

# Key Native Ecosystem Operational Plan for Otepua-Paruāuku Wetlands

2020-2025





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## 1. Purpose

The purpose of the five-year Key Native Ecosystem (KNE) Operational Plan for Otepua-Paruāuku Wetlands 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)<sup>1</sup>.

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

### **Greater Wellington Long Term Plan**

The Long Term Plan (2018-2028)<sup>2</sup> 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 Strategy<sup>3</sup> (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. Otepua-Paruāuku Wetlands Key Native Ecosystem site

The Otepua-Paruāuku Wetlands (sometimes referred to as Pukehou Swamp and Pritchards Swamp) KNE site (48 ha) is located adjacent to State Highway 1 (SH1), approximately 2 km north of the Ōtaki township at the bottom of Pukehou Hill and approximately 5 km west of the Tararua mountain range (See Appendix 1, Map 1).

The KNE site comprises a palustrine swamp situated in a broad gully floor, dammed by sand movement, between low terraces and gently rolling hill country<sup>4</sup>. The wetland is scheduled as a Significant Natural Wetland in the Proposed Natural Resources Plan (PNRP)<sup>5</sup> for its representativeness, rarity and ecological context. The site is also recognised as a regionally significant wetland being the best and largest representative example of wetland-swamp forest associations within the Foxton and Manawatu Plains Ecological Districts<sup>6</sup>.

The KNE site contains a number of distinctly different habitat types ranging from open water, raupō reedland, *Carex* sedgeland, harakeke flaxland, through to mixed shrubland, swamp forest and secondary indigenous forest<sup>7</sup>. The KNE site also supports a number of indigenous fish, bird and plant species of conservation concern and provides an important ecological corridor for bird movement within the wider landscape.

The Otepua-Paruāuku Wetlands is surrounded by drained farmland but provides an important role within the wider landscape context as it is located within close proximity to several other important wetlands and coastal KNE sites including; Waitohu Coast and Wetlands, Lake Waorongomai and Stream and Haruātai/Pareomatangi.

A large portion of the KNE site is legally protected by QEII National Trust (QEII) open space covenants (see Appendix 1, Map 2), with the majority of the site also designated by the Kāpiti Coast District Council (KCDC) as Ecological Sites of Significance (see Appendix 1, Map 3). Part of the site is also legally protected by a Department of Conservation (DOC) Conservation Covenant (see Appendix 1, Map 2), with the majority of the site also recognised as a DOC Designated Ecological Site and DOC Recommended Area for Protection (RAP) (see Appendix 1, Map 4).



## 5. Parties involved

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

### 5.1. Landowner(s)/Land Manager

The majority of the Otepuā-Paruāuku Wetlands KNE site is privately owned by 16 separate landowners. These private landowners are actively engaged, to varying degrees, in biodiversity restoration activities within the KNE site undertaking restoration planting, ecological weed and/or pest animal control.

The New Zealand Railways Corporation own a ~1.5 ha strip of land on either side of the North Island Main Trunk (NIMT) railway line which cuts through the middle of the KNE site in a north-south direction. This land is currently managed by the railway operators, KiwiRail.

### 5.2. Operational delivery

Within Greater Wellington, 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.

Two large land parcels within the KNE site are protected by QEII covenants (see Appendix 1, Map 2). QEII supports landowners with covenants in the protection and enhancement of the biodiversity values of their properties. QEII can provide funding for fencing of covenants and other management activities.

KCDC has funding available for private landowners for preservation and management of the KNE site as an Ecological Site of Significance in the KCDC Heritage Register in accordance with the Kāpiti Coast District Plan<sup>8</sup> (See Appendix 1, Map 3). Landowners can apply for funding through the contestable fund on an annual basis. KCDC has previously provided funding and support to landowners for revegetation at the KNE site.

Many of the private landowners without covenanted land parcels have also committed to undertaking restoration activities on their properties. These landowners have previously undertaken ecological weed control, pest animal control, fencing and restoration planting with advice and assistance provided by GWRC and KCDC.

### 5.3. Mana whenua partners

The Otepuā-Paruāuku Wetlands KNE site is a site of significance for Ngā hapū o Ōtaki. The cultural values listed within the PNRP and provided by iwi are shown in Table 1, below.

Ngā hapū o Ōtaki are aware that their areas of interest are located on private land. Greater Wellington will provide contact details of landowners to Ngā hapū o Ōtaki if they wish to consult directly with landowners about the values at the site.



**Table 1: Ngā hapū o Ōtāki sites of significance in Otepua-Paruāuku Wetlands KNE site<sup>9</sup>**

Sites of significance	Mana whenua values
Schedule C1 - O-te-pua wetland	Papa kāinga, mahinga kai, puna raranga, puna rongoā, puna uku, wai ora.

## 5.4. Stakeholders

KiwiRail manage NZ Railways Corporation owned land associated with the railway embankment through the centre of the KNE site. However, they are not actively involved in the management of the site.

## 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 Otepua-Paruāuku Wetlands KNE site.

**Table 2: Designations at the Otepua-Paruāuku Wetlands KNE site**

Designation level	Type of designation
National	<p>Parts of the Otepua-Paruāuku Wetlands KNE site have been identified by DOC as Designated Ecological Sites (See Appendix 1, Map 4):</p> <ul style="list-style-type: none"> <li>• 113: Pukehou Swamp (23.5 ha)</li> <li>• 15: Forest Lake 2 (2.8 ha)</li> <li>• 59: Lake Waitawa (45.9 ha)</li> </ul> <p>Part of the Otepua-Paruāuku Wetlands KNE site has been identified by DOC as a Recommended Area for Protection (RAP):</p> <ul style="list-style-type: none"> <li>• RAP 9: Pritchards Swamp (16.8 ha)</li> </ul> <p>Part of the Otepua-Paruāuku Wetlands KNE site is legally protected by a DOC Conservation Covenant (See Appendix 1, Map 2):</p> <ul style="list-style-type: none"> <li>• S25036: Paruauku Wetland Covenant (4.2 ha)</li> </ul>
Regional	<p>Parts of the Otepua-Paruāuku Wetlands KNE site are scheduled under Greater Wellington's proposed Natural Resources Plan (PNRP)<sup>10</sup> as Ecosystems and Habitats with Significant Indigenous Biodiversity Values:</p> <ul style="list-style-type: none"> <li>• River with significant indigenous ecosystems – Habitat for indigenous fish species of conservation interest: Waitohu Stream and all tributaries (Schedule F1)</li> <li>• River with significant indigenous ecosystems – Habitat for 6 or more migratory indigenous fish species: Waitohu Stream and all tributaries (Schedule F1)</li> <li>• Significant Natural Wetland: O te Pua (Pukehou / Pritchard's Swamp) (27.4 ha) (Schedule F3)</li> </ul>
District	<p>Parts of the Otepua-Paruāuku Wetlands KNE have been identified by KCDC as Ecological Sites of Significance (See Appendix 1, Map 3). They are listed in the</p>

	KCDC District Plan Heritage Register <sup>11</sup> as: <ul style="list-style-type: none"> <li>• K013: Pukehou Swamp (22.6 ha)</li> <li>• K219: State Highway 1 South, Ōtaki (2.2 ha)</li> <li>• K239: Pukehou Swamp forest remnant (1.7 ha)</li> </ul>
Other	Parts of the Otepua-Paruāuku Wetlands KNE site are legally protected by QEII open space covenants (See Appendix 1, Map 2): <ul style="list-style-type: none"> <li>• 5-07-400 (3.8 ha)</li> <li>• 5-07-404 (8.2 ha)</li> <li>• 5-07-808 (6.0 ha)</li> </ul>

## 6.2. Ecological significance

The Otepua-Paruāuku Wetlands 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 system<sup>12</sup> indicates the vast majority of the KNE site is considered Acutely Threatened with less than 10% indigenous cover remaining and the habitat under-protected on a national scale. Some small fragments are classified as Critically Underprotected having more than 30% of its indigenous vegetation cover remaining on a national scale but with less than 10% of that under legal protection.

Wetlands are now considered an uncommon habitat type in the Wellington Region with approximately 2.3% of their original extent remaining<sup>13</sup>. The Otepua-Paruāuku Wetland is scheduled as a Significant Natural Wetland in the PNRP<sup>14</sup> and is regarded as the best and largest representative example of wetland-swamp forest associations within the Foxton and Manawatu Plains Ecological Districts<sup>15</sup>.

### *Rarity/distinctiveness*

The Otepua-Paruāuku Wetlands KNE site has a distinct vegetation sequence ranging from flaxland, through shrubland to swamp forest and secondary indigenous forest<sup>16</sup>. One naturally uncommon ecosystem type<sup>17,18</sup> is present within the KNE site which comprises stable sand dunes with a classification of 'Endangered'.

