# I

# Appendix I – Lizard and Threatened Plant Survey

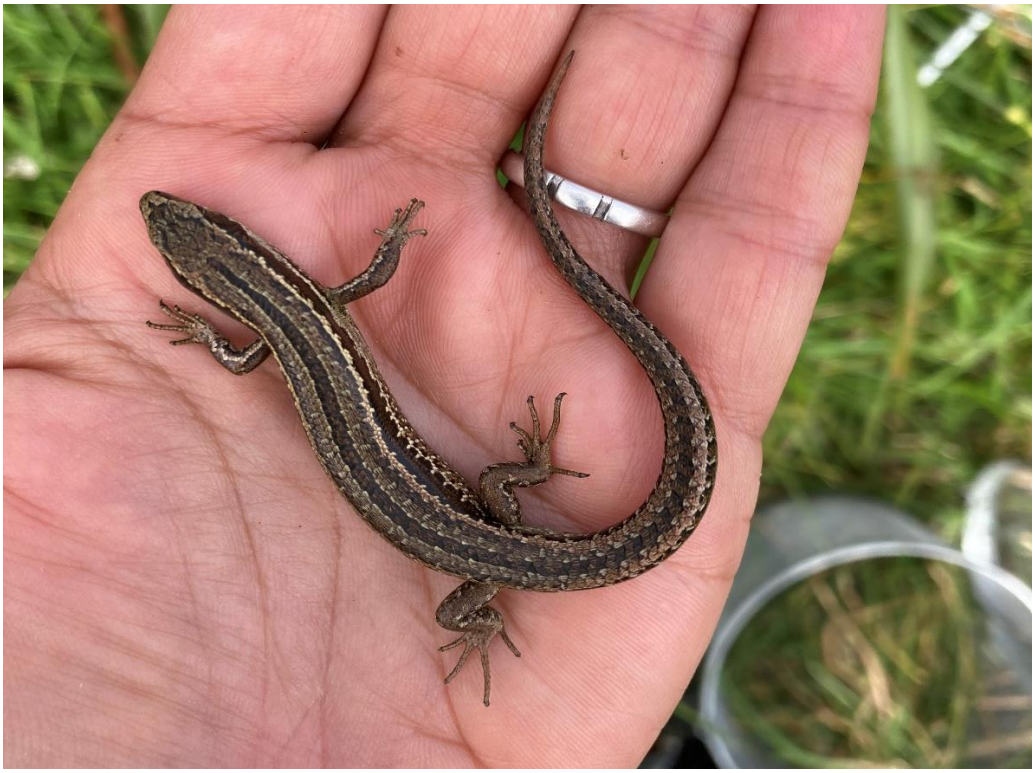
# LIZARD AND THREATENED PLANT SURVEYS AT A PROPOSED SLUDGE MINIMISATION FACILITY AT MOA POINT, WELLINGTON

providing outstanding ecological services to sustain and improve our environments

Wildlands

R6177a

# LIZARD AND THREATENED PLANT SURVEYS AT A PROPOSED SLUDGE MINIMISATION FACILITY AT MOA POINT, WELLINGTON



A northern grass skink (*Oligosoma polychroma*) captured in a funnel trap at the proposed sludge minimisation facility at Moa Point, Wellington

## Contract Report No. 6177a

July 2022

**Project Team:**
Nicki Papworth - Field survey and report author
Jina Sagar - Field survey and report author
Trent Bell - Report author
Cameron Thorp - Field survey
Florence Kelly - Report author
Federico Mazzieri - GIS

**Prepared for:**
Beca
PO Box 6345
Victoria Street West
Auckland 1142

WELLINGTON OFFICE: 4 MOHUIA CRESCENT, ELSDON, PORIRUA 5022; P.O. BOX 50-539, PORIRUA 5240
Ph 04-237-7341; Fax 04-237-7496

99 SALA STREET, WHAKAREWAREWA, 3010, P.O. BOX 7137, TE NGAE, ROTORUA 3042
Ph 07-343-9017; Fax 07-343-9018, email ecology@wildlands.co.nz, www.wildlands.co.nz

# CONTENTS

**Reviewed and approved for release by:**

Kelvin Lloyd
Principal Ecologist
Wildland Consultants Ltd

# 1. INTRODUCTION

Beca Limited (Beca) is assisting the Wellington City Council (WCC) in obtaining resource consents and altering an existing designation for a new sludge minimisation facility (SMF) at Moa Point, Wellington. The proposed SMF site (*c.*1.12 hectares) is located off Stewart Duff Drive, between the existing Moa Point waste water treatment plant (WWTP) to the south and east, Rangitatau Reserve to the east, Miramar Links Golf Course to the north, residential development to the south and Wellington International Airport to the west (Figure 1).

Beca conducted a preliminary ecological investigation that included both a desktop review of available regional ecological records and herpetological /vegetation databases (Huang 2021) and a site visit. Although no lizard records were found at the site from the desktop review, and no lizards were detected during the site visit, the desktop review found four species of lizard were associated with records nearby: barking gecko (*Naultinus punctatus*; 'At Risk – Declining'), northern spotted skink (*Oligosoma kokowai*; 'At Risk – Relict'), Raukawa gecko (*Woodworthia maculata*; 'Not Threatened') and northern grass skink (*Oligosoma polychroma*; 'Not Threatened')[1]. Vegetation on the site was described as potential habitat for lizards. Given the nearby lizard records and apparently suitable lizard habitats on site, Beca commissioned Wildland Consultants Ltd to undertake a lizard and threatened plant survey to determine the presence/absence of these fauna and flora.

The survey area for lizards and plants was undertaken in the area potentially affected by SMF activities – i.e. the maximum extent of bulk earthworks, proposed built footprint and potential land disturbance in the form of new pipework connections – plus representative adjacent habitat due to access constraints (see Figure 1). This report provides the results of the lizard and threatened plant surveys as well as an assessment of the potential ecological effects of the proposed development and suggestions for avoiding, remedying, or mitigating any potential adverse effects.

Note that an adjacent site, called 'The Hillock', is excluded from this assessment. Any future assessments, planning and consenting for the Hillock will be a separate process.

# 2. ECOLOGICAL CONTEXT

## 2.1 Overview

Moa Point is located on the south coast of Te Motu Kairangi/ Miramar Peninsula within the Wellington Ecological District. The Ecological District is described by McEwen (1987) as being characterised by steep hills and valleys, with frequent high winds and gales. Prevailing winds are from the north and northwest, and annual rainfall is 900-1,400 millimetres.

Valleys in the District have young alluvial, peaty or stony soils with varying degrees of drainage, generally more friable and better structured than hard packed coastal soils.

[1] Threat classifications from Hitchmough *et al.* (2021).

Upper slopes are moderately fertile, with loess depths varying across the region, which results in variable erosion and weathering regimes.

Vegetation on Southern coastal Te Motu Kairangi/Miramar Peninsula (from Buchanan 1872) would have comprised coastal broadleaf/podocarp forest dominated by kohekohe (*Didemocheton spectabilis*) and māhoe (*Melicytus ramiflorus*), with emergent rīmū (*Dacrydium cupressinum*) and northern rātā (*Metrosideros robusta*) in gullies and less exposed sections of hills, with grey scrub dominated by *Coprosma propinqua* and tauhinu (*Ozothamnus leptophyllus*) with *Muehlenbeckia astonii*, matakouri (*Discaria toumatou*), *Carmichaelia australis* covered in abundant climbers (*Muehlenbeckia complexa* and *M. australis*, kōkihi (*Tetragonia trigyna*), and New Zealand bindweed (*Calystegia tuguriorum*)) on ridges and steep areas. On the coast there would have been shrubland including wharariki (*Phormium cookianium cookianum*), makaka (*Plagianthus divaricatus*), *Coprosma propinqua*, tauhinu, sand coprosma (*Coprosma acerosa*), *Pimelea sp.*, taupata (*Coprosma repens*), shore spurge (*Euphorbia glauca*) and tussocks (*Poa sp.*) in drier, rocky areas, with intermittent sedgeland and rushland including wīwī (*Juncus sp.*), *Ficinia nodosa*, and kapungawha (*Schoenoplectus tabernaemontani*) and turf including maakoako (*Samolus repens*), remuremu (*Selliera radicans*), sea holly (*Eryngium vesiculosum*), arrowgrass (*Trichglochin striata*), *Chenopodium triandrum*, and beaded samphire (*Salicornia quinqueflora*) on edges of rockpools. Some duneland likely would have existed on the Eastern and Western sides of Moa Point in more protected areas, including *Spinifex sericeus*, sand sedge (*Carex pumila*), pīngao (*Ficinia spiralis*), and wharariki. On the most exposed areas, such as seaside banks and rocky outcrops, sparse vegetation includes *Senecio lautus* and *S. sterquilinus*, iceplant (*Disphyma australe*), *Apium prostratum*, and samphire.

Extensive farming in the region, both historical and present, has removed much of this indigenous forest, and urban encroachment is continuing. Podocarp trees have largely been logged out of many remaining remnants and gorse (*Ulex europaeus*) and Darwin's barberry (*Berberis darwinii*) are common invasive species (McEwen 1987).

Moa Point is exposed to strong and salt laden winds from the Cook Strait. Te Motu Kairangi/Miramar Peninsula was an island until the 1400s, when a large earthquake uplifted the area (Best 1923, Pillans and Huber 1992, cited in Herbert 2020). While much of the original kohekohe/tawa forest has been cleared, remnants of the original vegetation remain in the nearby Rangitatau Reserve (Huang 2021), and regeneration of short coastal māhoe forest is occurring, alongside coastal scrub (Herbert 2020).

Mammalian pest control is being carried out throughout the Miramar Peninsula, which includes predator trapping for rats, hedgehogs, and mustelids (Herbert 2020). Possums are thought to have been eradicated in 2006 (Herbert 2020), and rat numbers are now extremely low (Predator Free Wellington 2021).

