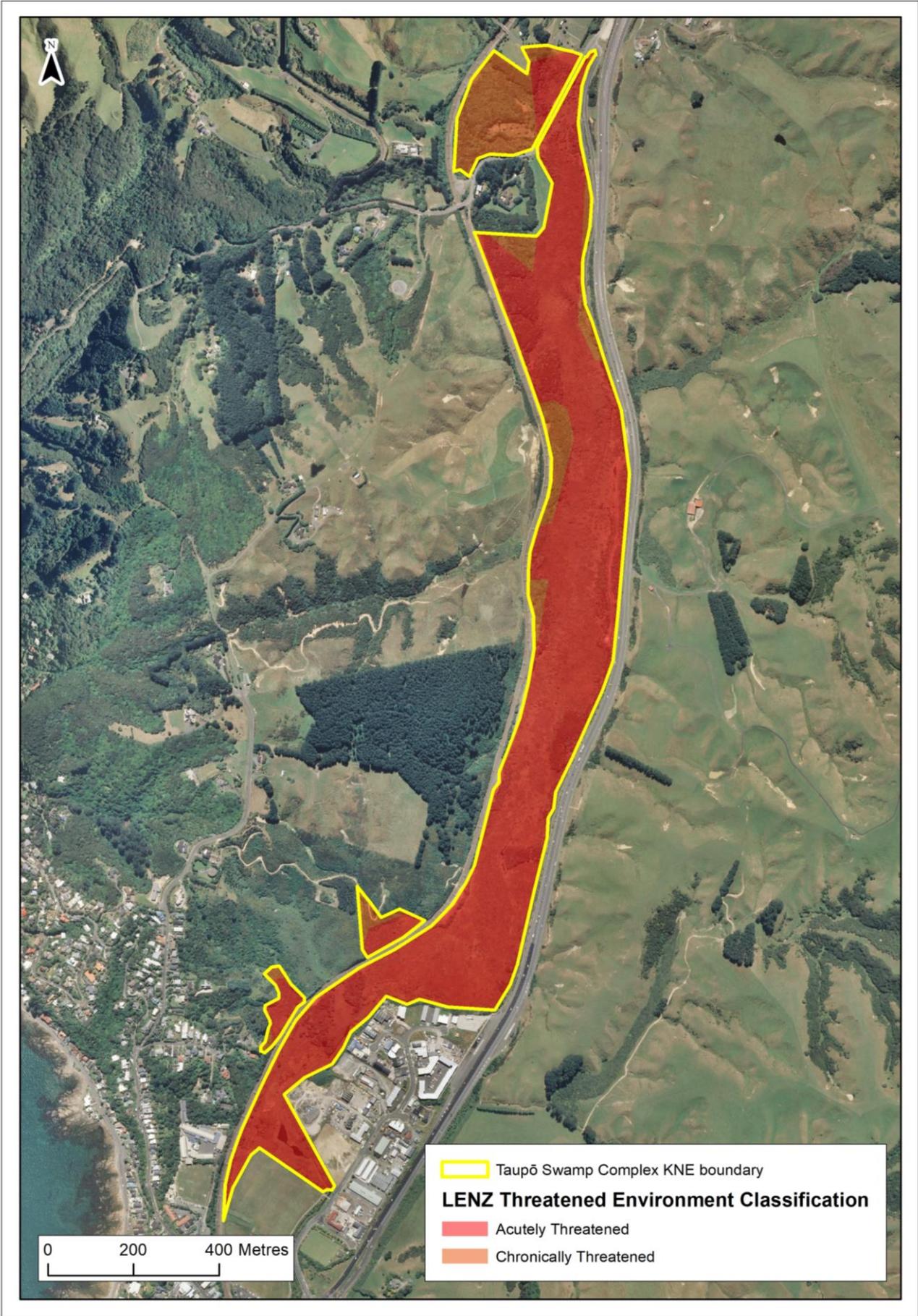
Map 2: QEII covenants within the Taupō Swamp Complex KNE site



