GREAT SPOTTED KIWI MONITORING IN CYPRESS STREAM CATCHMENT , STOCKTON PLATEAU, SPRING 2010 TO SPRING 2011

Cover photo: *A juvenile great spotted kiwi, about 2-years old, found sheltering with its parents on the Mt William Range in April 2011.*

A REPORT TO SOLID ENERGY NZ LTD

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Declaration: John McLennan is also a director of Pestproof Fences Ltd

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Summary

The feasibility and practicality of creating four fenced bio-sanctuaries on parts of the Denniston and Stockton Plateaux, Buller District, is currently being evaluated by representatives of Alliance Ecology Ltd and Bathhurst Resources Ltd, Westport. The four sites range from 14.6 ha to 694.5 ha in size. The intention is to encircle each site with a 2m high fence, capable of excluding all mammalian predators and browsers including mice. The fences will also restrict the movements of a wide range of native species, including weka and great spotted kiwi, the plateaux's flightless avian inhabitants.

This report, commissioned by Alliance Ecology Ltd, specifically considers the potential impacts of the fences on great spotted kiwi, an iconic and nationally threatened species that is thinly but widely distributed across both plateaux. All four of the proposed enclosure sites are probably being used by great spotted kiwi now. The current spatial relationships between the footprints of the enclosures and the footprints of existing kiwi territories are not known. If built, the enclosures will inevitably cause short-term social disruption and boundary adjustments, favouring some territory holders at the expense of others. Some harm is also possible during construction if care is not taken to avoid roost and nest disturbance, the stranding of pair members on either side of a fence, or the premature separation of young from their parents. The intent of Bathurst Resources Ltd to build the fences whenever possible on existing roads and tracks will help to minimise some of these potential effects.

The three largest of the proposed enclosures are all big enough to support permanent populations of great spotted kiwi. They will, over 40-50 years, increase the reproductive output of their inhabitants, by reducing losses of young kiwi to stoats. They will also increase overall kiwi densities within the enclosures back to pre-human levels, as has happened in fenced sanctuaries elsewhere in New Zealand. The density responses on the plateaux may, however, be modest by national standards given the harsh climate, the infertile soils, and the large expanses of exposed sandstone in all sites. The enclosures between them may eventually support about 14 pairs, if territories inside compress to half the size of those on the outside. Ongoing monitoring and management will be required to maintain the genetic diversity of the confined populations and facilitate dispersal of young.

The predicted lifespan of the enclosures is virtually identical to the average lifespan of the kiwi themselves. Individual turnover will be minimal, with the overall benefits of the enclosures for kiwi depending entirely on how their inhabitants perform. If their lifetime reproductive rates are average or better, longterm benefits will vastly exceed short-term costs.

1 Introduction

Bathhurst Resources Ltd is currently investigating the feasibility and costs of establishing ring-fenced bio-sanctuaries on various parts of the Denniston and Stockton Plateaux, Buller District. Four potential sites have been identified, varying from 14.6 ha to 694.5 ha in size; and detailed assessments by representatives of Pestproof Fences Ltd have confirmed that all four sites are indeed 'fence-able'(Broadbridge and McLennan, 2025).

Full height (2.0 m) stainless steel exclusion fences with a 40-50 year lifespan are proposed for each of the sites, capable of excluding all introduced pest mammals including mice. The fences will also, inevitably, restrict the movements of native species that have limited (or no) ability to climb or fly, effectively preventing dispersal in and out of the enclosures, and, for some species, access to resources that were previously accessible. The fences will therefore have a mix of both beneficial and negative effects, with the net effect varying from species to species, depending on their vulnerability to predators and their specific habitat requirements.