Small, remnant blocks of kahikatea-pukatea forest are also present on the elevated wetland margins on the northern side of the main wetland as well as within the northern forest block. Kahikatea-pukatea forest is a regionally rare forest type with only 1% of its original area remaining in the Wellington region<sup>19</sup>.

New Zealand's national threat classification system<sup>20</sup> lists five plant, eight bird and two 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 2020<sup>21</sup> also lists five plant species as Regionally Threatened within the KNE site. Nationally Threatened species are listed in Appendix 2 and Regionally Threatened species in Appendix 3.

### *Diversity*

The Singers and Rogers<sup>22</sup> classification of pre-human ecosystems in New Zealand indicates that three ecosystem types were present within the KNE site. These were comprised largely of a swamp mosaic of flaxland (WL18), raupō reedland (WL19) and coprosma, twiggy tree daisy scrub (WL20) which was prominent within the areas now recognised as wetland. The dune slopes surrounding the wetland margins and the northern-most forest area were comprised largely of kohekohe-tawa forest (MF6) whilst a small area in the southern portion of the northern-most forest block was comprised of tōtara, mataī, broadleaved forest dune forest (WF6).

Aspects of these original ecosystem types are still evident within the KNE site today, although in a modified and regenerating condition. The MF6 and WF6 forest ecosystem types once present within the KNE site are considered regionally threatened ecosystems with only 16% and 2% respectively of their original area remaining in the Wellington region<sup>23</sup>.

At present, the KNE site contains a rich diversity of natural habitat types including small pockets of wetland swamp forest, wetland scrub and open water. These varied habitat types and the transitional ecotones that exist between different plant communities provides a range of habitats to support a high diversity of flora and fauna.

### *Ecological context*

The Otepua-Paruāuku Wetlands KNE site is situated within a network of remnant, natural wetlands that would have once been extensive across the landscape including; Waimanguru Lagoon (Forest Lake), Ngatotara Lagoon and Lake Kaitawa & Keelings Bush, all of which are scheduled as significant natural wetlands in the PNRP<sup>24</sup>. The KNE site is also located within 4 km of a number of other KNE sites, namely Haruātai/Pareomatangi, Waitohu Coast and Wetlands and Lake Wairongomai and Stream. 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 Otepua-Paruāuku Wetlands KNE site is located on the fringe of both the Foxton and Manawatu Plains Ecological Districts<sup>25</sup>. The Foxton Ecological District is characterised by Holocene sand-dune country whilst the Manawatu Plains comprises mostly low altitude, predominantly undissected, loess covered plains and terraces of Holocene alluvium. Both ecological districts have warm climates with warm summers and mild winters, westerly to north-westerly winds prevailing with relatively frequent or frequent gales and an annual rainfall ranging between 800-1200 mm<sup>26</sup>.

## Vegetation communities and plants

The Otepua-Paruāuku KNE site contains a number of distinctly different habitat types ranging from flaxland, through shrubland to swamp forest and secondary indigenous forest<sup>27</sup>. The KNE site has been divided into seven operational areas based on these different habitat types (See Appendix 1, Map 5).

### *Reedland/rushland/sedgeland with wetland scrub and open water (Operational Areas A, B and C)*

The eastern-most northern wetland finger (Operational Area A) comprises largely of *Carex geminata* grading into raupō (*Typha orientalis*) with *Isolepis prolifer* and scattered *Carex secta* and *Carex virgata* also present. A tributary of the Waitohu River catchment feeds in at the northern end and runs the length of the finger where it meets the large open water body on Booth's property (Operational Area B). The water body margins comprise of *Carex secta* and harakeke (*Phormium tenax*) flax. The large lowland area on the eastern-most side of the waterbody is predominantly exotic herbfield with *Carex* sedgeland and occasional harakeke flax, toetoe (*Austroderia toetoe*) and cabbage tree (*Cordyline australis*). The southern wetland finger comprises of mānuka (*Leptospermum scoparium*) grading in to an almost monospecific stand of raupō through the interior wetland channel. The drier, wetland margins around the western edge of this area are dominated by mānuka, various divaricating *Coprosma* species, whēkī tree fern (*Dicksonia squarrosa*) and exotic scrub species.

### *Scrub margin (Operational Area D)*

The railway margin comprises a mix of native and exotic scrub on the drier, elevated embankment where the NIMT railway line transects through the main body of the Otepua-Paruāuku wetland. Dominant scrubland species include mānuka, whēkī tree fern, *Coprosma* spp. and gorse (*Ulex europaeus*) with exotic climbing species such as old man's beard (*Clematis vitalba*) and Japanese honeysuckle (*Lonicera japonica*) also present.

### *Dominant Flaxland (Operational Area E)*

The main body of the Otepua-Paruāuku Wetlands, situated on the western side of the NIMT railway line, is largely dominated by harakeke flaxland (~70%) with interspersed toetoe and several emergent cabbage trees. Scattered *Carex secta*, baumea (*Machaerina rubiginosa*), *Muehlenbeckia complexa*, mānuka, karamū (*Coprosma robusta*) and twiggy tree daisy (*Olearia virgata*) are present throughout the wetland interior<sup>28</sup>. Occasional raupō also occurs in the more saturated low lying areas.

Records also show the Nationally Threatened dwarf mistletoe (*Korthalsella salicornioides*; Nationally Critical) has previously been observed within the main body of the Otepua-Paruāuku Wetlands<sup>29,30</sup>.

### *Swamp Forest (Northern edges of Operational Area E)*

The northern edges of the main body of the Otepua-Paruāuku Wetlands grades in to a shrub community dominated by mānuka. Numerous small lancewood (*Pseudopanax crassifolius*) with scattered karamū, five-finger (*Pseudopanax arboreus*) and koromiko (*Veronica stricta*) are present<sup>31</sup>.

In the north-east, the wetland narrows in to a closed gully where wetland scrub and sedgeland grades in to a small remnant swamp forest with a canopy of kohekohe (*Dysoxylum spectabile*), tawa (*Beilschmiedia tawa*) and emergent rewarewa (*Knightsia excelsa*)<sup>32</sup>. Other common canopy species present include kahikatea (*Dacrycarpus dacrydioides*) as well as scattered lancewood, pukatea (*Laurelia novae-zelandiae*) and swamp maire (*Syzygium maire*). The sub-canopy comprises largely of whekī tree fern with intermittent lancewood, tītoki (*Alectryon excelsus*), tawa, pukatea, karamū, swamp *Coprosma* (*Coprosma tenuicaulis*) and hīnau (*Elaeocarpus dentatus*) with kamahi (*Weinmannia racemosa*) and kaikomako (*Pennantia corymbosa*) present around the edges<sup>33</sup>. Groundcover species largely comprise of numerous native ferns including; kiokio (*Parablechnum novae-zelandiae*), water fern (*Histiopteris incisa*), shaking brake (*Pteris tremula*), hound's tongue (*Microsorium pustulatum*), sickle spleenwort (*Asplenium polyodon*) and the Regionally Threatened *Hiya distans* (At Risk - Declining)<sup>34</sup>.

#### *Regenerating lowland forest (Operational Areas F and G)*

The northern most area of the KNE site comprises an area of regenerating lowland forest which is transected by Forest Lakes Road. The small swamp forest remnant, situated immediately south of Forest Lakes Road (Operational Area F), comprises largely of mature kahikatea-pukatea forest surrounding a small 1 ha lake. The forest on the northern and eastern edges of the lake has retained most of its natural character and comprises a small area of remnant kohekohe-tawa forest as well as some very large kahikatea and areas of kiekie (*Freycinetia banksii*). Very small areas of *Carex* sedgeland and harakeke flaxland are also present<sup>35,36</sup>.

Immediately north of Forest Lakes Road is the northern-most forest block of the KNE site (Operational Area G) which comprises largely of regenerating kohekohe-tawa dune forest with emergent tītoki, kahikatea, karaka (*Corynocarpus laevigatus*) and slender tree fern (*Cyathea cunninghamii*). The understory largely comprises of seedlings of the canopy tree species as well as coprosmas, ground ferns and the Nationally Threatened large leaved milk tree (*Streblus banksia*; At Risk – Relict)<sup>37,38</sup>. Exotic tree species are also interspersed throughout this forest area<sup>39</sup>.

Additionally, records show the Nationally Threatened *Selliera rotundifolia* (At Risk – Declining) and akatea (*Metrosideros perforata*; Nationally Vulnerable) have both recently been observed within the northern-most forest block<sup>40</sup>.