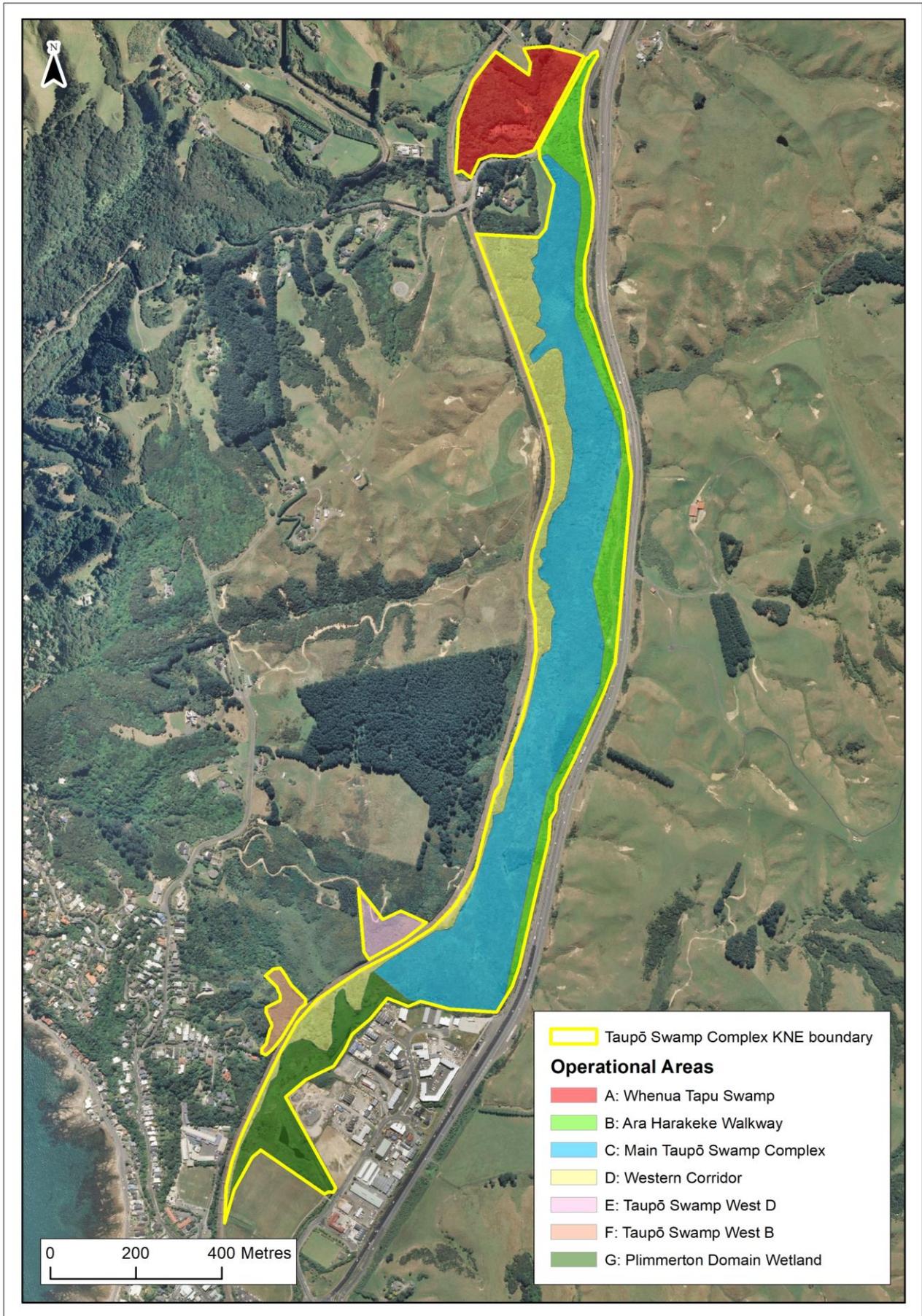
Map 3: DOC Designated Ecological Sites within the Taupō Swamp Complex KNE site