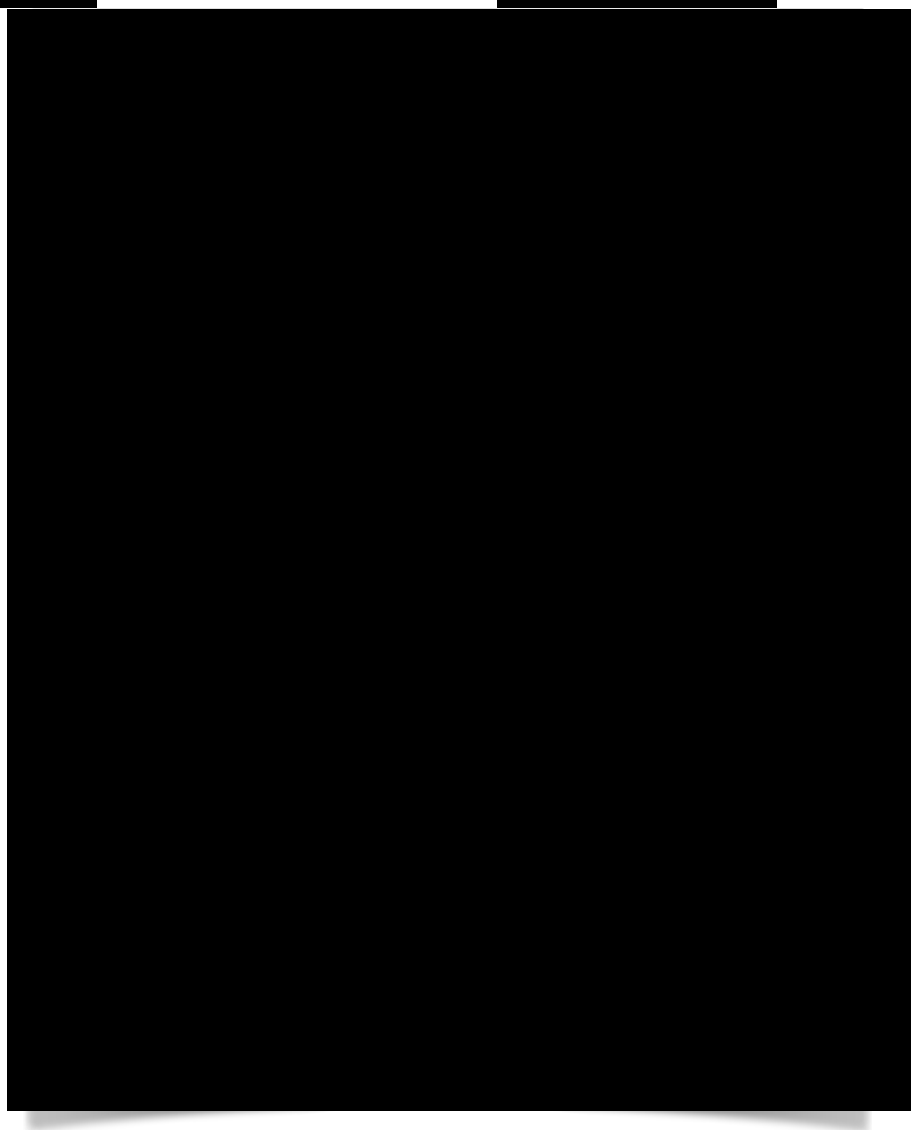
This report considers the potential impacts of the proposed fences on great spotted kiwi (Roroa, *Apteryx maxima,* formerly *A. haastii)*) an iconic inhabitant of the plateaux (Girardet and McLennan, 1997). The general ecology and behaviour of the kiwi on the plateaux is reasonably well known, following various studies on radio-tagged individuals over the last two decades (McLennan, 2010; McLennan 2011). There are no fenced populations of great spotted kiwi anywhere in Aotearoa New Zealand, apart from a handful of individuals in captive breeding facilities, and some juveniles in a crèche near Blackball, which are released to the wild when they become large enough to fend off stoats. The opinions in this report are therefore based mainly on studies and personal observations of surrogate species (little spotted, tokoeka and North Island brown) living permanently within and alongside fenced enclosures elsewhere in New Zealand.