## Species

### *Birds*

The KNE site is known to provide significant habitat for a range of native bird species, including a number of threatened species. The wetland areas of the KNE site have been recognised as providing important breeding habitat for a colony of New Zealand dabchicks (*Poliiocephalus rufopectus*; At Risk – Recovering). A recent survey undertaken within the KNE site<sup>41</sup> also recorded the presence of a large number (14) of spotless crane (*Porzana tabuensis*; At Risk – Declining) suggesting that the site may provide significant seasonal or core habitat for this threatened species.

Other threatened bird species known to be present include; Australasian bittern (*Botaurus poiciloptilus*; Nationally Critical), royal spoonbill (*Platalea regia*; Naturally Uncommon), little black shag (*Phalacrocorax sulcirostris*; Naturally Uncommon), black shag (*Phalacrocorax carbo*; Naturally Uncommon), pied shag (*Phalacrocorax varius*; At Risk – Recovering) and New Zealand falcon (*Falco novaeseelandiae*; At Risk – Recovering)<sup>42,43,44,45,46</sup>.

Other more common bird species known to be present at the KNE site include; white faced heron (*Egretta novaehollandiae*), grey teal (*Anas gracilis*), Australasian harrier (*Circus approximans*), Australasian shoveler (*Anas rhynchos*), pied stilt (*Himantopus himantopus*), New Zealand kingfisher (*Todiramphus sanctus vagans*), New Zealand scaup (*Aythya novaeseelandiae*), pūkeko (*Porphyrio melanotus melanotus*), paradise shelduck (*Tadorna variegata*), black swan (*Cygnus atratus*), kererū (*Hemiphaga novaeseelandiae*), grey warbler (*Gerygone igata*), silvereye (*Zosterops lateralis*) and tūī (*Prothemadera novaeseelandiae*)<sup>47,48</sup>.

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

#### *Fish and aquatic invertebrates*

The Otepua-Paruāuku Wetlands and Waitohu stream tributaries, which traverse the KNE site, provide known habitat for a wide range of freshwater fish species, including a number of threatened species.

Two species of fish classified as threatened have previously been recorded in the KNE site and include, longfin eel (*Anguilla dieffenbachia*; At Risk – Declining) and īnanga (*Galaxias maculatus*; At Risk – Declining). Other non-threatened native fish species known to be present within the KNE site include the shortfin eel (*Anguilla australis*), banded kōkopu (*Galaxias fasciatus*) and common bully (*Gobiomorphus cotidianus*) as well as the freshwater crustacean species, koura/crayfish (*Paranephrops planifrons*)<sup>49,50</sup>.

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

## 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 Otepua-Paruāuku Wetlands KNE site are ecological weed species, pest animals, altered hydrology and degraded vegetation communities resulting from surrounding land use.

Ecological weeds are widespread throughout the KNE site ranging from exotic climbers, ground-covering plants, exotic grasses, woody tree species and aquatic weeds. 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.

Mustelids, such as stoats (*Mustela erminea*), weasels (*Mustela nivalis*) and ferrets (*Mustela furo*), are the biggest threats to the identified ecological values of the KNE site. These pest species predate native wetland bird species, particularly nesting birds, chicks and eggs. Other pest animal species such as feral cats (*Felis catus*), possums (*Trichosurus vulpecula*), hedgehogs (*Erinacues europaeus*) and rats (*Rattus* spp.) are also likely to pose an enduring threat to the biodiversity values within the KNE site by over-browsing native vegetation, out-competing native species for food and resources and through direct predation.

A number of historical activities have caused significant adverse effects to the ecological values of the KNE site. Such activities include the construction of SH1 adjacent to the wetland and the construction of the NIMT railway line, which severed the wetland into two parts and consequently altered the wetland's hydrological regime. Drainage channels and culverts previously installed within the wetland have caused further changes to the wetland hydrology and now maintain the water level below what would have been historically observed. Current surrounding land uses also pose a number of threats to the KNE site's ecological values and hydrology including pollution from agricultural run-off and road usage.

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 Otepua-Paruāuku Wetlands 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 5).



**Table 3: Summary of all threats to ecological values present at the Otepuā-Paruāuku Wetlands 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: pampas ( <i>Cortaderia selloana</i> / <i>C. jubata</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: Gorse ( <i>Ulex europaeus</i> ) and willow ( <i>Salix cinerea</i> / <i>S. fragilis</i> ) (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: Japanese honeysuckle ( <i>Lonicera japonica</i> ), old man's beard ( <i>Clematis vitalba</i> ) and blackberry ( <i>Rubus fruticosus</i> agg.) (see full list in Appendix 4)	Entire KNE site
EW-4	Aquatic weeds out-compete native aquatic species and choke watercourses. Key weed species include: Hornwort ( <i>Ceratophyllum demersum</i> ) and giant reed sweet grass ( <i>Glyceria maxima</i> ) (see full list in Appendix 4)	A, B, C, E, F
Pest animals		
PA-1	Mustelids (stoats <sup>51,52</sup> ( <i>Mustela erminea</i> ), ferrets <sup>53,54</sup> ( <i>M. furo</i> ) and weasels <sup>55,56</sup> ( <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	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 <sup>57,58</sup>	Entire KNE site
PA-3	Hedgehogs ( <i>Erinaceus europaeus</i> ) prey on native invertebrates <sup>59</sup> , lizards <sup>60</sup> and the eggs <sup>61</sup> and chicks of ground-nesting birds <sup>62</sup>	Entire KNE site
PA-4*	Possums ( <i>Trichosurus vulpecula</i> ) browse palatable canopy vegetation until it can no longer recover <sup>63,64</sup> . This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates <sup>65</sup>	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 <sup>66,67</sup>	Entire KNE site
PA-6*	Feral, stray and domestic cats ( <i>Felis catus</i> ) prey on native birds <sup>68</sup> , lizards <sup>69</sup> and invertebrates <sup>70</sup> , reducing native fauna breeding success and potentially causing local extinctions <sup>71</sup>	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 <sup>72</sup> . Rabbits are particularly damaging in sand dune environments where they graze native binding plants and restoration plantings. In drier times hares especially, will penetrate into wetland forest areas browsing and reducing regenerating native seedlings	Drier margins of KNE site
PA-8*	Wasps ( <i>Vespula</i> spp.) adversely impact native invertebrates and birds through predation and competition for food resources. They also affect nutrient cycles in beech forests <sup>73</sup>	Entire KNE site
PA-9*	Exotic waterfowl such as Canada geese ( <i>Branta canadensis</i> ) and feral geese ( <i>Anser anser</i> ) graze native marginal aquatic plants and in high numbers can result in the eutrophication of waterbodies	B, E, F
Human activities		
HA-1*	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 <sup>74</sup>	Outside of KNE site
HA-2*	Plantation forestry on adjoining land parcels to the KNE site have the potential to cause habitat loss or degradation, disturb native wildlife, damage boundary fencing and increase sediment load in watercourses via surface run-off during harvesting operations	Outside of KNE site
HA-3*	Intensive farming in the surrounding catchment is accelerating natural flows of nutrients into the wetland system. Increased nutrient flows can affect native biota and eventually cause the open body of water to become eutrophic. The proximity of SH1 and the NIMT railway line means that stormwater and sediment runs into the wetland system bringing pollutants in. These pollutants such as heavy metals and brake dust can have an adverse effect on the native biota, in particular on native aquatic invertebrate diversity	Outside of KNE site
Other threats		
OT-1*	Small forest remnants are effected by environmental impacts on their edges such as changing environmental conditions (eg, soil moisture or temperature levels), changing physical environment (eg, different plant assemblages compared to the interior) and changing species interactions (eg, increased predation by invasive species) <sup>75,76</sup>	Entire KNE site
OT-2*	A lack of legal protection can leave a site at risk of future development or destruction and resources invested in the site may be wasted. Part of this KNE site is private property and uncovenanted, having no protection status	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 Otepua-Paruāuku Wetlands KNE site comprises a resilient and interconnected wetland dominated by regenerating native vegetation communities and supporting thriving populations of native wetland birds and fish.

### 8.2. Objectives

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

The following objectives will guide the operational activities at the Otepua-Paruāuku Wetlands KNE site.

- 1. To protect and increase regeneration of native plant communities within the interior wetland at the KNE site**
- 2. To protect and enhance essential habitat for native wetland bird species, particularly threatened or regionally rare species**
- 3. To enhance the values of native fish habitat within the KNE site**
- 4. To support landowners to enhance, restore and protect the wetland values on their properties**

## 9. Operational activities

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

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

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

For practicality of management, the KNE site has been divided into seven operational areas based on their ecological features (See Appendix 1, Map 5). These are:

- A:** North-eastern wetland finger (2.8 ha)
- B:** Otepua Wetland East (11.1 ha)
- C:** South-eastern wetland finger (2.7 ha)
- D:** Railway margin embankment (3.0 ha)
- E:** Otepua Wetland West (18.6 ha)
- F:** Kahikatea-pukatea remnant forest block (4.6 ha)
- G:** Mature kohekohe-tawa remnant forest block (5.1 ha)

## 9.1. Ecological weed control

The aim of weed control at the Otepua-Paruāuku Wetlands KNE site is to protect the intact interior and facilitate natural regeneration of native plant species on the wetland and forest margins in line with all objectives outlined in this plan by reducing the distribution and density of existing weed populations and preventing the incursion of new weed species through the wetland interior.