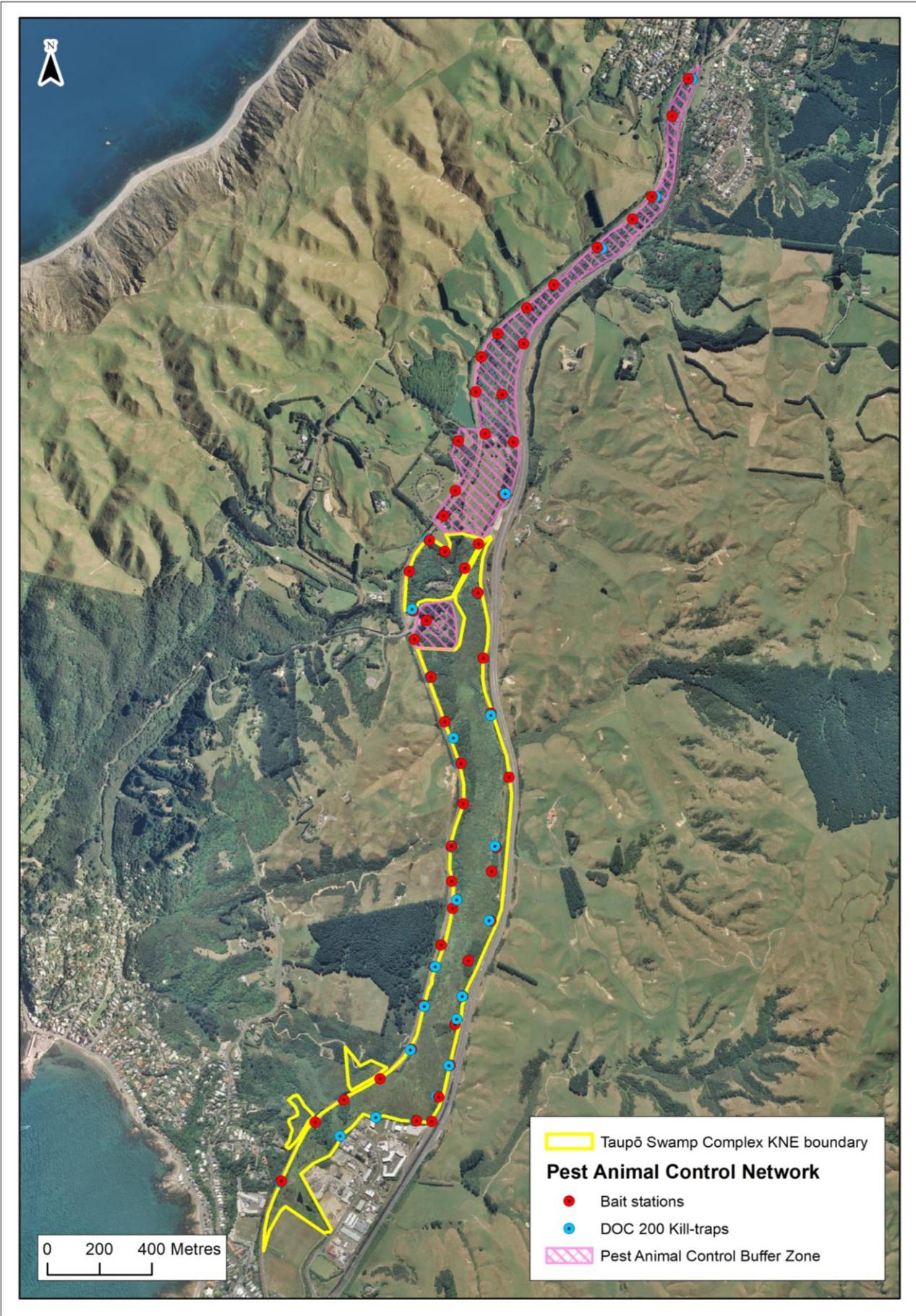
Map 4: Land ownership within the Taupō Swamp Complex KNE site