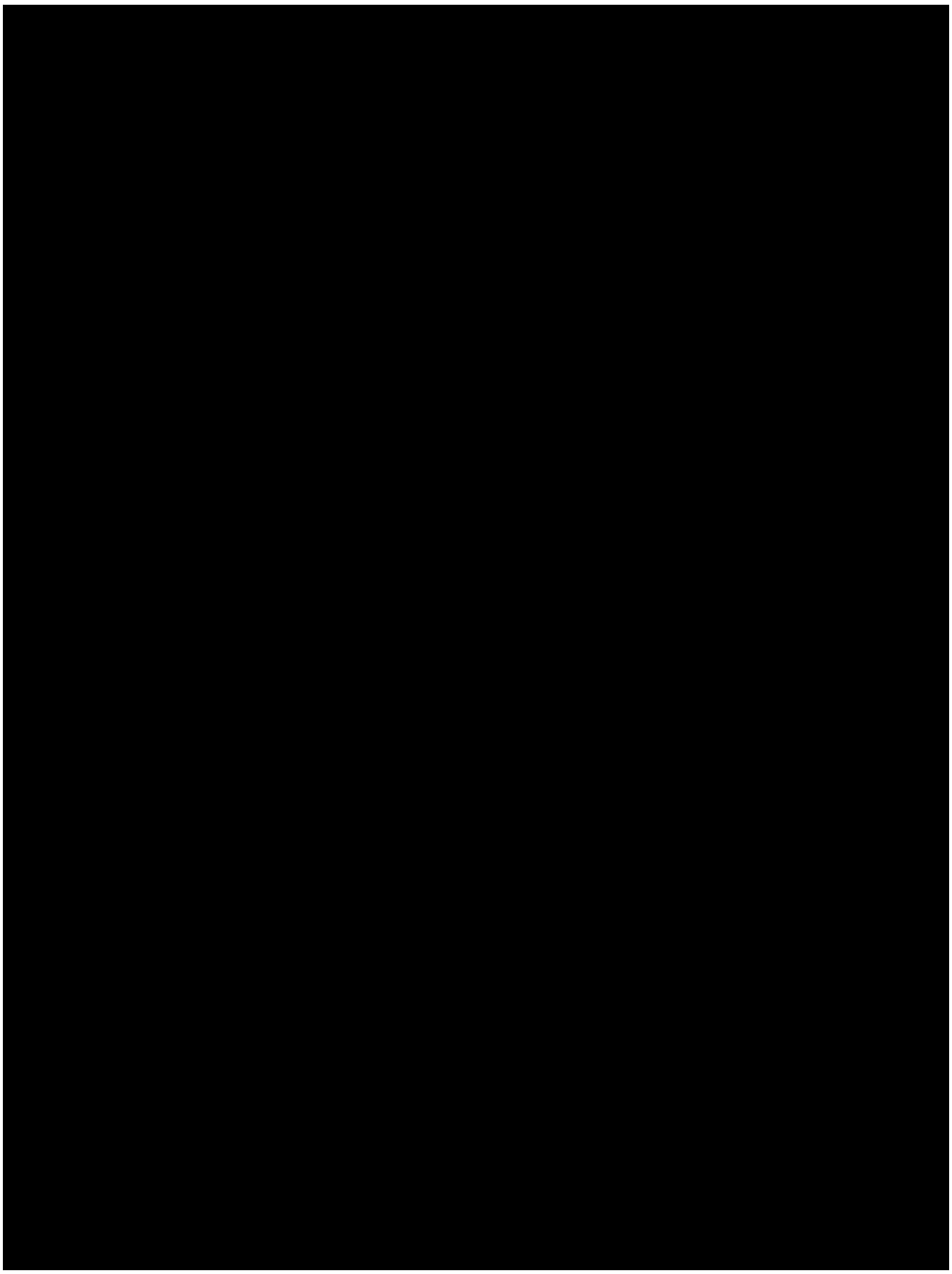
The report was commissioned in September 2025 by Dr Helen Blackie of Alliance Ecology, Auckland, as part of a general assessment of the potential ecological costs and benefits of pest-exclusion fencing on the coal plateaux.

2 The fence sites

All of the proposed fences are in wet sub-alpine landscapes, in ‘coal measure’ habitats, characterised by thin poorly- drained soils, expanses of exposed sandstone, and localised patches of stunted vegetation, often less than one metre high (Such habitats have not been pest-exclusion fenced before. Two of the proposed sites are on the Stockton Plateau and two on the Denniston Plateau

The smallest of the proposed enclosures (14.63 ha) on is also the most elevated at It abuts forest on its





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Great spotted kiwi and fences

, inhabited by kiwi, but is otherwise surrounded by mine workings, some currently being re-habilitated. Almost all of the vegetation within the proposed enclosure is low stature, clustered between sandstone pavements and outcrops.

he second roposed fence ite on the tockton Plateau s the largest at 94.5 ha (It oo is dominated y sandstone avements, but it ontains a range of egetation types nd landforms, ncluding a orested hill) nd some deeply issected streams, ordered by hrublands (