The KNE site contains numerous ecological weed species with the priority ecosystems targeted for weed control including; the interior of Otepua Wetland West (Operational Area E) as well as the drier margins around wetland areas (Operational Areas A, B, C, D and E) where the largest known weed infestations have been recorded.

Greater Wellington will undertake weed control on an annual basis in these priority areas targeting species that have a 'Severe' or 'High' ecological impact (see Appendix 4). Both ground-based and aerial-based control methods are required within the KNE site to ensure the biodiversity values present are protected and restored.

Ecological weed species recorded at the KNE site and a ranking of the potential ecological impact of each are listed in Appendix 4.

### Ground-based weed control

Ground-based control methods will be undertaken within specified areas of the Otepua-Paruāuku Wetlands KNE site where access is permissible on foot to target priority ecological weed species.

Multi-species ecological weed control within the north-eastern wetland finger (Operational Area A), Otepua Wetland East (Operational Area B), the South-eastern wetland finger (Operational Area C) and Otepua Wetland West (Operational Area E) will be undertaken on an annual basis. Control in these areas will focus on reducing priority climbing and woody weed species around the wetland margins and within regenerating bush above the wetland edges. Priority target weed species include but are not limited to; blackberry (*Rubus fruticosus* agg.), gorse, barberry (*Berberis glaucocarpa*), old man's beard and Japanese honeysuckle. Willows (*Salix* spp.) located within the interior wetland of these areas have been prioritised for control over the duration of this plan. Willows will be controlled via ground-based methods where access is permissible on foot and via aerial control methods as required where access is impeded (Further detail regarding aerial-based willow control is outlined below).

Surveillance and control of reed sweet grass (*Glyceria maxima*), located around water margins within the north-eastern wetland finger (Operational Area A) and Otepua Wetland East (Operational Area B), and hornwort (*Ceratophyllum demersum*), located within Otepua Wetland West (Operational Area E), will also be undertaken as required to target new growth and prevent the establishment of large infestations.

Multi-species weed control will be undertaken within the kahikatea-pukatea remnant forest block (Operational Area F) and the mature kohekohe-tawa remnant forest block (Operational Area G) as required. Control in these areas will target woody, groundcover and climbing weed species with the intention of reducing the incursion of weed species around the margins and promoting natural regeneration of the understorey. Priority target weed species include but are not limited to; old man's

beard, Japanese honeysuckle, cathedral bells (*Cobaea scandens*), banana passionfruit (*Passiflora* spp.), ivy (*Hedera helix*), jasmine (*Jasminum polyanthum*) and blackberry.

### **Aerial-based weed control**

An aerial application of herbicide by helicopter will be undertaken in summer 2020/21 to target a large infestation of willow within Otepua Wetland West (Operational Area E) where access is not permissible on foot.

The purpose of this aerial operation is to reduce the abundance and distribution of willow that is out-competing and displacing native vegetation and altering the hydrology of the wetland. It is expected that natural regeneration of native species will occur over time following this control operation.

Greater Wellington will supervise a contractor to undertake the aerial application of herbicide by drone or helicopter to control willow within the KNE site. Resource consent was granted for a 10 year period (2019-2029) to allow for this activity.

A spot spray applicator, attached to the drone or helicopter, will be used to target the isolated willow infestations to reduce the risk of non-target damage and result in less chemical herbicide applied within the wetland. Compared to ground-based application methods, such as gun and hose application, aerial control is a more targeted method for applying chemical at sites with difficult access conditions.

Follow-up aerial control operations may be required within the term of this plan to control any regrowth of aerially targeted weed species across the KNE site. However, follow-up aerial control will only be undertaken if there is enough regrowth to warrant such an operation and this will be determined by the GWRC's Biodiversity department prior to any aerial control operation being agreed. Regrowth of aerially targeted weed species will be monitored on an annual basis using observations taken during work assessments and from photopoint photos (further detail regarding photopoint monitoring is outlined in Section 9.4). Any subsequent aerial control will be funded through the existing ecological weed control budget with approximate costs based on the 2020/21 aerial operation cost of \$4,500.

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, there is sufficient foliage to take in the chemical 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 4 of this plan.

A pest animal control network around the main wetland body has been serviced and maintained by landowners in the past. However, the network is currently in disrepair and in need of updating and refurbishment. In 2020/21, the entire pest animal control network will be updated and refurbished to comprise 27 DOC-250 kill traps around the entire KNE site perimeter (see Appendix 1, Map 6). Once the network has been

installed, landowners will resume servicing the network on a monthly basis and bait will be provided by Greater Wellington.

Additionally, rabbit and Canada geese control is undertaken periodically by landowners as deemed necessary to reduce population numbers to allow natural native plant regeneration and to protect the planting areas from browsing.

Greater Wellington also control possums and mustelids within the wider Ōtaki area with a poison bait-station and mustelid-trap network as part of the Regional Possum Predator Control Programme (RPPCP). This programme benefits the KNE site by further reducing possums and mustelids in the wider landscape, thereby decreasing the risk of reinvasion into the KNE site.

### 9.3. Revegetation

A large number of landowners within the KNE site undertake restoration planting within and surrounding the wetlands on their properties to increase native plant dominance and increase plant diversity. KCDC has previously provided funding to several landowners for revegetation within the KNE site via the KCDC Nature Heritage Fund, and it is advised that landowners continue to apply for funding via this method.

Greater Wellington will actively encourage landowners to continue current revegetation efforts within the KNE site whilst also planting rare and uncommon species to expand threatened plant communities and planting buffer areas around the wetland with species such as; kahikatea, pukatea, tōtara (*Podocarpus totara*), mataī (*Prumnopitys taxifolia*), and broadleaf (*Griselinia littoralis*) to increase the surrounding area of protection. All plants should be eco-sourced from the Foxton and Manawatu Plains Ecological Districts and it is advised that plant protectors are used to protect the plantings from hare, rabbit and pūkeko browse.

### 9.4. Monitoring

A series of 10 photopoint monitoring sites will be set up within the Otepua-Paruāuku Wetlands KNE site in 2020/21. The photopoint locations will comprise of both aerial (via drone) and ground-based sites to provide a complete and accurate depiction of the entire site. Photos will be taken annually 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 may be used to help guide future management actions undertaken at the site.

The Otepua-Paruāuku Wetlands 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 Otepua-Paruāuku Wetlands KNE site was first surveyed in 2017/2018 and will be surveyed again in 2022/2023. As part of this survey the vegetation composition, soil condition, plant nutrient status, wetland condition and wetland pressure index is recorded in plots throughout the complex. Fish and wetland bird surveys are also undertaken. The follow-up survey in 2022/2023 will be used to identify trends in wetland health. This will be used to inform management activities at the KNE site.

## 10. Future opportunities

There are numerous potential opportunities for landowners, iwi, 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 opportunities include:

- Increase the frequency of pest animal control network servicing during peak nesting periods to reduce predation pressure on wetland bird species during the breeding season, particularly those threatened species
- Undertake targeted revegetation planting within the wetland areas for habitat enhancement of threatened wetland bird species, particularly Australasian bittern and Spotless crane
- Undertake revegetation planting of rare wetland plant species in appropriate locations within the KNE site to increase native biodiversity at the site and assist in the regeneration of declining plant species within the region.
- Investigate fish passage at the site and potential opportunities for fish habitat enhancement
- Two private landowners have QEII covenants within the KNE site. The remaining landowners of the KNE site may also wish to legally protect their wetlands and the Biodiversity Advisor for the site can provide more information about the QEII covenanting process



## 11. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Otepua-Paruāuku Wetlands KNE site, and their timing and cost 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 5).