Map 5: Land Environment New Zealand threat classifications for the Taupō Swamp Complex KNE site



Map 6: Operational areas in the Taupō Swamp Complex KNE site



Map 7: Location of the pest animal control network within the Taupō Swamp Complex KNE site

Appendix 2: Nationally threatened species list

The New Zealand Threat Classification System lists species according to their threat of extinction. The status of each species group (plants, reptiles, etc) is assessed over a five-year cycle¹²². 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 Taupō Swamp Complex KNE site.

Table 9: Threatened and At Risk species at the Taupō Swamp Complex KNE site

Scientific name	Common name	Threat status	Observation
Plants(vascular) ¹²³			
<i>Kunzea robusta</i>	Kānuka	Threatened – Nationally Vulnerable	Porirua City Council, 2019 ¹²⁴
<i>Leptospermum scoparium</i>	Mānuka	At Risk - Declining	Wildlands, 2016 ¹²⁵ ; Porirua City Council, 2019
<i>Ranunculus macropus</i>	Swamp buttercup	Data Deficient	Ogle, 1978 ¹²⁶ ; Bagnall & Ogle, 1981 ¹²⁷ ; Enright and Smith, 2015 ¹²⁸ ; Wildlands, 2016 ¹²⁹
<i>Urtica perconfusa</i>	Swamp nettle	At Risk – Declining	Bagnall & Ogle, 1981
Birds ¹³⁰			
<i>Botaurus poiciloptilus</i>	Australasian Bittern	Threatened – Nationally Critical	Parrish, 1984 ¹³¹ ; Cromarty & Scott 1996 ¹³² ; Todd et al. 2013 ¹³³
<i>Bowdleria punctata vealeae</i>	North Island fernbird	At Risk - Declining	Parrish, 1984
<i>Falco novaeseelandiae</i>	New Zealand falcon	At Risk - Recovering	Porirua City Council, 2019
<i>Haematopus finschi</i>	South Island pied oyster catcher	At Risk - Declining	Small, 2015 ¹³⁴
<i>Haematopus unicolor</i>	Variable oystercatcher	At Risk - Recovering	Small, 2015
<i>Porzana pusilla affinis</i>	Marsh crake	At Risk - Declining	Parrish, 1984; Todd et al. 2013
<i>Porzana tabuensis</i>	Spotless crake	At Risk - Declining	Parrish, 1984; Small, 2015; http://ebird.org/content/newzealand/ (accessed July 2019) ¹³⁵
Freshwater fish ¹³⁶			
<i>Anguilla dieffenbachia</i>	Longfin eel	At Risk - Declining	Porirua City Council, 1980 ¹³⁷ ; Hicks, 1980 ¹³⁸
<i>Galaxias argenteus</i>	Giant kōkopu	At Risk - Declining	Porirua City Council, 1980; Hicks, 1980
<i>Galaxias maculatus</i>	Īnanga	At Risk - Declining	Hicks, 1980
<i>Gobiomorphus hubbsi</i>	Bluegill bully	At Risk - Declining	Hicks, 1980; Leigh, 2005 ¹³⁹

Appendix 3: Regionally threatened plant species list

The following table lists regionally threatened species that have been recorded in the Taupō Swamp Complex KNE site. Native plant species have been identified in the Conservation status of indigenous vascular plant species in the Wellington region report 2020¹⁴⁰.