## 2.2 Site description

The proposed Moa Point SMF site is part of a rocky peninsula that was quarried (between 1938 and the 1950s) and cleared of vegetation to accommodate the Wellington International Airport (Huang 2022). The survey area for lizards and plants comprises the wastewater treatment plant buildings and carpark, the hill and steep

slopes behind the buildings and the indigenous plantings and exotic grassland between the access road and the Miramar Links Golf Course (Figure 1).

# 3. METHODS

## 3.1 Lizard survey methods

An initial site visit was undertaken on 3 March 2022 by two experienced herpetologists, in order to visually assess potential lizard habitats, and to determine the number of, and suitable locations for, lizard sampling units to place on site. Gee's minnow live capture traps (funnel traps), non-destructive visual encounter searches (day searches), and spotlighting were used to capture and record lizards over the course of a three-day survey period over 7-10 March 2022.

It was determined not to use Onduline Artificial Cover Objects (ACOs), a common lizard survey technique. At this time of the year (mid-summer), ACOs perform very poorly (i.e. low lizard uptakes of ACOs) due to the heat of the day. Lizards normally residing in ACOs will have vacated the ACO to forage or hide in surrounding grassland which tend to be cooler. Trapping at this time of the year is a more effective lizard survey methodology.

### 3.1.1 Gee's minnow traps (funnel traps)

Gee's minnow traps are live capture funnel traps used for lizard (or fish) capture. These funnel traps are metal wire-mesh cylinders with a small opening on both ends; lizards enter the trap and cannot find their way back out. Funnel traps were placed out across the Moa Point site in prime lizard habitats (see Targeted Habitats section below for details) and checked every 24 hours. A piece of canned pear (as an attractant), a moistened sponge (to help regulate body moisture and temperature), and some leaf litter or grass (to provide cover and reduce stress for any lizards captured) were placed into the funnel traps. Trapped lizards were captured by hand, processed, and released back into the wild next to the trap.

Captured lizards were identified to species level and the following measurements were taken from each individual captured: snout-vent length (SVL) as a proxy for body size, total tail length (TL), length of regenerated portions of tail (if present), and sex. The sex of adult lizards (SVL >50 millimetres) was determined by examination of the internal and external features of the cloacal region. Data collection on lizard captures included the date and location (site and trap number).

### 3.1.1 Spotlighting and day-searching

Nocturnal spotlighting, using LED Lenser torches, was used to search for arboreal lizards (both diurnal and nocturnal species). Spotlighting was undertaken at dark (2100 to 0100) and involved searching foliage, large trunks and branches and forest edges for lizards in the planted indigenous and exotic treeland (Vegetation Type 2). At night, cover objects such as metal roofing, logs on the ground and pampas grass fronds were also searched for lizards. Spotlighting was carried out during warm, dry, and calm evenings (12°C minimum, with no rain).

Concurrent with funnel trap checks, the survey area was also day-searched by turning over cover objects to look for lizards. Cover objects included downed logs, stumps, plastic sheeting, the base of harakeke (*Phormium tenax*), wharariki, and pampas grass including fronds, loose rocks, and corrugated iron roofing (Appendix 2, Plate 6).

A targeted survey specifically for *Naultinus punctatus* was undertaken using both day searching and spotlighting methods.

### 3.1.2 Targeted habitats for survey

Site selection for trap placement was based on where the project herpetologists determined there was a reasonable likelihood that a lizard population was present, given suitable habitat. Funnel trap locations were selected both to sample the range of potential habitats and to provide maximum coverage to the survey area. Accessibility was a key constraint due to the steep terrain of the hill slope.

Funnel traps were set out in vegetation and habitat types known to support lizard populations. On the proposed Moa Point SMF site those included: gorse-pōhuehue-mingimingi shrubland (Vegetation Type 1), planted indigenous and exotic treeland (Vegetation Type 2), gorse/kikuyu-pōhuehue grassland (Vegetation Type 4), buffalo grass grassland (Vegetation Type 5), and karo/wharariki-taupata-cape ivy shrubland (Vegetation Type 6; see Section 5.1 below for vegetation and habitat type descriptions).

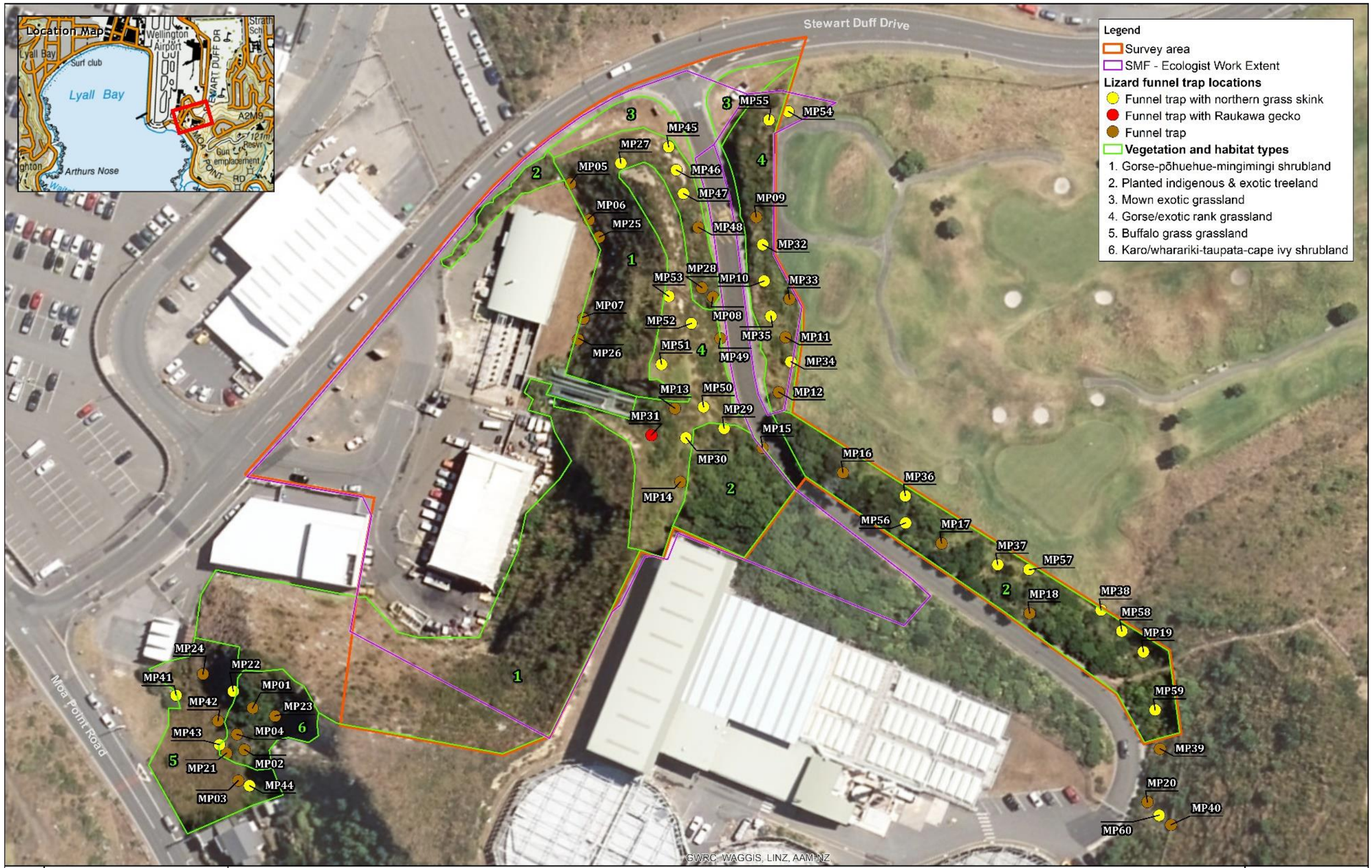
Grassland habitats with complex ground cover (such as kikuyu grass; Appendix 2, Plate 7) and sunny edges provide basking opportunities and cover, particularly for the northern grass skink. Copper skink and ornate skink can also be found in these complex grasslands. Funnel traps are an effective way of capturing these lizards, supported by day searching.

In addition to grassland habitats, copper skink and ornate skink can also be found in areas of forest, shrubland and scrub, provided there also exists deep leaf litter and refugia from predators, such as complex root systems, rock piles or fallen logs. Terrestrial live capture traps and day searching under cover objects are suitable methods for detecting these species.

In forest and shrubland habitats, ngāhere geckos and barking geckos may also be present, but these species can be difficult to detect, especially when at low densities. This is because these gecko species are arboreal (live in trees) and are highly cryptic in complex foliage. Raukawa geckos are both terrestrial and arboreal and are associated with indigenous forest sites, but are also with rocky habitats, particularly if rock cracks or piles have interstitial spaces that allow for retreats. In this survey, spotlighting at night (across the site and in the planted indigenous and exotic treeland) and day-searching (including turning over rocks for Raukawa geckos) were employed to find these gecko species.

### 3.1.3 Survey effort

The lizard survey was undertaken for three days over 7-10 March 2022 during ideal conditions, when the weather was warm and dry (19-25°C, average 21.5°C, no rain). Twenty funnel traps were used and each trap was moved daily so every trap location was sampled for a 24-hour period for a total of 60 trap nights across 60 unique funnel trap locations). Nocturnal spotlighting was carried out on 9 March 2022 by two experienced herpetologists (total of four person hours) between 2100 and 0100 hours. The spotlighting was carried out during a warm, dry, and calm evening (16-17°C minimum, with no rain). During funnel trap checks, the survey area was day-searched (a total of three person hours) by turning over cover objects within the survey area to look for lizards.