**Table 4: Five-year operational plan for the Otepua-Paruāuku Wetlands 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	Ecological weed control	A, B, C, E	Ground-based control of priority climbing and woody weed species	Suppression of priority weed species in marginal areas to prevent their incursion in to the wetland proper; new willow growth accessible on foot is controlled annually as discovered	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2, 3	Ecological weed control	A, B, E	Surveillance of reed sweet grass and hornwort with targeted control as budget/ priorities allow	Native aquatic margin vegetation dominance and fish habitat is maintained	GWRC Biosecurity department	✓ <sup>+</sup>	✓ <sup>+</sup>	✓ <sup>+</sup>	✓ <sup>+</sup>	✓ <sup>+</sup>
1, 2	Ecological weed control	F, G	Ground-based control of priority target weed species	Suppression of priority weed species in forest margins to prevent their incursion in to the forest interior; increased forest understory regeneration and native plant dominance	GWRC Biosecurity department	✓ <sup>+</sup>	✓ <sup>+</sup>	✓ <sup>+</sup>	✓ <sup>+</sup>	✓ <sup>+</sup>

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	Ecological weed control	A, B, C, E	Aerial-based control of willow. The need for follow-up control will be confirmed by the Biodiversity Advisor	Existing willow infestations are eradicated and new willow growth is monitored and controlled using the appropriate methodology.	GWRC Biosecurity department	✓	TBC <sup>^</sup>	TBC <sup>^</sup>	TBC <sup>^</sup>	TBC <sup>^</sup>
1, 2, 4	Pest animal control	Entire KNE site	Refurbishment of pest animal control network	A functioning pest control network and an increase in catch rates of target pest species	GWRC Biosecurity department	✓ <sup>++</sup>				
1, 2, 4	Pest animal control	Entire KNE site	Traps and bait stations serviced on a monthly basis after network refurbishment	Browsing pest animal populations are kept to: possums <5% RTC*; rats <10% TTI**; mustelids <2% TTI** to facilitate native vegetation growth and protect wetland bird species	Landowners	✓	✓	✓	✓	✓
1, 2	Pest animal control	Entire KNE site	Annual audit of pest animal control network and bait provision	A functioning and well maintained pest animal control network	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2	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)

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	Monitoring	Entire KNE site	SOE wetland health monitoring of vegetation, fish and birds.	Trends in wetland health are quantified and areas for improvement are identified.	GWRC Environmental Science department			✓		

\*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

<sup>†</sup> = This work is subject to change year to year depending on the needs of the site.

<sup>^</sup> = The need for a follow-up aerial operation within the term of this plan will be determined and confirmed by the Biodiversity Advisor.

<sup>††</sup> = The timeframe for this action is indicative only and may be undertaken at any time over the duration of this plan.

## 12. Funding contributions

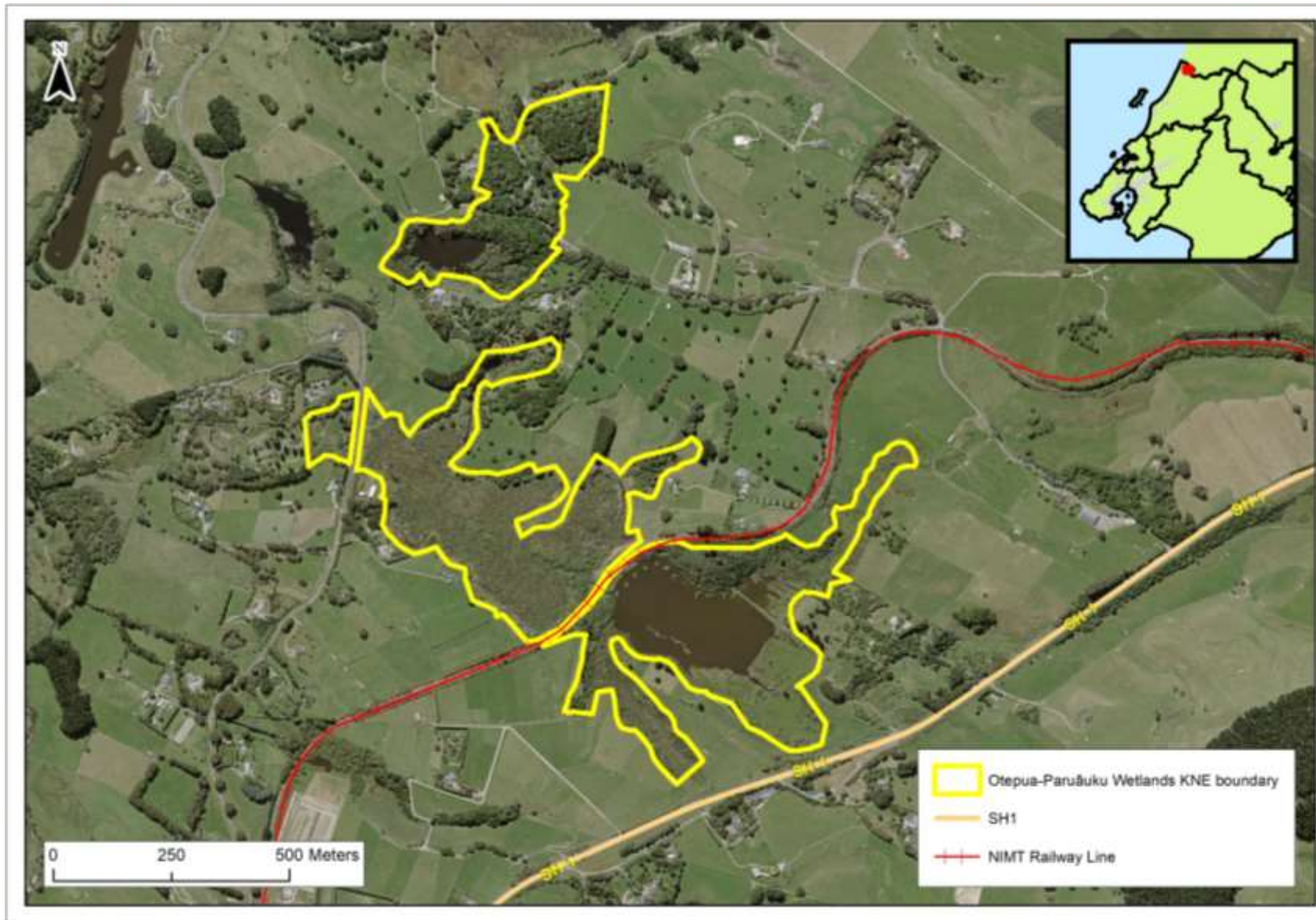
### 12.1. Budget allocated by Greater Wellington

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

**Table 5: Greater Wellington allocated budget for the Otepua-Paruāuku Wetlands KNE site**

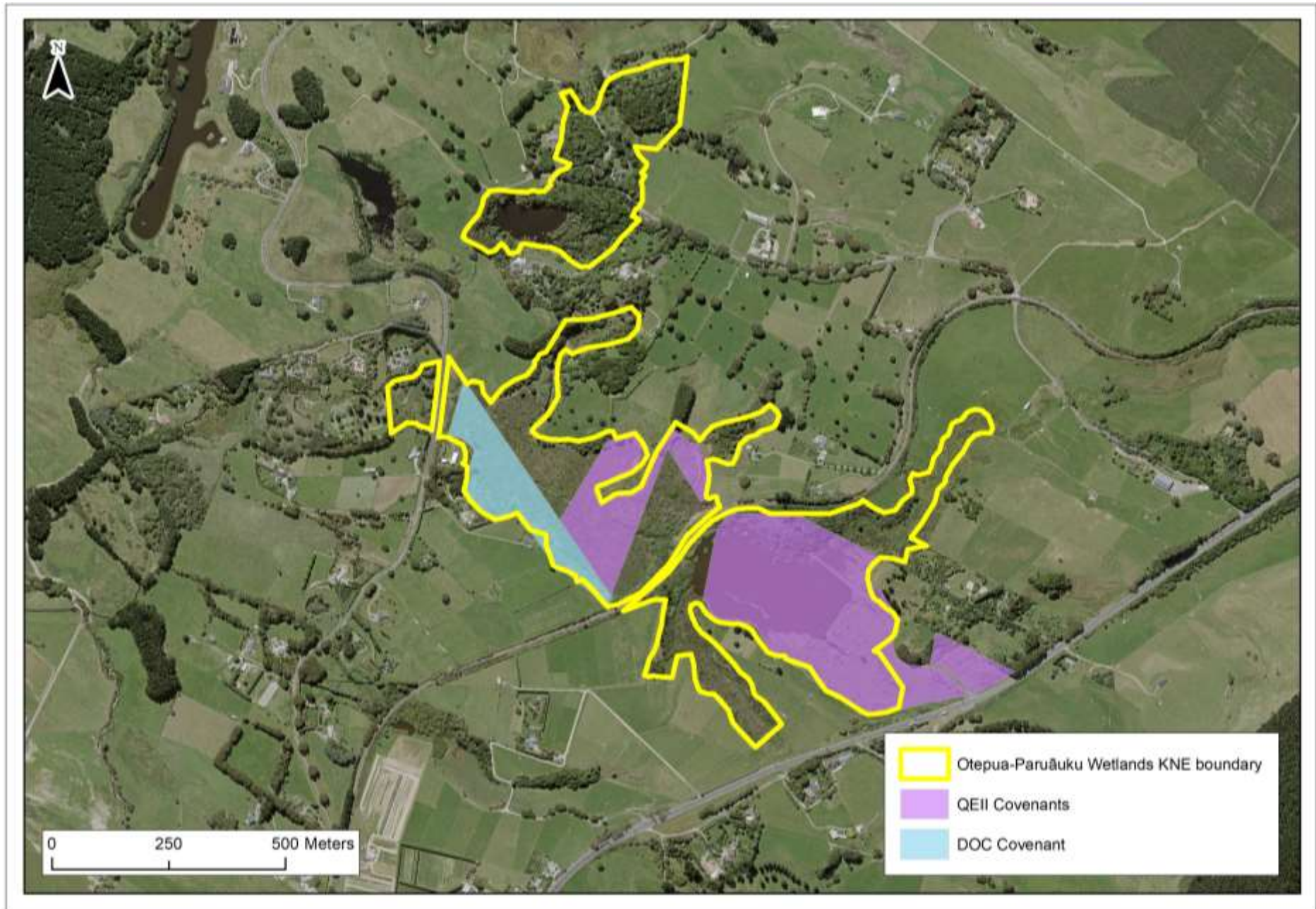
Management activity	Timetable and resourcing				
	2020/21	2021/22	2022/23	2023/24	2024/25
Ecological weed control	\$10,000	\$11,000	\$11,000	\$11,000	\$11,000
Pest animal control	\$4,000	\$3,000	\$3,000	\$3,000	\$3,000
<b>Total</b>	<b>\$14,000</b>	<b>\$14,000</b>	<b>\$14,000</b>	<b>\$14,000</b>	<b>\$14,000</b>