Table 10: Regionally threatened plant species recorded in the Taupō Swamp Complex KNE site

Scientific name	Common name	Threat status	Observation
Plants			
<i>Diplazium australe</i>	Austral Lady Fern	Threatened - Regionally Vulnerable	Enright and Smith, 2015 ¹⁴¹ ; Wildlands, 2016 ¹⁴²
<i>Epilobium chionanthum</i>	Marsh willowweed	At Risk – Naturally Uncommon	Ogle, 1978 ¹⁴³ ; Enright and Smith, 2015
<i>Lindsaea linearis</i>	<i>Lindsaea linearis</i>	At Risk – Naturally Uncommon	Wildlands, 2016
<i>Ranunculus macropus</i>	Swamp buttercup	Data Deficient	Ogle, 1978; Bagnall & Ogle, 1981 ¹⁴⁴ ; Enright and Smith, 2015; Wildlands, 2016
<i>Urtica perconfusa</i>	Swamp nettle	Threatened - Regionally Critical	Bagnall & Ogle, 1981

Appendix 4: Ecological weed species

The following table lists key ecological weed species that have been recorded in the Taupō Swamp Complex KNE site.

Table 11: Ecological weed species recorded in the Taupō Swamp Complex KNE site

Scientific name	Common name	Priority	Weed type
<i>Asparagus setaceus</i>	Asparagus fern	Severe	Climber
<i>Clematis vitalba</i>	Old man's beard	Severe	Climber
<i>Lonicera japonica</i>	Japanese honeysuckle	Severe	Climber
<i>Passiflora</i> spp.	Banana passionfruit	Severe	Climber
<i>Rubus fruticosus</i> agg.	Blackberry	Severe	Climber
<i>Salix cinerea</i>	Grey willow	Severe	Woody
<i>Salix fragilis</i>	Crack willow	Severe	Woody
<i>Acer pseudoplatanus</i>	Sycamore	High	Woody
<i>Apium nodiflorum</i>	Water celery	High	Marginal aquatic
<i>Cortaderia jubata</i>	Purple pampas grass	High	Exotic grass
<i>Cortaderia selloana</i>	Pampas	High	Exotic grass
<i>Corynocarpus laevigatus</i> *	Karaka	High	Woody
<i>Delairea odorata</i>	German Ivy	High	Climber
<i>Erica lusitanica</i>	Spanish heath	High	Woody
<i>Glyceria maxima</i>	Reed sweetgrass	High	Marginal aquatic
<i>Hedera helix</i>	Ivy	High	Climber
<i>Hedychium</i> spp.	Ginger	High	Groundcover
<i>Ilex aquifolium</i>	Holly	High	Woody
<i>Ipomoea indica</i>	Blue morning glory	High	Climber
<i>Phalaris arundinacea</i>	Reed canary grass	High	Marginal aquatic
<i>Pittosporum crassifolium</i> *	Karo	High	Woody
<i>Prunus</i> spp.	Cherry	High	Woody
<i>Selaginella kraussiana</i>	African club moss	High	Groundcover
<i>Senecio angulatus</i>	Cape ivy	High	Climber
<i>Zantedeschia aethiopica</i>	Arum lily	High	Groundcover
<i>Acacia</i> spp.	Wattle	Moderate	Woody
<i>Agapanthus praecox</i> subsp. <i>orientalis</i>	Agapanthus	Moderate	Groundcover
<i>Aponogeton distachyos</i>	Cape pondweed	Moderate	Aquatic
<i>Asparagus scandens</i>	Climbing asparagus	Moderate	Climber