**Data Acknowledgment**

Map contains data sourced from LINZ
Crown Copyright Reserved
2021 GWRC Regional aerial

Report: 6177
Client: Boca
Ref: DS 0832
Path: E:\gis\MoaPoint_Hillock\mxd\
File: Figure_Vegetation_Lizard_MoaPoint.mxd

**Figure 1. Overview of lizard and threatened plant surveys at Moa Point SMF, Wellington**

0 20 40 m

Wildlands
www.wildlands.co.nz, 0508 WILDNZ

Scale: 1:850
Date: 5/05/2022
Cartographer: LD
Format: A3R

## 3.2 Threatened plant survey

### 3.2.1 Desktop assessment

Relevant literature, reports, and data sets were reviewed to support the survey and collate a list of threatened plants most likely to occur in the area and within the habitats on site. Key information used for this review included:

- The Department of Conservation BioWeb Flora database
- Plant lists stored on the New Zealand Plant Conservation (NZPCN) website located within five kilometres of the property boundary.
- Research grade observations of plants on iNaturalist within three kilometres of the property boundary.

### 3.2.2 Survey effort

The site was botanically surveyed on 9 and 10 March 2022, during which time the site was slowly walked by an experienced botanist whilst searching for threatened plants. Binoculars were used where necessary to search cliff faces and areas unsafe to access.

All vascular plant species observed were recorded and are listed in Appendix 3. Vegetation and habitat types were described, mapped, and digitised onto aerial imagery using ArcGis10.7.

# 4. VEGETATION AND HABITATS

Six terrestrial vegetation and habitat types were identified and mapped in the March 2022 survey:

1. Gorse-pōhuehue-mingimingi shrubland
2. Planted indigenous and exotic treeland
3. Mown exotic grassland
4. Gorse/kikuyu-pōhuehue grassland
5. Buffalo grass grassland
6. Karo/wharariki-taupata-cape ivy shrubland

These are described in more detail below and mapped in Figure 1.

**1. Gorse-pōhuehue-mingimingi shrubland (*c*.0.52 hectares)**

The cliffs surrounding the AGS Automotive building and lining the road to the Moa Point Wastewater Treatment Plant are covered in a dense mix of wind-shorn gorse (*Ulex europaeus*) and mingimingi (*Coprosma propinqua* var. *propinqua*) shrubs with abundant pōhuehue (*Muehlenbeckia complexa* var. *complexa*) (Plate 1). Wharariki (*Phormium cookianum* subsp. *hookeri*), koromiko (*Veronica stricta* var. *stricta*), boneseed (*Chrysanthemoides monilifera* subsp. *monilifera*), and fennel (*Foeniculum vulgare*) are common throughout. Shrub cover is sparser at the margins and on sheer rock-sides, and species such as silver tussock (*Poa cita*), pig's ear (*Cotyledon orbiculata*),

Tangier pea (*Lathyrus tingitanus*), and *Coriaria sarmentosa* are present in these areas.

**2. Planted indigenous and exotic treeland (c.0.24 hectares)**

Two areas lining the road from Stewart Duff Drive to the wastewater treatment plant were vegetated in planted indigenous and exotic trees with a sparse understorey (Plate 2). The southern side is dominated by karo (*Pittosporum crassifolium*) and ngaio (*Myoporum laetum*), while the northern side is predominantly pōhutukawa (*Metrosideros excelsa*) interspersed with exotics such as Sydney golden wattle (*Acacia longifolia*) and eucalyptus (*Eucalyptus* species). The karo is replaced by large koromiko (*Veronica stricta)*, gorse, and karo saplings at western edges of the southern side.

The understorey is sparse on both sides, predominantly comprising thick leaf litter and the occasional huruhuru whenua (*Asplenium oblongifolium*) and kawakawa (*Piper excelsum* subsp. *excelsum*), with swathes of kikuyu (*Cenchrus clandestinus*) at the edges where there is more light penetration.

**3. Mown exotic grassland (c.0.04 hectares)**

Two small areas of mown exotic grasses and pasture herbs are located at the intersection of Stewart Duff Drive and at the entrance to the wastewater treatment plant.

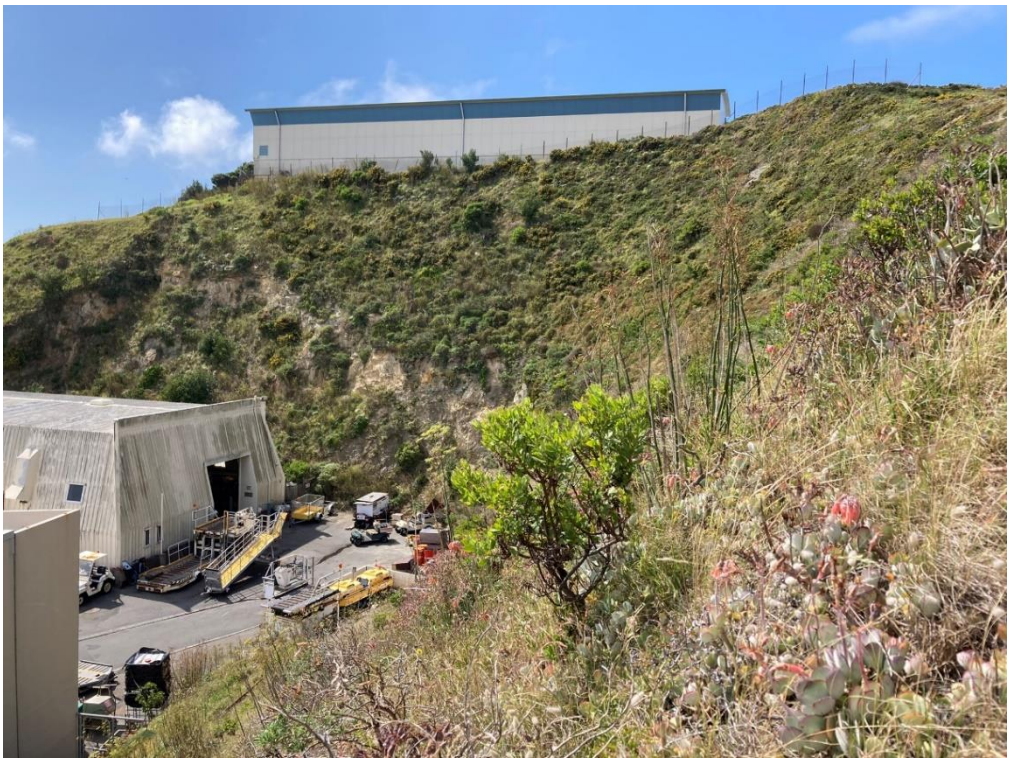


Plate 1: North-facing cliffsides overlooking the AGS Automotive building covered with gorse-pōhuehue-mingimingi shrubland (Vegetation Type 1). March 2022.

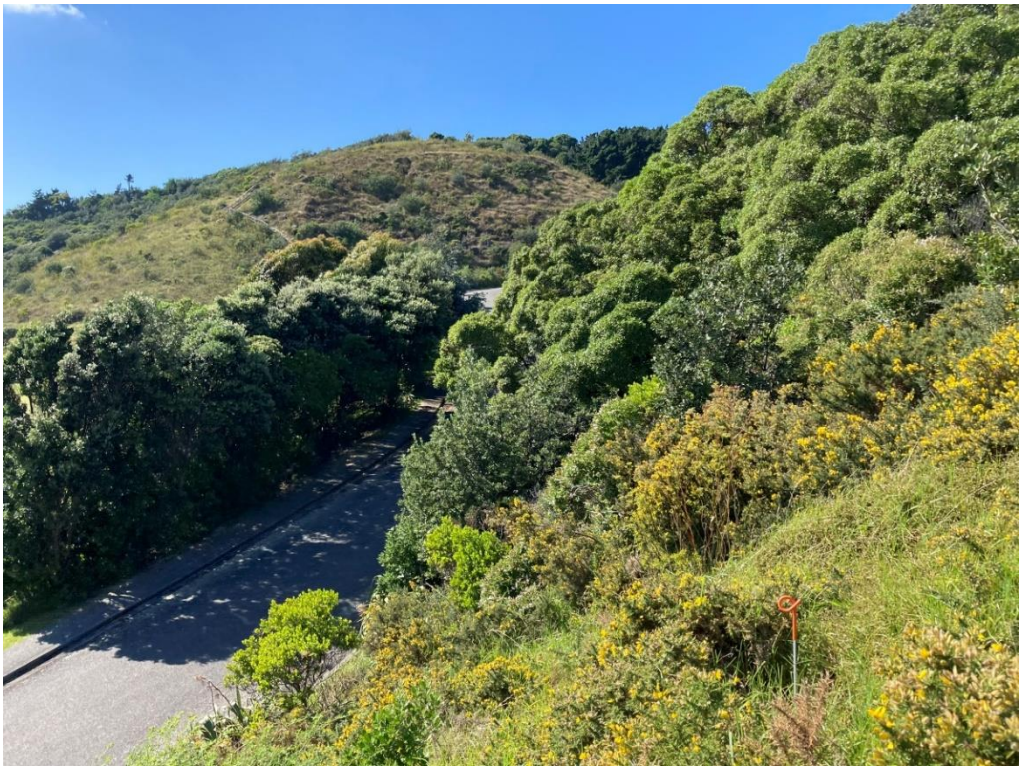


Plate 2: Planted indigenous and exotic treeland (Vegetation Type 2) on the Stewart Duff Drive entrance to the Moa Point Wastewater Treatment Plant. March 2022.

## 4. Gorse/kikuyu-pōhuehue grassland (c.0.20 hectares)

These areas are dominated by rank kikuyu grass (over 20 centimetres tall), interspersed with abundant pōhuehue and wind sheared gorse shrubs. Taupata (*Coprosma repens*), mingimingi, fennel, and wīwī (*Ficinia nodosa*) are scattered throughout.