## Appendix 1: Site maps



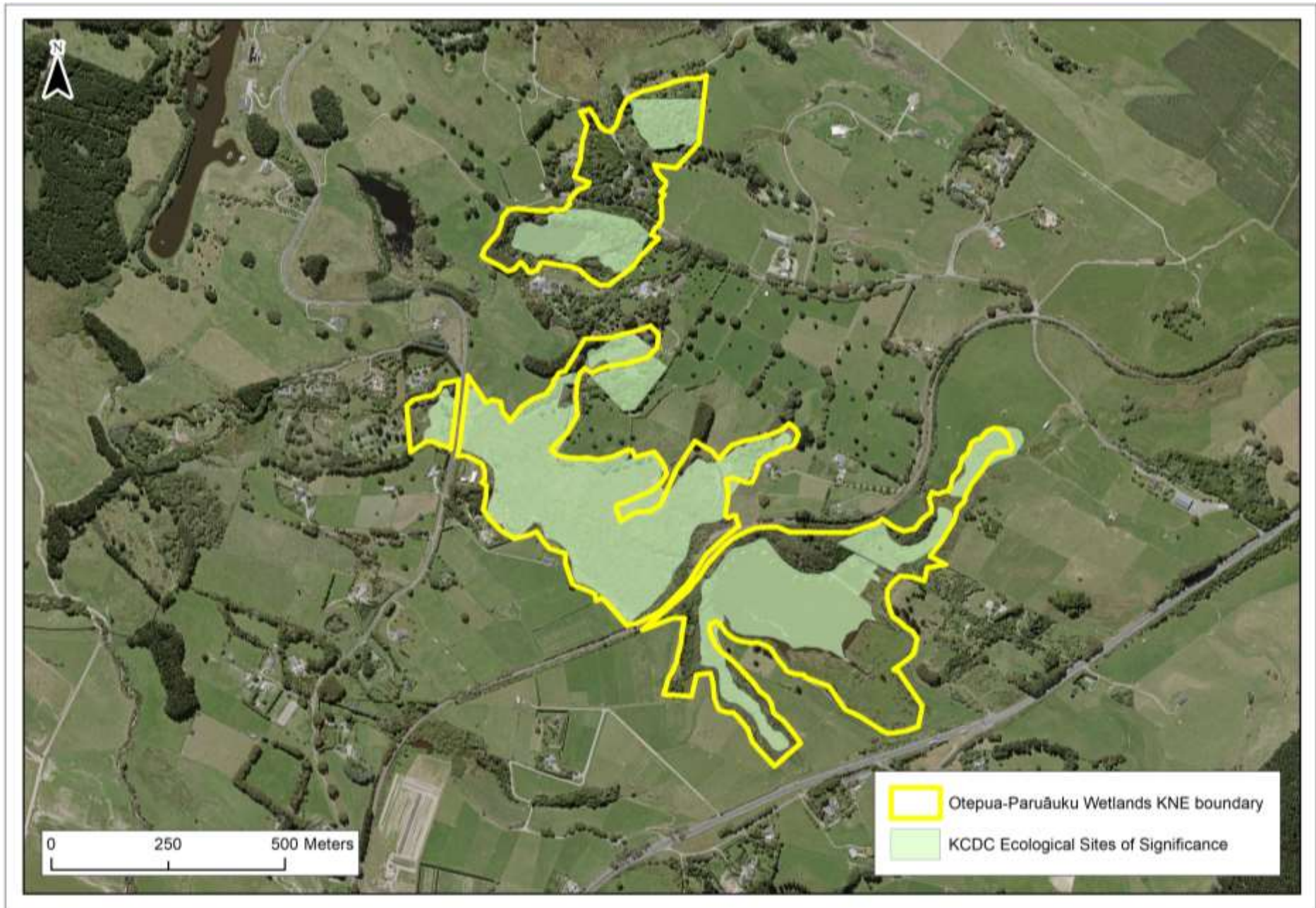
Map 1: The Otepua-Paruāuku Wetlands KNE site within the context of the wider landscape





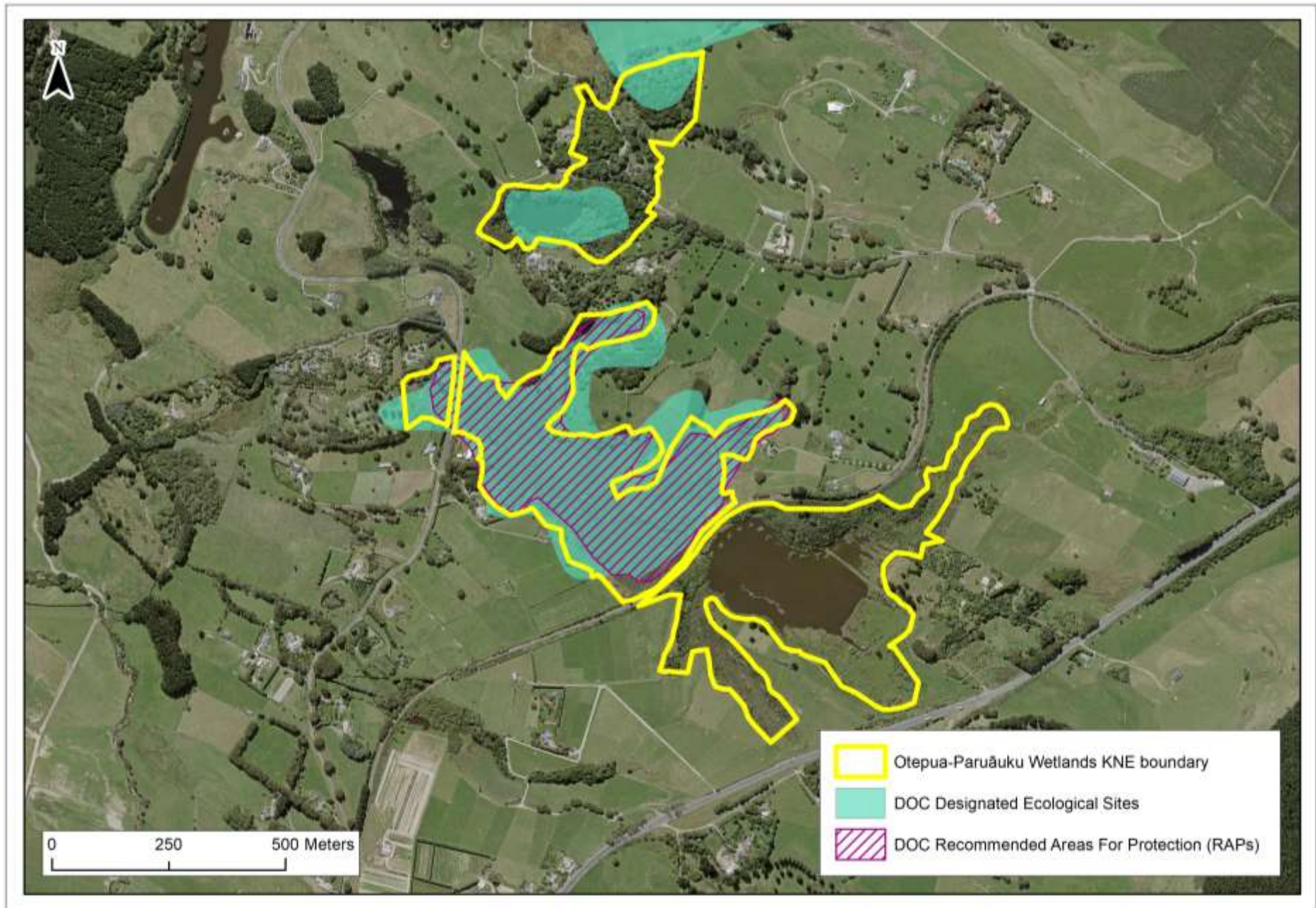
Map 2: QEII and DOC covenants within the Otepua-Paruāuku Wetlands KNE site