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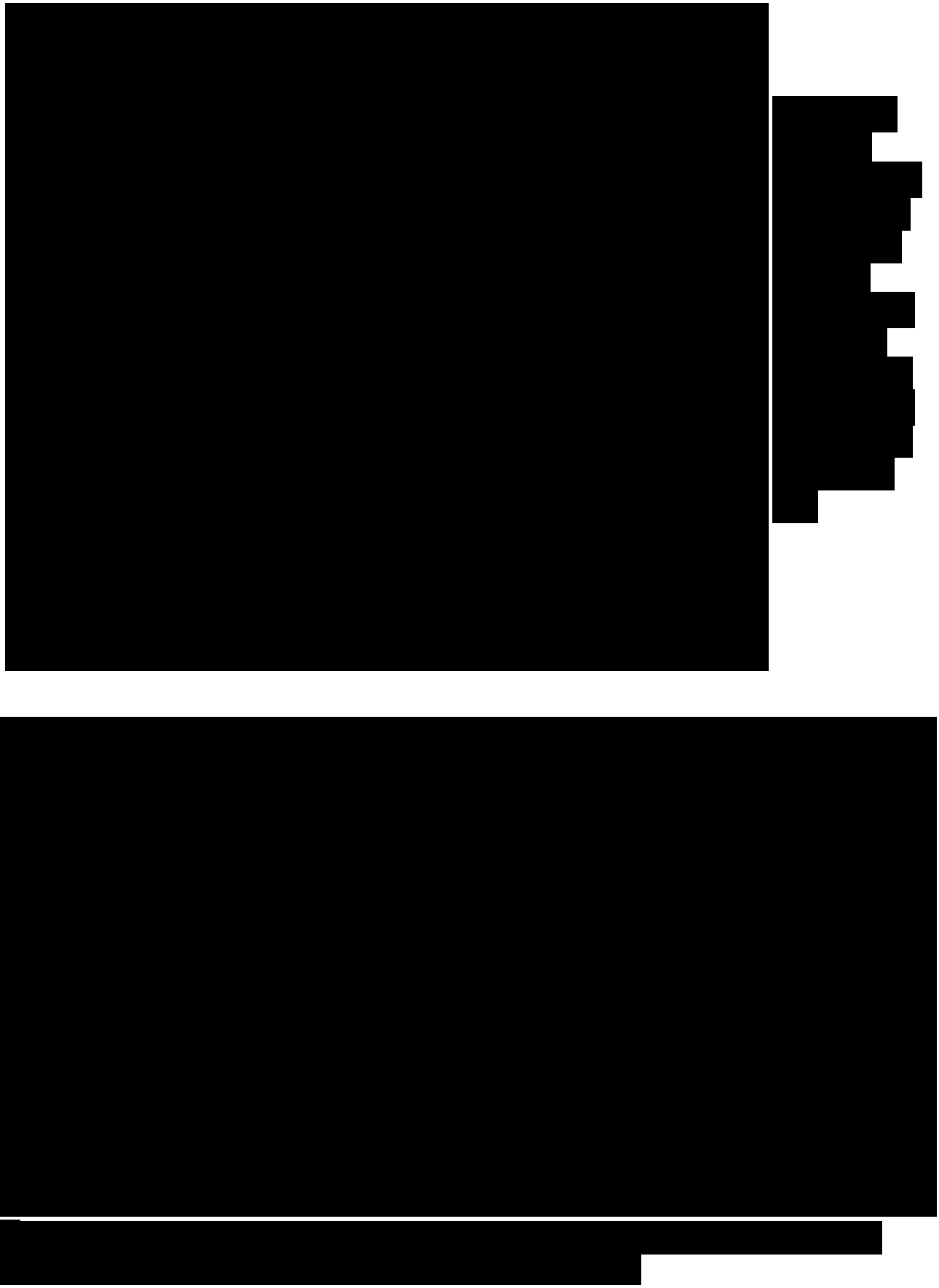
The largest of the proposed Denniston sites), large expanses of sparsely vegetated sandstone pavements, and some large patches of forest and shrubland, covering in total about one third of the site. The south-eastern corner abuts forests in steep tributaries of the Buller River. .

The second of the proposed sites ( ) is also relatively large at It is the most vegetated of the four, with an almost complete cover of stunted shrublands (dominated by manuka) mountain flax and tangle fern. Kiwi live near it and probably in it.