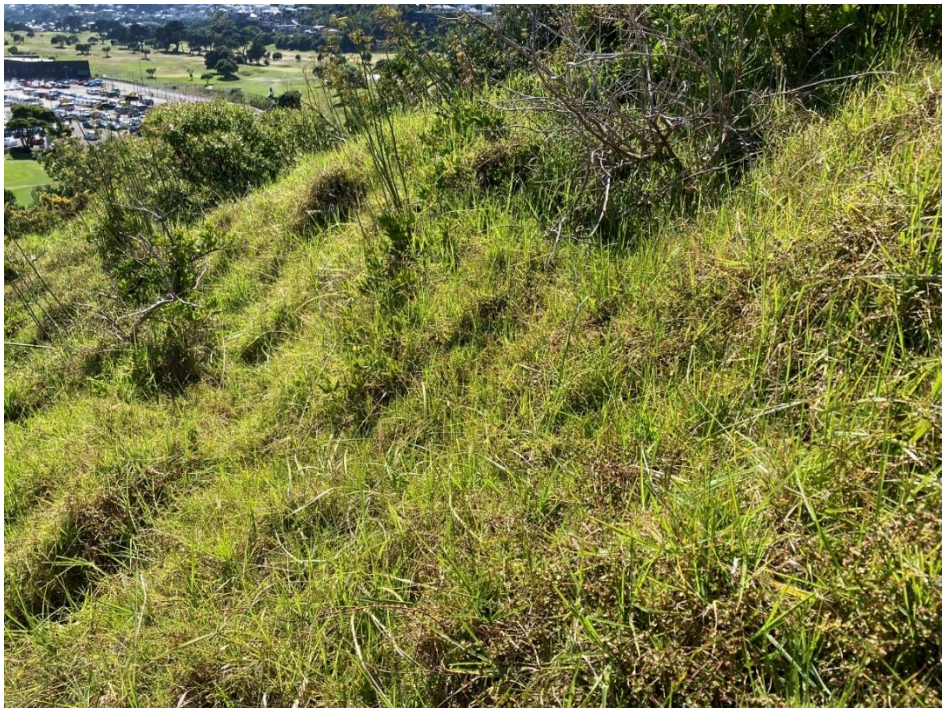


Plate 3: Gorse/kikuyu-pōhuehue grassland (Vegetation Type 4) on the Stewart Duff Drive entrance to the Moa Point Wastewater Treatment Plant. March 2022.

## 5. Buffalo grass grassland (c.0.08 hectares)

Rank buffalo grass (*Stenotaphrum secundatum*) dominates the area between Moa Point Road and the south facing sea cliffs (Plate 4). Occasional patches of freeway daisies (*Dimorphotheca fruticosa*), agapanthus (*Agapanthus praecox*), and ice-plant (*Carpobrotus edulis*) occur throughout, and taupata lines the eastern side.

## 6. Karo/wharariki-taupata-cape ivy shrubland (c.0.04 hectares)

A shrubland of karo, low growing taupata, and wharariki occurs on the slopes leading to the south facing cliffs on Moa Point Road (Plate 5). Dense cape ivy (*Senecio angulatus*) lines the southern edges and several young pōhutukawa are present among the karo. The vertical cliff sides contain patches of taupata, wīwī, horokaka (*Disphyma australe* subsp. *australe*), coastal woodrush (*Luzula banksiana* var. *banksiana*), wallflower (*Erysimum ×cheriri*), and pig's ear. These species are also present in the understorey, along with kōkihi (NZ spinach, *Tetragonia trigyna*), coastal spleenwort (*Asplenium appendiculatum* subsp. *maritimum*) and *Coriaria sarmentosa*.

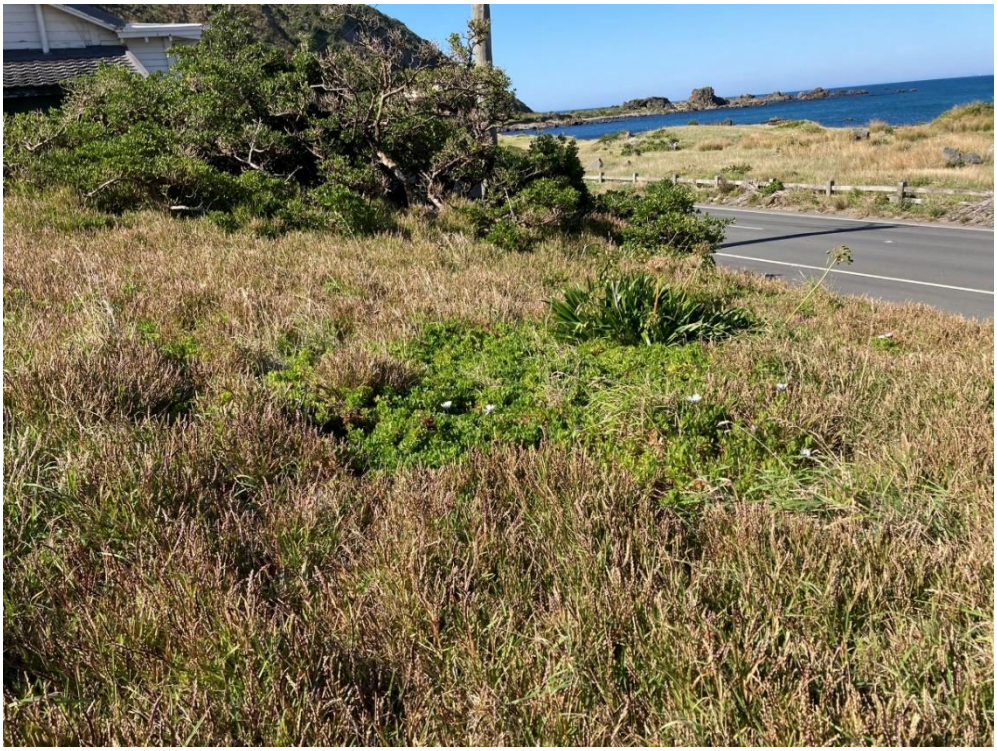


Plate 4: Buffalo grass grassland (Vegetation Type 5) on the northern side of Moa Point Road. March 2022.

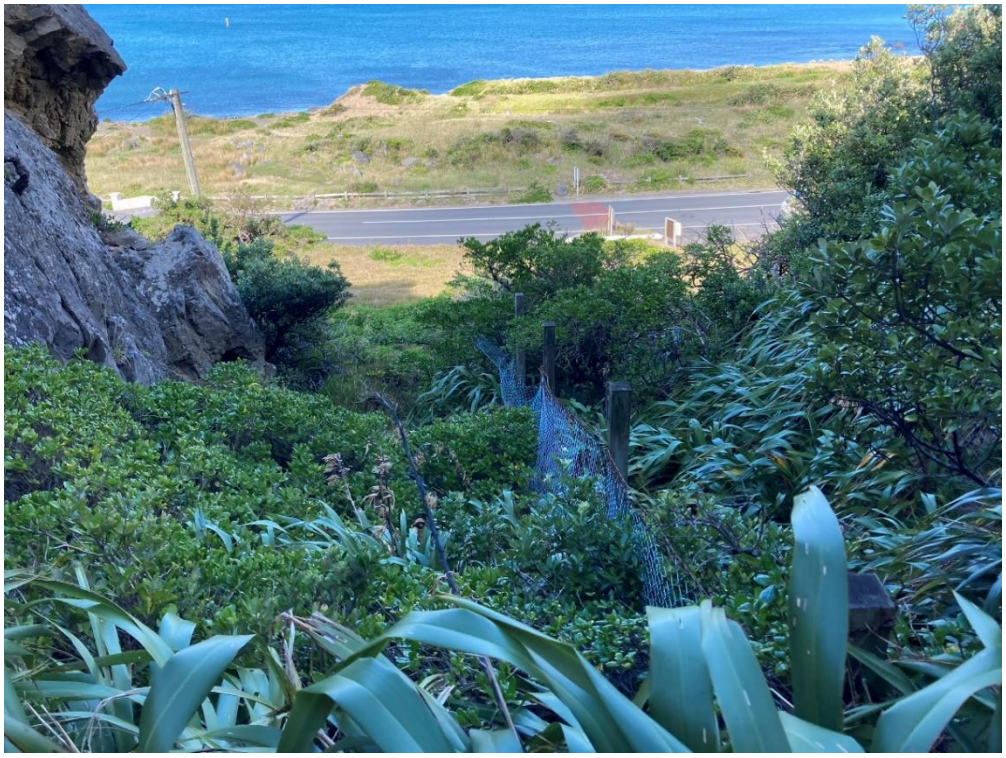


Plate 5: Karo/wharariki-taupata-cape ivy shrubland (Vegetation Type 6) on the northern side of Moa Point Road. March 2022.

# 5. SURVEY RESULTS

## 5.1 Lizard survey results

Two lizard species were detected over the course of the three days of the lizard survey: northern grass skink (*Oligosoma polychroma*, 'Not Threatened') and Raukawa gecko (*Woodworthia maculata*; 'Not Threatened')[1] (Photos in Appendix 2, Plates 8 and 9). Sixty northern grass skinks were recorded, in funnel traps, across the survey area (see Appendix 1 for capture data). Although some of the northern grass skink may have been recaptures, sixty skinks in an *c.*1.12 hectare area indicates a particularly dense skink population is present.

Two Raukawa gecko were found in the same funnel trap (indicated on Figure 1, capture data in Appendix 1). The funnel trap where Raukawa geckos were captured had been placed next to a rocky wall where the hill had been cut away for the wastewater pipes. The Raukawa gecko population found on site will be a minimum number given they were found near rocky outcrops close to inaccessible areas for survey due to the presence of WWTP facilities and steep slopes. These inaccessible areas provide suitable habitat for Raukawa gecko.