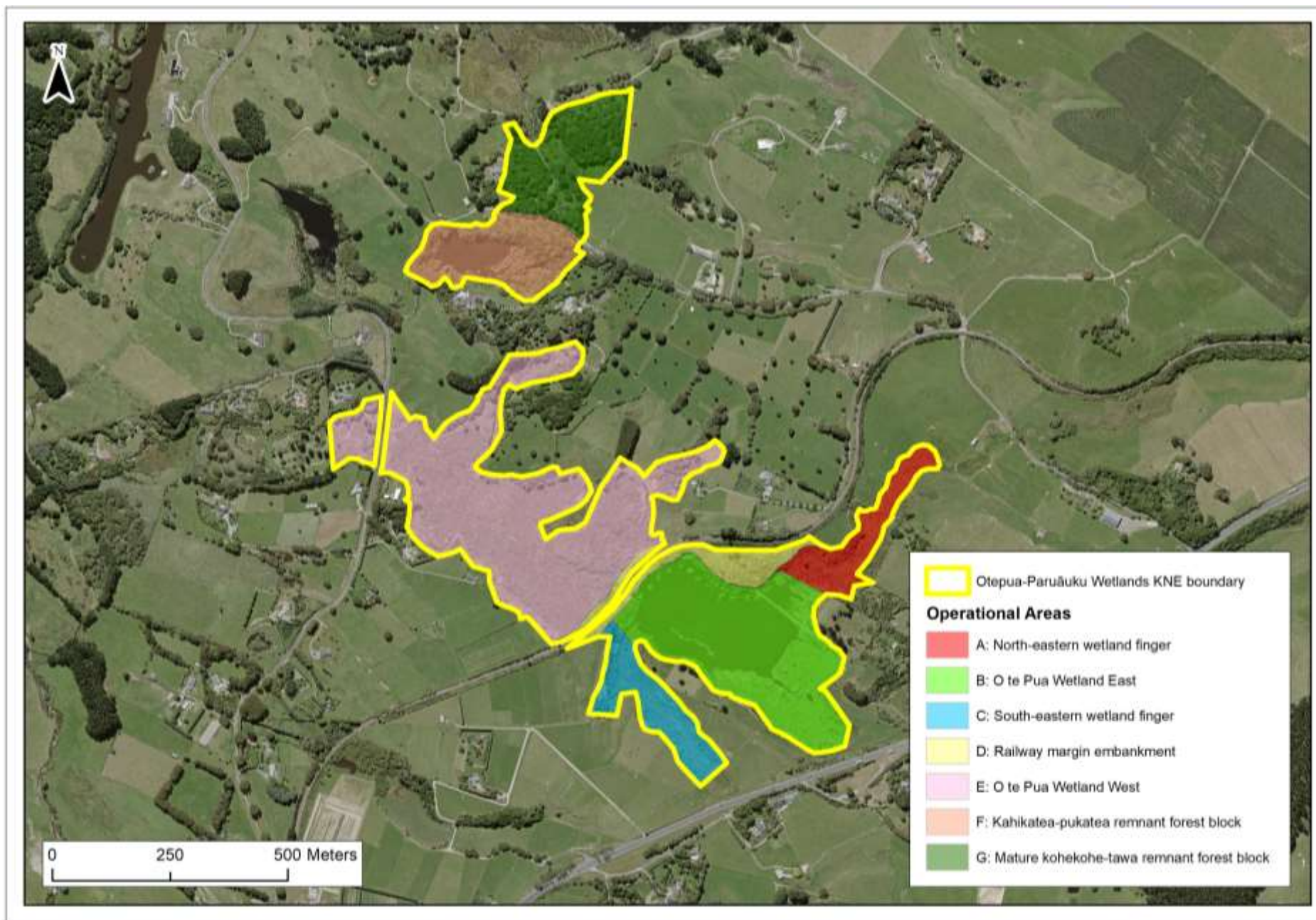
Map 3: Designated KCDC Ecological Sites of Significance within the Otepua-Paruāuku Wetlands KNE site





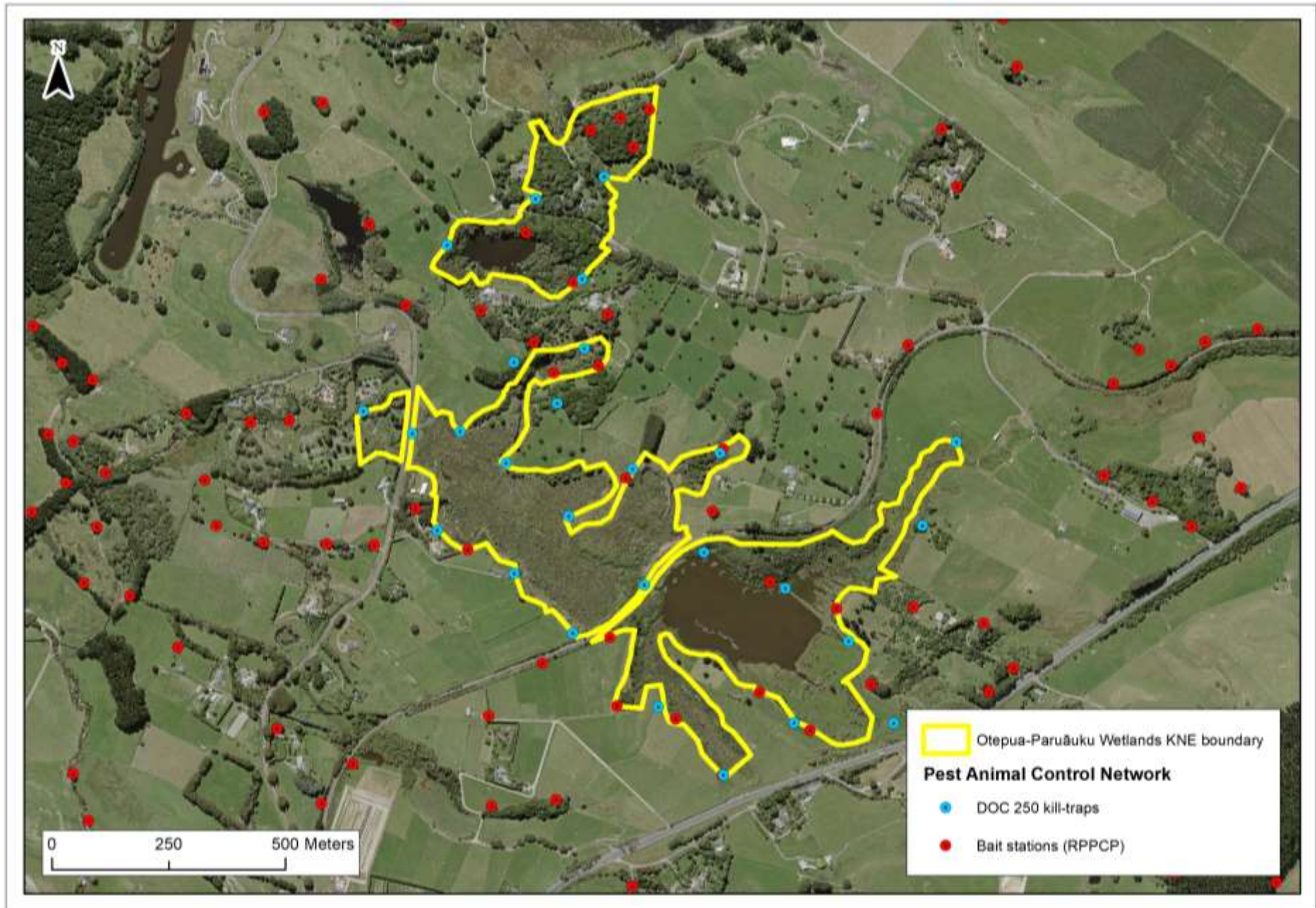
Map 4: DOC Designated Ecological Sites and Recommended Areas for Protection within the Otepua-Paruāuku Wetlands KNE site





Map 5: Operational areas in the Otepua-Paruāuku Wetlands KNE site





Map 6: Location of the proposed pest animal control network within the Otepua-Paruāuku Wetlands 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 cycle<sup>77</sup>. 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 Otepua-Paruāuku Wetlands KNE site.