3 Relevant Behaviour and ecology of great spotted kiwi

The great spotted kiwi on the plateaux are part of a population that extends more or less continuously from the base of Farewell Spit to the southern end of the Paparoa Range (McLennan and McCann , 2002; Toy *et. al.,* 2021). There is a 25 km wide gap in their distribution between the Little Wanganui River and Mokihinui River; and the Buller River is thought to restrict movements between the populations on its northern and southern banks. The Northwestern region of the South Island is their stronghold, containing more than 80% of the national population, currently estimated at about 14,000 (Germano *et al.*, 2018). A smaller satellite population, centred on Arthur's Pass, is genetically similar to the northwestern population, indicating recent separation.

Great spotted kiwi are classified as *Threatened - Nationally Vulnerable*, the third highest threat ranking (Robertson *et.al.,* 2021). Stoat predation on juveniles is the main cause of population decline (McLennan *et. al.*; 1996). They are therefore 'predation limited' as are the other species of kiwi, and are less numerous now than they used to be. The average rate of decline across all great spotted populations is estimated to be 1.6% per annum, though some populations near people are declining at a faster rate ((Germano *et al.*, 2018).

Great spotted kiwi live as monogamous pairs in territories which they defend against other kiwi. The adults are typically very long-lived (50 + years) and pair bonds are usually long-lasting. In the densest populations in Kahurangi National Park, territories are about 25 ha (McLennan and McCann, 1991) about a quarter the size of those in and around the Stockton and Denniston Plateaux (McLennan, 2010).

Great spotted kiwi pairs have low reproductive rates (McLennan and McCann, 1991; Deverall, 2012; Toy and Toy, 2021). Most pairs lay just one or two eggs a year which both sexes incubate. Hatching rates range from 23% to 47%. Young remain in their parents territory for their first 2-3 years of life, until they reach adult size. The dispersal distances of 'young adults' are not known but they appear to be relatively short (15-20 km); recent studies indicate great spotted populations have high genetic diversity with fine-scale structuring, indicating limited dispersal and mating with close neighbours (Taylor *et. al.* 2021). The overall pattern of genetic variation lacks a consistent broad geographic pattern, but populations in different mountain ranges (Northwest Nelson, Paparoa Range, and Arthur's Pass) are considered to be sufficiently distinctive to justify separate management.

Great spotted kiwi are challenging to manage and options to improve their conservation status are limited. There are no security populations on offshore islands; they live mostly in remote wilderness landscapes that are difficult to access; they do not tolerate handling by people; and are generally not amenable to techniques which involve egg removal and

captive rearing of young. Currently, aerial applications of 1080 are the main management tool, and 50% of the national population has to be treated every three years in order to maintain it (Germano *et.al.* 2018). Currently less than 10% of the national population is benefiting from sustained predator control (Toy, *et. al.*, 2021).

4. Kiwi and fences

4.1 Population responses

Kiwi do extremely well in predator-free fenced sanctuaries, and on predator-free offshore islands from which there is no escape. Populations in these protected and confined environments reach densities which are exceptionally high by today's standards, but are presumably representative of those that prevailed everywhere in pre-human times. The fenced sanctuary on Maungatautari Mountain, for example, now has an estimated 3000 North Island brown kiwi, equating to 1 per ha (T. Joustra *pers. comm. Save the Kiwi Trust*) This density is 30-50 times higher than that in Urewera, the largest native forest remaining in the North Island. Similarly, there are an estimated 1000 little spotted kiwi and 50-100 brown kiwi on predator-free Kapiti Island, equating to about 1 kiwi per 2 ha ((Germano *et.al.* 2018).

It is important to note that the kiwi densities achieved in fenced sites on mainland New Zealand are never achieved in unfenced sites, except on isolated peninsulas that are effectively islands. Predator control alone is usually not sufficient to restore kiwi populations on the mainland, unless it is undertaken on a very large scale. In unfenced sites, young kiwi saved from predators often disperse out of the managed area, settling in places where they and their offspring no longer benefit from predator control. This dispersal slows population growth in the managed area and sometimes prevents it altogether. At Lake Waikaremoana, Urewera, the managed population on a 750 ha peninsula recovered only when the neck of the peninsula was fenced, preventing juveniles from leaving (Basse and McLennan, 2003).