The survey for *Naultinus punctatus* on 4 July was undertaken in weather conditions somewhat suitable for the species, with warm sunlit conditions falling on the shrubs that might contain these geckos during day searching, and calm, dry night conditions during spotlighting. Two-and-half person hours day searching and four person hours spotlighting was undertaken specifically for these geckos. See Appendix 4 for the appropriateness of undertaking *Naultinus* survey work during winter.

It should be noted that no sign of predators was found during the survey, including mouse droppings or mice in the traps. This is potentially due to intensive trapping operations undertaken by Predator Free Wellington on the Miramar Peninsula. The combination of ideal habitats for northern grass skinks (buffalo grass grassland, gorse/exotic rank grassland, kikuyu grass), sunny aspect, and the lack of predators all contribute to the presence of a high number of skinks.

## 5.2 Threatened plant survey results

One threatened plant species, pōhutukawa, was found during the survey. Pōhutukawa has a national-level threat classification of 'Threatened – Nationally Vulnerable' (de Lange *et al*. 2018). However, pōhutukawa is a member of the Myrtaceae family, which is at risk of infection by myrtle rust (*Austropuccinia psidii*), a potentially devastating rust which has no known treatment. Along with other species in the Myrtaceae family, the threat status of pōhutukawa has been elevated as a precautionary measure based on the potential threat posed by myrtle rust.

Pōhutukawa in the Wellington region are also outside their natural distribution range, and are currently common and widespread in the local environment, planted extensively, and to date have not been greatly affected by myrtle rust; thus, we place little weight on its nationally threatened status in this context.

[1] Threat classes from Hitchmough *et al.* 2021.

It should be noted that small, threatened grasses, sedges, or herbaceous species could not be extensively surveyed for given the topography of the site. However, given the situation and current use of the site, and the few recorded occurrences of those species in the near vicinity, the likelihood of their presence in the survey area is low.

# 6. ECOLOGICAL VALUES

## 6.1 Assessment of affected fauna habitat

Ecological value assessments are based on the Environment Institute of Australia and New Zealand (EIANZ) guidelines (Roper-Lindsay *et al.* 2018) and are further informed by professional opinion and expertise. The ecological values of indigenous and exotic habitat types at the Moa Point SMF are to be described by Beca. Northern grass skink is likely present in most identified vegetation/habitats (Vegetation Types 1-2 and 4-6). Raukawa gecko are likely to be present in some, but not all, communities. The geckos are currently recorded in gorse-pōhuehue-mingimingi shrubland, but may also be elsewhere. In summary, two species of lizards are present throughout the entire site (both accessible and inaccessible), and are therefore likely to be present in moderate numbers on construction work sites. The assessment in this report is restricted to assessment of value for lizards only.

## 6.2 Assessment of fauna values

Raukawa gecko and northern grass skink, two 'Not Threatened' lizard species (Hitchmough *et al.* 2021), are confirmed as present on or adjacent to the Moa Point SMF. No lizard species listed as 'Threatened' or 'At Risk' have been identified as present or potentially present at the site. However, it is possible that some 'At Risk' species may be present in low numbers, in areas in inaccessible to the survey. The most likely undetected species are barking gecko (*Naultinus punctatus*, 'At Risk – Declining') or copper skink (*Oligosoma aeneum*, 'At Risk – Declining'). As for Raukawa gecko and northern grass skink, these may also be adversely affected by habitat clearance and earthworks. Lizard management planning should consider the potential presence of other lizard species, and implement appropriate management measures should these be discovered.

The ecological values, based on the threat status of Raukawa gecko and northern grass skink, are summarised in Table 2.

Table 2: Ecological value assessment for indigenous lizards that occur or potentially occur at the Moa Point Slude Minimisation Facility, that may be impacted by habitat clearance and earthworks for the project (as per Roper-Lindsay *et al.* 2018).

| Species | Threat Status | Assigned Value |
|---|---|---|
| Raukawa gecko | Not Threatened | Moderate |
| Northern grass skink | Not Threatened | Moderate |

Another lizard species preliminary identified in the ecological constraints assessment are now not expected to be present. This is the northern spotted skink. This is a rare

species that is not currently known at Te Motu Kairangi/Miramar Peninsula, although it would have historically existed throughout Te Motu Kairangi.

# 7. ACTUAL AND POTENTIAL EFFECTS ON LIZARDS

## 7.1 Evaluation of ecological effects

The EIANZ guidelines for undertaking assessments of ecological effects in New Zealand (Roper-Lindsay *et al.* 2018) were referred to in preparing this report. Professional opinion and expertise have been applied throughout the assessment to ensure that the results are ecologically robust.

## 7.2 Effects on lizards

Potential adverse effects of the proposed development of the site on lizards can be summarised as:

- Disturbance, injuries and/or deaths of lizards during vegetation clearance and associated earthworks, particularly slope stabilisation and colluvial rubble clearance.
- Temporary displacement and social disturbance of lizards and their populations.
- Permanent loss and modification of lizard habitat.
- Increased predation risk to lizards by introduced predators due to increased movements/ displacement (however this effect is low due to effective mammal pest control throughout Te Motu Kairangi/Miramar Peninsula).
- Disturbance during construction including dust/vibration and noise.

Most of the adverse impacts on Raukawa gecko northern grass skink will arise from the clearance of potential lizard habitat through the slope stabilisation works. Specifically identified direct impacts through vegetation/ habitat clearance likely to arise are as follows: a proposed footpath or truck passing lanes to the north of the site; and slope cutting and stabilisation of the steepest section of the site. Northern grass skinks are present in grassland, shrubland including those on the rocky slope and colluvial rubble at the base of the slope (Vegetation Types 1-2 and 4-6) and Raukawa geckos in Vegetation Type 1 on the rocky sites on slope, including the colluvial rubble. No impact on lizards is expected through building removal or pipeline realignment.

The magnitude and level of each effect have been defined as outlined in the EIANZ guidelines (Roper-Lindsay *et al.* 2018). The magnitude of effects on both Raukawa gecko and northern grass skink are ranked ‘Moderate’, and the Level of Effect ranked ‘Moderate’ without avoidance or mitigation. The moderate magnitude of effect is due to loss or alteration to key elements/features of baseline habitat condition, such that post-development character will be partially changed and loss of a moderate proportion of the known population present on site. As Raukawa gecko and northern grass skink are both very abundant and widespread throughout the lower North Island and upper South Island, losses represent only <1% of the population.

It will be difficult to efficiently avoid or minimise impacts on Raukawa gecko and northern grass skink using conventional mitigation techniques (such as salvage-and-

relocation programmes). This is because of the inaccessibility of the site, as well as lizard behaviour making it difficult to capture all individuals within the existing population. For example, when inactive, both species can be well-hidden in thick shrubland or grassland habitat, and skinks in particular can be difficult to catch when active. It will be difficult to cost-effectively extract all individuals out of the works area through a salvage programme, thus achieving a 'no net loss' outcome. Northern grass skink are also mobile, making it difficult to keep skinks from returning to work sites.

### 7.3 Effect management

Risks can be minimised by avoiding, mitigating, or compensating for the identified adverse effects through the preparation and implementation of a Lizard Management Plan (LMP) for the project prior to vegetation clearance and commencement of construction work. The implementation of activities in the LMP is likely to lead to a 'Low' or 'Very Low' level of effects for lizards. Best practice (and evidence-based, where available) lizard management planning is likely to be able to achieve these outcomes. Development of a science-based monitoring programme is to be a key objective in the management plan.

## 8. WILDLIFE MANAGEMENT

All indigenous lizards, indigenous birds and some indigenous invertebrates are absolutely protected under the Wildlife Act (1953). It is an offence to disturb or destroy protected wildlife without a Wildlife Act Authorisation (WAA; also known as a wildlife permit) from the Department of Conservation. A permit must be obtained from the Department before any protected wildlife (and/or their habitats) can be disturbed, handled, translocated or killed.

A wildlife permit is required to carry out modification or land development that have adverse impacts on indigenous New Zealand lizards (Department of Conservation 2018). As two legally protected species of lizard (Raukawa gecko and northern grass skink), have been confirmed present, and adverse effects are unavoidable, a Lizard Management Plan (LMP) is required. LMPs are often required as a resource consent condition, as are continuing to meet all other legal obligations (such as obtaining required permits) when carrying out consented activities.

A LMP should comprise a comprehensive plan that clearly avoids, mitigates, offsets or compensates for the losses of lizard populations and their habitats. Wildlife management actions could include avoidance, and/or relocation of lizards and site management (habitat enhancement, pest management, monitoring) at specific sites. The Department will need to be reasonably confident that, on balance, lizard populations will not be worse off than prior to works. This may include use of *in situ* mitigation management of lizards or the use of offsetting or compensatory tools elsewhere.

A LMP needs to be prepared and implemented by a qualified and permitted ecologist/ herpetologist, to ensure the appropriate wildlife management actions are implemented. Together with the LMP, a wildlife permit allows for the impacts on lizards and the management of effects.

It is acknowledged that the wildlife permitting process can be lengthy (3-6 months after submission of an application along with a LMP) and there are seasonal constraints when working with wildlife. Depending on the management options selected, pre-preparation of sites may be required ahead of commencing wildlife management, thus site works may be further delayed.

# 9. CONCLUSIONS

Two species of lizards are present on site, however threatened plants are not a concern. However, due to the inaccessibility of the slope, botanical survey effectiveness was constrained. Impact assessment for the two lizard species was described as 'moderate' for magnitude of effect and level of effect. Impact assessment for the identified vegetation communities is to be undertaken by Beca.