**Table 6: Threatened and At Risk species at the Otepua-Paruāuku Wetlands KNE site**

Scientific name	Common name	Threat status	Observation
Plants(vascular) <sup>78</sup> (lichens) <sup>79</sup> (bryophytes) <sup>80</sup>			
<i>Korthalsella salicornioides</i>	Dwarf mistletoe	Threatened – Nationally Critical	Enright, 2002 <sup>81</sup> ; Enright and Olaf, 2002 <sup>82</sup>
<i>Leptospermum scoparium</i>	Mānuka	At Risk – Declining	Ravine, 1995 <sup>83</sup> ; Spearpoint, 2018 <sup>84</sup> ; Hurley, 2019 <sup>85</sup>
<i>Metrosideros perforata</i>	Akatea	Threatened – Nationally Vulnerable	<a href="https://inaturalist.nz/">https://inaturalist.nz/</a> (accessed December 2019) <sup>86</sup>
<i>Selliera rotundifolia</i>	Selliera	At Risk – Declining	<a href="https://inaturalist.nz/">https://inaturalist.nz/</a> (accessed December 2019)
<i>Streblus banksii</i>	Large leaved milk tree	At Risk – Relict	Enright, 2002; Spearpoint 2020 <sup>87</sup>
<i>Syzygium maire</i>	Swamp maire	Threatened – Nationally Critical	Ravine, 1995; Enright, 2002
Birds <sup>88</sup>			
<i>Botaurus poiciloptilus</i>	Australasian Bittern	Threatened – Nationally Critical	McLaren, 2014 <sup>89</sup> ; <a href="http://ebird.org/content/newzealand/">http://ebird.org/content/newzealand/</a> (accessed August 2019) <sup>90</sup>
<i>Falco novaeseelandiae</i>	New Zealand falcon	At Risk – Recovering	Booth, 2016 <sup>91</sup>
<i>Phalacrocorax carbo</i>	Black shag	At Risk – Naturally Uncommon	Spearpoint, 2017 <sup>92</sup>
<i>Phalacrocorax sulcirostris</i>	Little black shag	At Risk – Naturally Uncommon	<a href="http://ebird.org/content/newzealand/">http://ebird.org/content/newzealand/</a> (accessed August 2019)
<i>Phalacrocorax varius</i>	Pied shag	At Risk – Recovering	Spearpoint, 2017
<i>Platalea regia</i>	Royal spoonbill	At Risk – Naturally Uncommon	Booth, 2016; Spearpoint, 2017
<i>Poliiocephalus rufopectus</i>	New Zealand dabchick	At Risk – Recovering	Booth, 2016; Spearpoint, 2017; <a href="http://ebird.org/content/newzealand/">http://ebird.org/content/newzealand/</a> (accessed August 2019)

Scientific name	Common name	Threat status	Observation
<i>Porzana tabuensis</i>	Spotless crane	At Risk – Declining	Peace and Haughton, 2015 <sup>93</sup> ; Spearpoint, 2017; <a href="http://ebird.org/content/newzealand/">http://ebird.org/content/newzealand/</a> (accessed August 2019)
Freshwater fish <sup>94</sup>			
<i>Anguilla duffenbachii</i>	Longfin eel	At Risk – Declining	McEwan, 2014 <sup>95</sup> ; McEwan 2017 <sup>96</sup>
<i>Galaxias maculatus</i>	Īnanga	At Risk – Declining	McEwan, 2017

### Appendix 3: Regionally threatened plant species list

The following table lists regionally threatened species that have been recorded in the Otepua-Paruāuku Wetlands KNE site. Native plant species have been identified in the Conservation status of indigenous vascular plant species in the Wellington region report 2020<sup>97</sup>.

**Table 7: Regionally threatened plant species recorded in the Otepua-Paruāuku Wetlands KNE site**

Scientific name	Common name	Threat status	Observation
Plants			
<i>Diplazium australe</i>	Austral Lady Fern	Threatened – Regionally Vulnerable	GWRC, 2019 <sup>98</sup>
<i>Hiya distans</i>	<i>Hiya distans</i>	At Risk – Declining	Ravine, 1995 <sup>99</sup> ; Spearpoint and Myers, 2018 <sup>100</sup>
<i>Korthalsella salicornioides</i>	Dwarf mistletoe	Threatened – Regionally Critical	Enright, 2002 <sup>101</sup> ; Enright and Olaf, 2002 <sup>102</sup>
<i>Selliera rotundifolia</i>	Selliera	At Risk – Declining	<a href="https://inaturalist.nz/">https://inaturalist.nz/</a> (accessed December 2019) <sup>103</sup>
<i>Streblus banksii</i>	Large-leaved milk tree	At Risk – Relict	Enright, 2002; Spearpoint, 2020 <sup>104</sup>

## Appendix 4: Ecological weed species

The following table lists key ecological weed species that have been recorded in the Otepua-Paruāuku Wetlands KNE site.

**Table 8: Ecological weed species recorded in the Otepua-Paruāuku Wetlands KNE site**

Scientific name	Common name	Priority	Weed type
<i>Clematis vitalba</i>	Old man's beard	Severe	Climber
<i>Cortaderia selloana/C. jubata</i>	Pampas grass	Severe	Groundcover
<i>Lonicera japonica</i>	Japanese honeysuckle	Severe	Climber
<i>Passiflora</i> spp.	Banana passionfruit	Severe	Climber
<i>Salix cinerea</i>	Grey willow	Severe	Woody
<i>Salix fragilis</i>	Crack willow	Severe	Woody
<i>Ceratophyllum demersum</i>	Hornwort	High	Aquatic
<i>Cobaea scandens</i>	Cathedral bells	High	Climber
<i>Glyceria maxima</i>	Giant reed sweet grass	High	Marginal aquatic
<i>Hedera helix</i>	Ivy	High	Climber
<i>Ilex aquifolium</i>	Holly	High	Climber
<i>Jasminum polyanthum</i>	Jasmine	High	Climber
<i>Rubus fruticosus</i> agg.	Blackberry	High	Climber
<i>Selaginella kraussiana</i>	African club moss	High	Groundcover
<i>Ulex europaeus</i>	Gorse	High	Woody
<i>Zantedeschia aethiopica</i>	Arum lily	High	Groundcover
<i>Berberis glaucocarpa</i>	Barberry	Moderate	Woody
<i>Bidens frondosa</i>	Beggars ticks	Moderate	Marginal aquatic
<i>Calystegia silvatica</i> subsp. <i>disjuncta</i>	Convolvulus/ Great bindweed	Moderate	Climber
<i>Corynocarpus laevigatus</i> *	Karaka	Moderate	Woody
<i>Iris foetidissima</i>	Stinking iris	Moderate	Groundcover
<i>Leycesteria formosa</i>	Himalayan honeysuckle	Moderate	Groundcover
<i>Pinus radiata</i>	Radiata pine	Moderate	Woody
<i>Pittosporum crassifolium</i> *	Karo	Moderate	Woody
<i>Populus</i> spp.	Poplar	Moderate	Woody
<i>Prunus campanulata</i>	Taiwan cherry	Moderate	Woody
<i>Solanum pseudocapsicum</i>	Jerusalem cherry	Moderate	Groundcover
<i>Tradescantia fluminensis</i>	Tradescantia	Moderate	Groundcover
<i>Vinca major</i>	Periwinkle	Moderate	Groundcover



Scientific name	Common name	Priority	Weed type
<i>Galium palustre subsp. palustre</i>	Marsh bedstraw	Low	Groundcover
<i>Holcus lanatus</i>	Yorkshire fog	Low	Groundcover
<i>Iris pseudacorus</i>	Yellow flag iris	Low	Groundcover
<i>Lolium arundinaceum subsp. arundinaceum</i>	Tall fescue	Low	Groundcover
<i>Lotus pedunculatus</i>	Lotus	Low	Groundcover
<i>Paspalum distichum</i>	Mercer grass	Low	Groundcover
<i>Persicaria hydropiper</i>	Water pepper	Low	Marginal aquatic
<i>Ranunculus repens</i>	Creeping buttercup	Low	Groundcover
<i>Sambucus nigra</i>	Elderberry	Low	Woody
<i>Verbena bonariensis</i>	Purple-top	Low	Groundcover
<i>Veronica anagallis-aquatica</i>	Blue Water Speedwell	Low	Groundcover

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

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