Scientific name	Common name	Priority	Weed type
<i>Bidens frondosa</i>	Beggars ticks	Moderate	Marginal aquatic
<i>Calystegia silvatica.</i>	Bindweed	Moderate	Climber
<i>Chrysanthemoides monilifera</i>	Boneseed	Moderate	Woody
<i>Cotoneaster</i> spp.	Cotoneaster	Moderate	Woody
<i>Crataegus monogyna</i>	Hawthorn	Moderate	Woody
<i>Gunnera tinctoria</i>	Chilean rhubarb	Moderate	Groundcover
<i>Leycesteria formosa</i>	Himalayan honeysuckle	Moderate	Climber
<i>Lycium ferocissimum</i>	Boxthorn	Moderate	Woody
<i>Paraserianthes lophantha</i>	Brush wattle	Moderate	Woody
<i>Populus alba</i>	Silver poplar	Moderate	Woody
<i>Populus nigra</i>	Lombardy poplar	Moderate	Woody
<i>Rhododendron ponticum</i>	Rhododendron	Moderate	Woody
<i>Rumex sagittatus</i>	Climbing dock	Moderate	Climber
<i>Solanum chenopodioides</i>	Velvety nightshade	Moderate	Climber
<i>Solanum nigrum</i>	Black nightshade	Moderate	Groundcover
<i>Tradescantia fluminensis</i>	Tradescantia	Moderate	Groundcover
<i>Ulex europaeus</i>	Gorse	Moderate	Woody
<i>Vinca major</i>	Periwinkle	Moderate	Groundcover
<i>Agrostis stolonifera</i>	Creeping bent	Low	Exotic grass
<i>Anthoxanthum odoratum</i>	Sweet vernal	Low	Exotic grass
<i>Berberis glaucocarpa</i>	Barberry	Low	Woody
<i>Buddleja davidii</i>	Buddleia	Low	Woody
<i>Cenchrus clandestinus</i>	Kikuyu grass	Low	Exotic grass
<i>Chamaecytisus palmensis</i>	Tree lucerne	Low	Woody
<i>Crocasmia × crocosmiiflora</i>	Montbretia	Low	Groundcover
<i>Cupressus macrocarpa</i>	Macrocarpa	Low	Woody
<i>Cytisus scoparius</i>	Broom	Low	Woody
<i>Dactylis glomerata</i>	Cocksfoot	Low	Exotic grass
<i>Ehrharta erecta</i>	Veldt grass	Low	Exotic grass
<i>Erythranthe guttata</i>	Monkey musk	Low	Marginal aquatic
<i>Eucalyptus</i> spp.	Gum trees	Low	Woody
<i>Foeniculum vulgare</i>	Fennel	Low	Groundcover
<i>Genista monspessulana</i>	Montpellier broom	Low	Woody
<i>Glyceria fluitans</i>	Floating sweetgrass	Low	Aquatic
<i>Holcus lanatus</i>	Yorkshire fog	Low	Exotic grass

Scientific name	Common name	Priority	Weed type
<i>Hydrangea macrophylla</i>	Hydrangea	Low	Groundcover
<i>Iris pseudacorus</i>	Yellow flag	Low	Groundcover
<i>Jacobaea vulgaris</i>	Ragwort	Low	Groundcover
<i>Juncus articulatus</i>	Jointed rush	Low	Groundcover
<i>Lavatera arborea</i>	Tree mallow	Low	Groundcover
<i>Lolium perenne</i>	Rye grass	Low	Exotic grass
<i>Lupinus arboreus</i>	Tree lupin	Low	Woody
<i>Metrosideros excelsa</i> *	Pohutukawa	Low	Woody
<i>Phalaris</i> sp.	Canary grass	Low	Exotic grass
<i>Pinus nigra</i>	Black pine	Low	Woody
<i>Pinus radiata</i>	Radiata pine	Low	Woody
<i>Poa annua</i>	Annual poa	Low	Exotic grass
<i>Prunus × domestica</i>	Plum	Low	Woody
<i>Quercus</i> spp.	Oak	Low	Woody
<i>Sambucus nigra</i>	Elder	Low	Woody
<i>Schedonorus arundinaceus</i>	Tall fescue	Low	Exotic grass
<i>Solanum pseudocapsicum</i>	Jerusalem cherry	Low	Woody

* Denotes a New Zealand native plant that is not local to the Wellington Region

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Greater Wellington Regional Council:

Wellington office
PO Box 11646
Manners Street
Wellington 6142

T 04 384 5708
F 04 385 6960

Upper Hutt office
PO Box 40847
Upper Hutt 5018

T 04 526 4133
F 04 526 4171

Masterton office
PO Box 41
Masterton 5840

T 06 378 2484
F 06 378 2146

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