Preparation of a LMP is required, along with an application for a Wildlife Act Authority (WAA). The Project is now in the process of preparing a LMP and WAA application. Pre-application discussions with the Department of Conservation indicate the below actions should be considered in a draft LMP:

- Salvage lizards from safely accessible parts of the work site.
- Reservation or covenant of a lizard management area *in situ*, with clear aims, objectives and purposes identified for land set aside for legal protection, as to ensure lizard values are protected.
- Enhance adjacent lizard habitat within the protected area for northern grass skink and Raukawa geckos.
- Release any lizards recovered from safely accessible parts of the work site.
- Monitoring of lizard management measures (assessing actual outcomes of relocation and habitat enhancement work).
- Prepare a compensation package for lizards that cannot be safely relocated from slope stabilisation work, because of inaccessibility and health and safety considerations.
- Follow the nine key principles for lizard mitigation (Department of Conservation 2019).

An Incidental Discovery Protocol should also be prepared for unexpected discoveries of lizards, in addition to any lizard management work identified above. This is related to the removal of industrial buildings, particularly the AGS Automotive building.

The implementation of activities in the LMP is likely to lead to a 'Low' or 'Very Low' level of effects for lizards.

It is also recommended that an Environmental Management Plan is prepared for the Moa Point SMF, so that restoration of the indigenous plant community, weed management, and habitat enhancement can be undertaken after site works. These could potentially include establishment of matagouri, *Muehlenbeckia complexa,* and

*Coprosma propinqua* on cliffs, and maintenance of planting areas for a minimum of three years.

## ACKNOWLEDGMENTS

Jennifer Beardsall and Richard Hickman (Beca) are thanked for their assistance with this project. We thank Ryan McAlister (Beca), and Ezekiel Hudspith and Liam Bullen (Dentons Kensington Swan) for their most valuable review of this report.

## REFERENCES

Buchanan, J. 1872: Art. XLVI.—List of Plants found on Miramar Peninsula, Wellington Harbour.* Written to accompany paper by J. C. Crawford, F.G.S., on the Miramar Peninsula, see Art. LVII. Transactions and proceedings of the Royal Society of New Zealand, vol 5. p34. https://paperspast.natlib.govt.nz/periodicals/TPRSNZ1872-5.2.6.1.46.

Department of Conservation 2019: Key principles for lizard salvage and transfer in New Zealand. Lizard Technical Advisory Group, Department of Conservation, Wellington. 23 pp.

Herbert S. 2020: Is habitat enhancement a viable strategy for conserving New Zealand's endemic lizards? Unpublished PhD thesis, Victoria University of Wellington.

Hitchmough R.A., Barr B., Knox C., Lettink M., Monks J.M., Patterson G.B., Reardon J.T., van Winkel D., Rolfe J., and Michel P. 2021: Conservation status of New Zealand reptiles, 2021: *New Zealand Threat Classification Series 35*. Department of Conservation, Wellington. 15 pp.

Huang S. 2021: Moa Point Sludge Minimisation Facility – Ecological Preliminary Assessment. Beca Memorandum 3258521-1535441118-94.

Predator Free Wellington 2021: https://www.pfw.org.nz/2020-21-impact-report/

Roper-Lindsay J., Fuller S.A., Hooson S., Sanders M.D., and Ussher G.T. 2018: Ecological Impact Assessment (EcIA). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition. EIANZ Melbourne, Australia.

# PROPOSED MOA POINT SMF LIZARD SURVEY RESULTS 7-10 MARCH 2022

All lizards captured with Gee's minnow traps (funnel traps). Note: Sex: F=Female, M=male, J=juvenile

| Number | Date | Trap Number | Species | Sex | SVL (mm) | Tail Length (mm) | Regenerating Tail (mm) |
|---|---|---|---|---|---|---|---|
| 1 | 8/3/2022 | 10 | Northern grass skink | M | 59 | 71 | |
| 2 | 8/3/2022 | 19 | Northern grass skink | J | 37 | 45 | |
| 3 | 8/3/2022 | 20 | Northern grass skink | F | 65 | 76 | 5 |
| 4 | 9/3/2022 | 22 | Northern grass skink | M | 61 | 75 | |
| 5 | 9/3/2022 | 22 | Northern grass skink | F | 52 | 66 | |
| 6 | 9/3/2022 | 27 | Northern grass skink | F | 53 | 72 | |
| 7 | 9/3/2022 | 29 | Northern grass skink | J | 48 | 56 | |
| 8 | 9/3/2022 | 31 | Raukawa gecko | M | 64 | 79 | |
| 9 | 9/3/2022 | 31 | Raukawa gecko | M | 66 | 80 | |
| 10 | 9/3/2022 | 31 | Northern grass skink | F | 53 | 65 | |
| 11 | 9/3/2022 | 30 | Northern grass skink | M | 51 | 65 | |
| 12 | 9/3/2022 | 32 | Northern grass skink | F | 55 | 68 | |
| 13 | 9/3/2022 | 34 | Northern grass skink | M | 55 | 50 | 31 |
| 14 | 9/3/2022 | 34 | Northern grass skink | M | 66 | 60 | 38 |
| 15 | 9/3/2022 | 34 | Northern grass skink | M | 60 | 70 | |
| 16 | 9/3/2022 | 35 | Northern grass skink | F | 62 | 64 | 51 |
| 17 | 9/3/2022 | 36 | Northern grass skink | F | 64 | 62 | 39 |
| 18 | 9/3/2022 | 36 | Northern grass skink | M | 62 | 57 | 32 |
| 19 | 9/3/2022 | 36 | Northern grass skink | M | 61 | 60 | 41 |
| 20 | 9/3/2022 | 36 | Northern grass skink | M | 55 | 42 | |
| 21 | 9/3/2022 | 37 | Northern grass skink | F | 64 | 63 | |
| 22 | 9/3/2022 | 38 | Northern grass skink | F | 65 | 55 | 33 |
| 23 | 10/3/2022 | 41 | Northern grass skink | F | 63 | 63 | 9 |
| 24 | 10/3/2022 | 41 | Northern grass skink | M | 62 | 75 | |
| 25 | 10/3/2022 | 41 | Northern grass skink | F | 59 | 63 | 1 |
| 26 | 10/3/2022 | 41 | Northern grass skink | M | 61 | 75 | 6 |
| 27 | 10/3/2022 | 43 | Northern grass skink | F | 58 | 73 | 10 |
| 28 | 10/3/2022 | 44 | Northern grass skink | F | 58 | 70 | |
| 29 | 10/3/2022 | 44 | Northern grass skink | F | 51 | 60 | 16 |
| 30 | 10/3/2022 | 45 | Northern grass skink | J/M | 50 | 62 | 14 |
| 31 | 10/3/2022 | 46 | Northern grass skink | M | 63 | 61 | 26 |
| 32 | 10/3/2022 | 46 | Northern grass skink | J/M | 50 | 65 | 14 |
| 33 | 10/3/2022 | 46 | Northern grass skink | M | 61 | 74 | 10 |
| 34 | 10/3/2022 | 47 | Northern grass skink | M | 51 | 60 | |
| 35 | 10/3/2022 | 47 | Northern grass skink | M | 61 | 65 | 23 |
| 36 | 10/3/2022 | 47 | Northern grass skink | M | 63 | 66 | 3 |
| 37 | 10/3/2022 | 50 | Northern grass skink | F | 52 | 55 | |
| 38 | 10/3/2022 | 51 | Northern grass skink | M | 61 | 55 | 38 |
| 39 | 10/3/2022 | 52 | Northern grass skink | M | 63 | 79 | 11 |
| 40 | 10/3/2022 | 52 | Northern grass skink | J | 49 | 60 | |
| 41 | 10/3/2022 | 53 | Northern grass skink | J | 43 | 57 | |
| 42 | 10/3/2022 | 53 | Northern grass skink | J | 49 | 62 | |
| 43 | 10/3/2022 | 54 | Northern grass skink | M | 62 | 69 | 17 |
| 44 | 10/3/2022 | 54 | Northern grass skink | M | 55 | 62 | |
| 45 | 10/3/2022 | 54 | Northern grass skink | F | 57 | 68 | |
| 46 | 10/3/2022 | 54 | Northern grass skink | M | 52 | 60 | |
| 47 | 10/3/2022 | 55 | Northern grass skink | F | 56 | 66 | 5 |
| 48 | 10/3/2022 | 56 | Northern grass skink | M | 57 | 69 | |

| Number | Date | Trap Number | Species | Sex | SVL (mm) | Tail Length (mm) | Regenerating Tail (mm) |
|---|---|---|---|---|---|---|---|
| 49 | 10/3/2022 | 57 | Northern grass skink | M | 50 | 61 | 4 |
| 50 | 10/3/2022 | 57 | Northern grass skink | M | 61 | 70 | 20 |
| 51 | 10/3/2022 | 57 | Northern grass skink | F | 54 | 49 | 26 |
| 52 | 10/3/2022 | 57 | Northern grass skink | F | 60 | 53 | 40 |
| 53 | 10/3/2022 | 58 | Northern grass skink | M | 58 | 60 | 36 |
| 54 | 10/3/2022 | 58 | Northern grass skink | M | 63 | 78 | |
| 55 | 10/3/2022 | 59 | Northern grass skink | M | 62 | 12 | 8 |
| 56 | 10/3/2022 | 59 | Northern grass skink | F | 54 | 61 | |
| 57 | 10/3/2022 | 59 | Northern grass skink | J | 49 | 62 | |
| 58 | 10/3/2022 | 60 | Northern grass skink | F | 61 | 64 | |
| 59 | 10/3/2022 | 60 | Northern grass skink | M | 61 | 70 | |
| 60 | 10/3/2022 | 60 | northern grass skink | J | 40 | 44 | |