Pest exclusion fences therefore have two effects on kiwi - they keep predators out, and they keep kiwi in. With no dispersal and predation losses, managed populations of kiwi within enclosures compress and increase, before reaching a new ceiling, imposed (presumably) by resource limitation.

The capacity of a population to increase following fencing and predator removal is often not apparent beforehand. Baseline territory mapping almost invariably shows that a landscape is fully occupied, regardless of whether the birds are numerous or scarce. All species of kiwi increase the size of their territories when densities decline, taking up 'reserve capacity' when opportunity allows. The very large and contiguous territories on

the Plateaux today therefore do not imply an absence of room for population increase., as discussed in section 5.

4.2 Individual responses

Kiwi respond to mesh fences in the same way that they respond to any physical barrier. They walk or run along them, but do not attempt to push through the mesh. Dispersing juveniles will often travel back and forth along a section of fence, looking for a way through. This behaviour means that they are easy to detect (with cameras positioned along a fence) and easy to trap and remove, if desired. Kiwi do not attempt to burrow under a fence, though they are potentially capable of doing so.

5 Probable effects of the proposed fences on kiwi on the plateaux

All of the spaces that the proposed fences will enclose on the plateaux are probably being used by kiwi now. The relationship between the footprints of the proposed enclosures and those of existing kiwi territories are unknown. Inevitably then, the fences (if built) will favour some territory holders and prevent others from accessing areas they currently utilise. They will cause boundary adjustments, as mining on the Stockton Plateau has done so recently in [redacted]. At worst, some pairs may be displaced, though evidence from Cypress suggests this is unlikely.

Conversely, the fences will protect some pairs from stoats, thereby enhancing their reproductive success. They will allow kiwi densities within the enclosures to increase. The two largest enclosures (154 ha and 694 ha) are clearly capable of sustaining permanent populations within them. [redacted] he Escarpment site (14.6 ha) is probably too small to support a pair, unless their food supplies were supplemented artificially.

The extent to which densities will increase inside the enclosures is difficult to determine because: 1) there are currently no island or fenced populations of great spotted kiwi anywhere, so their 'potential ceiling' densities are unknown; 2) the indications provided by North Island brown kiwi may not be particularly informative, given that they generally occupy more benign habitats, and often begin population recovery from a much lower base; and 3) the plateaux's habitats have no equivalents anywhere, but are clearly barren in many places. Toy *et. al.*, (2021) showed that great spotted kiwi are less abundant in habitats with high proportions of bare ground, high proportions of sub-alpine scrub, and rainfalls exceeding 4000-5000 mm per year - as on the plateaux.

The best guess is that current densities across the entire range of great spotted kiwi are about half what they used to be, based on a conservative estimate of an average 1% per

annum loss over the last 50 years. If true of the plateaux, [redacted] surviving to at least one year of age).

It is beyond the scope of this report to present a plan for minimising impacts on kiwi during enclosure construction, or managing them subsequently following enclosure completion. However, potential harm from construction will be minimal if appropriate measures are undertaken to prevent nest and roost disturbance, the inadvertent stranding of partners on opposite sides of a fence, or the premature separation of young from their parents. Similarly, the consequences of longterm isolation in enclosures will be minimal if measures are undertaken to avoid inbreeding (perhaps juvenile swaps between enclosures) and facilitate dispersal.

The carrying capacity of each enclosure will ultimately be revealed by the kiwi themselves. Annual counts will indicate when population growth finishes. Remote monitoring of weights and reproductive output (without the need to catch and handle individuals) may also help to indicate when density limits are being reached.

6. Summary and conclusions

The plateaux's resident kiwi will experience short-term social disruption and long-term territory boundary changes if the proposed fences are built. They might also experience other adverse effects if care is not taken during construction to minimise disturbance. Once established, the survival rates of young kiwi within the enclosures will increase, contributing to population growth, initially within the enclosures themselves, then later in the wider population (with assisted dispersal from the enclosures). The extent to which the enclosure populations will grow remains to be seen, but conservative calculations indicate they should at least double. The three largest enclosures are all big enough to support permanent populations, which - with appropriate management - should endure for as long as the fences themselves.

Over the longer term, the cumulative benefits of the enclosures for kiwi are likely to vastly exceed the harm they may cause during construction and establishment.

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