APPENDIX 2

PROPOSED MOA POINT SMF
PHOTOGRAPHS

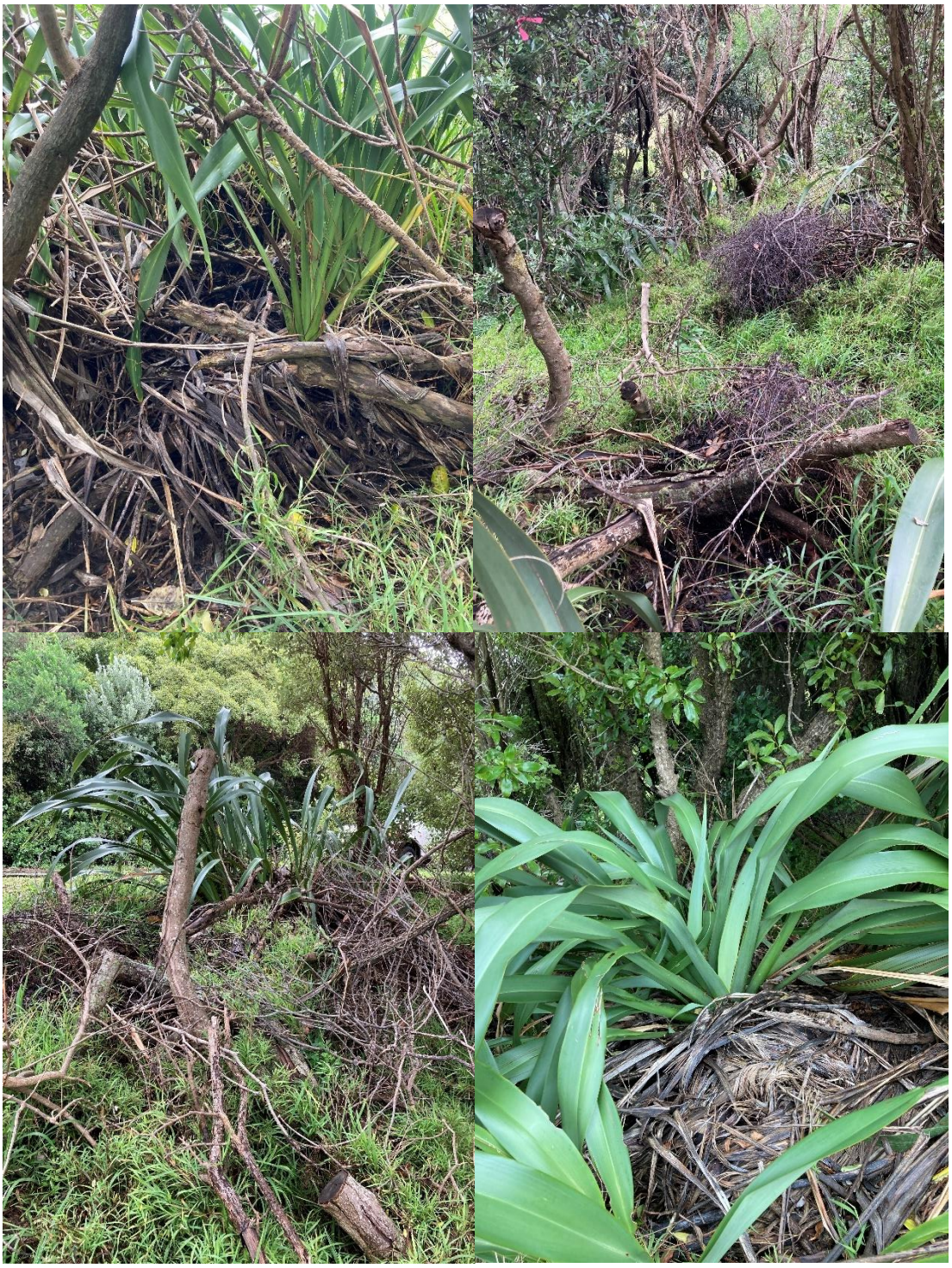


Plate 6: Examples of areas for day-searching within the proposed Moa Point SMF: dead harakeke fronds, log piles and downed woody debris. March 2022.

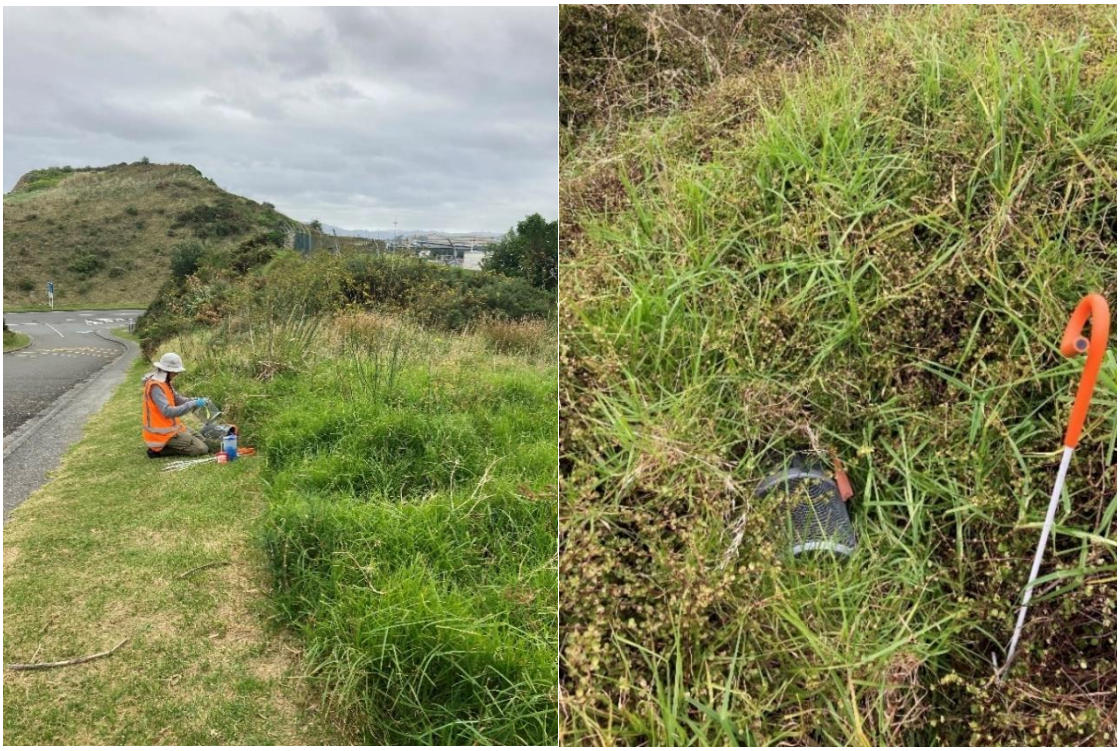


Plate 7 (both photographs): Examples of grassland habitats (gorse/kikuyu-pōhuehue grassland, Vegetation Type 4) at the proposed Moa Point SMF site that were targeted for terrestrial skinks. (Right photograph) Live capture funnel trap pictured *in situ*. March 2022.

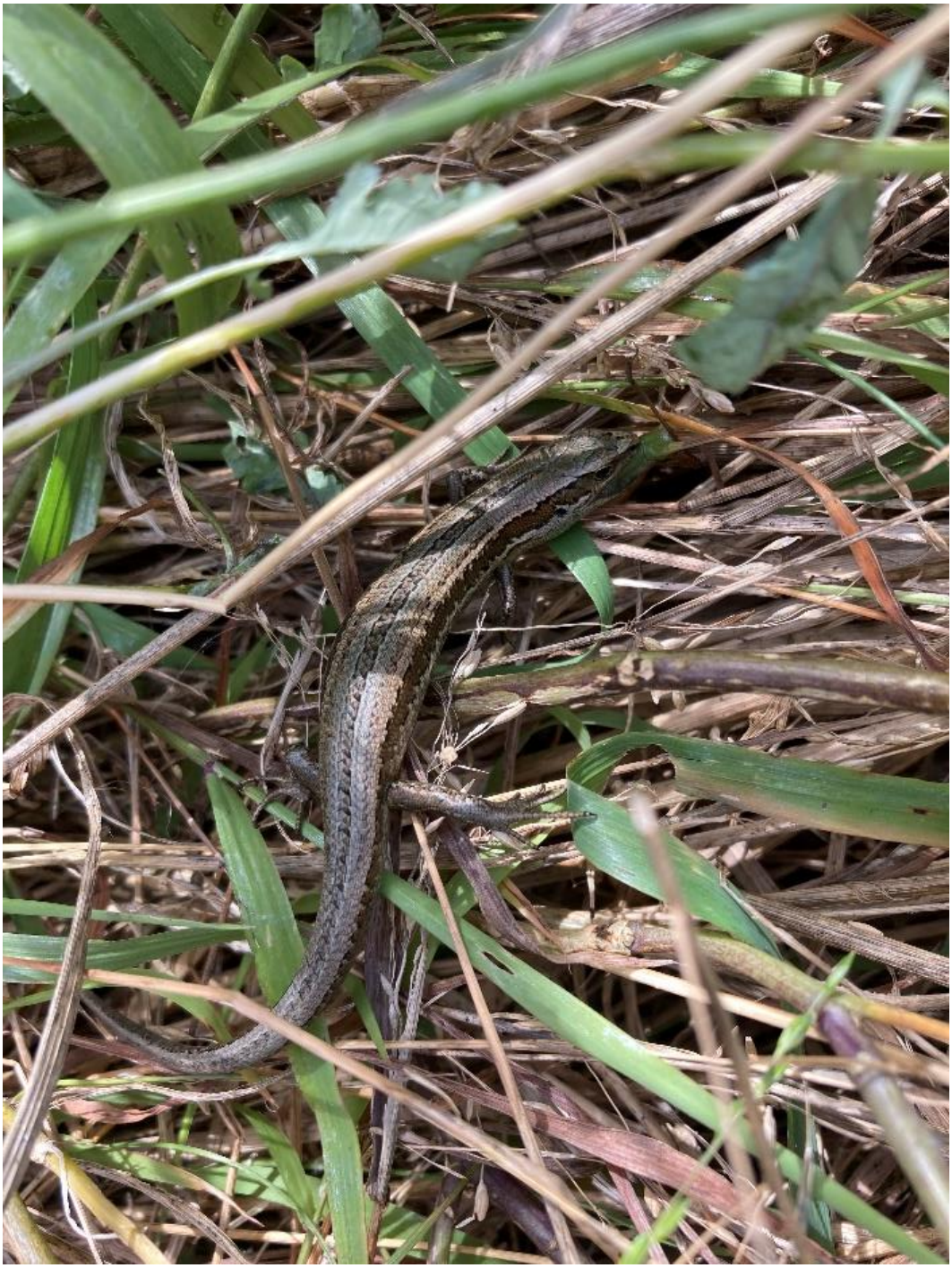


Plate 8: Northern grass skink (*Oligosoma polychroma)* at the proposed Moa Point SMF. March 2022.

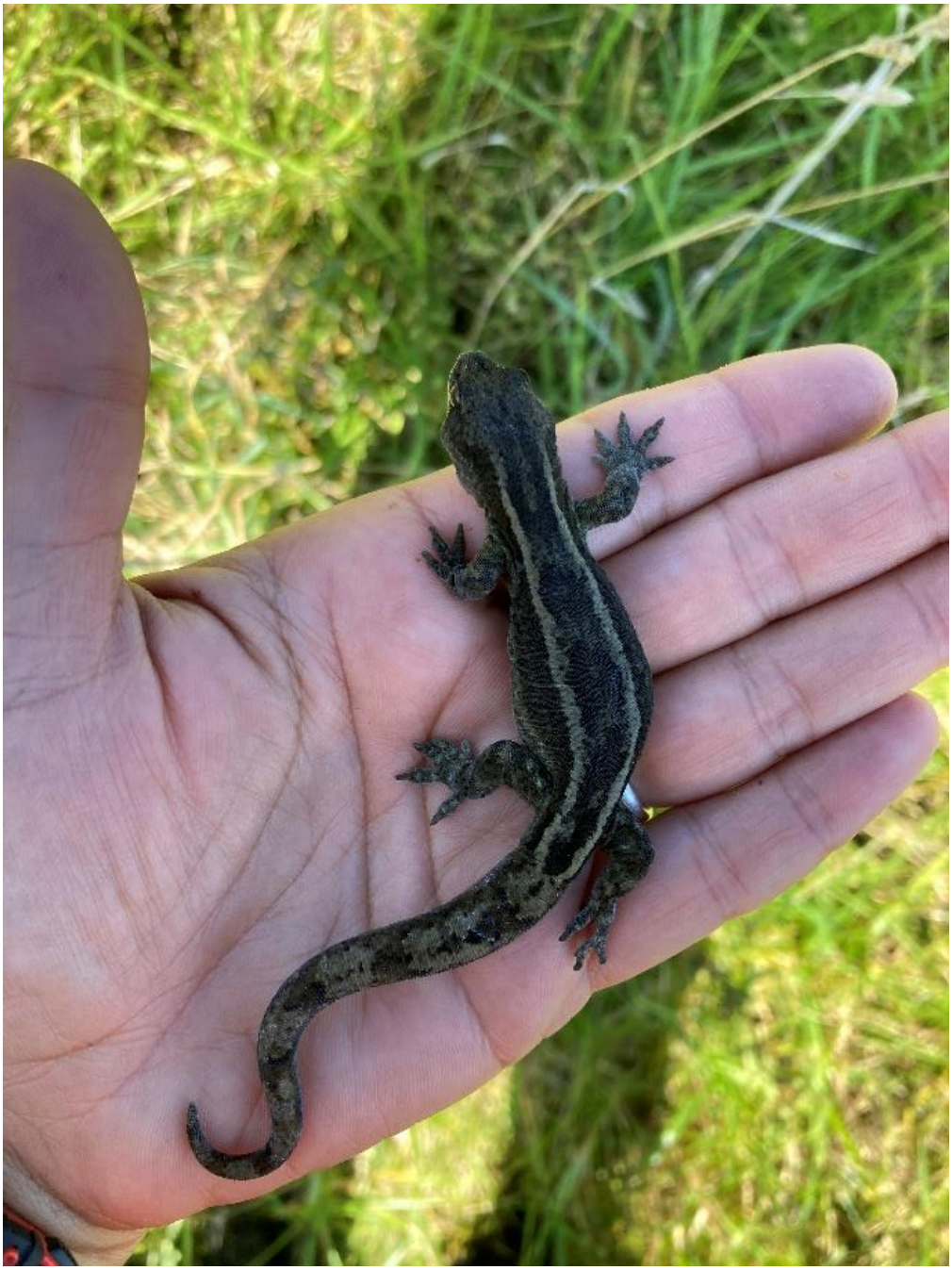


Plate 9: Raukawa gecko (*Woodworthia maculata*) captured at the proposed Moa Point SMF. March 2022.

APPENDIX 3

# VASCULAR PLANT SPECIES RECORDED AT MOA POINT SMF

## INDIGENOUS SPECIES

### Dicot. trees and shrubs

| | |
|---|---|
| *Coprosma propinqua* var. *propinqua* | mingimingi |
| *Coprosma repens* | taupata |
| *Coriaria sarmentosa* | |
| *Corynocarpus laevigatus* | karaka |
| *Dodonaea viscosa* | akeake |
| *Metrosideros excelsa* | pōhutukawa |
| *Myoporum laetum* | ngaio |
| *Ozothamnus leptophyllus* | tauhinu |
| *Piper excelsum* subsp. *excelsum* | kawakawa |
| *Pittosporum crassifolium* | karo |
| *Pittosporum ralphii* | |
| *Veronica stricta* var. *stricta* | koromiko, kōkōmuka |

### Dicot. lianes

| | |
|---|---|
| *Muehlenbeckia complexa* | pōhuehue |

### Ferns

| | |
|---|---|
| *Asplenium appendiculatum* subsp. *maritimum* | coastal spleenwort |
| *Asplenium oblongifolium* | huruhuru whenua |

### Grasses

| | |
|---|---|
| *Microlaena stipoides* | pātītī, meadow rice grass |

### Sedges

| | |
|---|---|
| *Ficinia nodosa* | wīwī |

### Rushes

| | |
|---|---|
| *Luzula banksiana* var. *banksiana* | coastal woodrush |

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

| | |
|---|---|
| *Phormium cookianum* subsp. *hookeri* | wharariki, mountain flax |

Composite herbs

| | |
|---|---|
| *Pseudognaphalium luteoalbum* agg. | pukatea |
| *Senecio lautus* var. *lautus* | |

Dicot. herbs (other than composites)

| | |
|---|---|
| *Disphyma australe* subsp. *australe* | horokaka |
| *Solanum americanum* | raupeti |
| *Tetragonia trigyna* | kōkihi, rengamutu, rengarenga, tūtae-ikamoana |

## NATURALISED AND EXOTIC SPECIES

Dicot. trees and shrubs

| | |
|---|---|
| *Chamaecytisus palmensis* | tree lucerne |
| *Chrysanthemoides monilifera* | boneseed |
| *Echium candicans* | tower of jewels |
| *Lathyrus tingitanus* | Tangier pea |
| *Lupinus arboreus* | lupin |
| *Senecio angulatus* | Cape ivy |
| *Ulex europaeus* | gorse |

Grasses

| | |
|---|---|
| *Agrostis capillaris* | browntop |
| *Anthoxanthum odoratum* | sweet vernal |
| *Briza maxima* | large quaking grass |
| *Cenchrus clandestinus* | kikuyu grass |
| *Cortaderia selloana* | pampas |
| *Hordeum murinum* subsp. *murinum* | salt barley grass |
| *Dactylis glomerata* | cocksfoot |
| *Ehrharta erecta* | veldt grass |
| *Lagurus ovatus* | harestail |
| *Lolium perenne* | rye grass |
| *Stenotaphrum secundatum* | buffalo grass |

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

| | |
|---|---|
| *Agapanthus praecox* | agapanthus |

Composite herbs

| | |
|---|---|
| *Achillea millefolium* | yarrow |
| *Argyranthemum frutescens* | marguerite |
| *Gazania linearis* | gazania |
| *Gazania rigens* | gazania |
| *Hypochaeris radicata* | catsear |

| | |
|---|---|
| *Lactuca serriola* | prickly lettuce |
| *Mycelis muralis* | wall lettuce |
| *Dimorphotheca fruticose* | rain daisy, dimorphotheca |
| *Dimorphotheca juncunda* | freeway daisy |
| *Senecio skirrhodon* | gravel groundsel |
| *Sonchus oleraceus* | puha, sow thistle |
| *Taraxacum officinale* | dandelion |

Dicot. herbs (other than composites)

| | |
|---|---|
| *Brassica rapa* subsp. *sylvestris* | wild turnip |
| *Carpobrotus edulis* | ice plant |
| *Centranthus ruber* | spur valerian |
| *Cotyledon orbiculata* | pig's ear |
| *Erysimum ×cheriri* | wallflower |
| *Foeniculum vulgare* | fennel |
| *Lobularia maritima* | alyssum |
| *Oxalis articulata* | sourgrass |
| *Parietaria judaica* | pellitory of the wall |
| *Plantago coronopus* | buck's-horn plantain |
| *Plantago lanceolata* | narrow-leaved plantain |
| *Sagina procumbens* | pearlwort |
| *Solanum chenopodioides* | velvety nightshade |
| *Vicia sativa* | vetch |

APPENDIX 4

# SURVEYS FOR *NAULTINUS* GECKOS DURING WINTER

New Zealand's nine species of green gecko (*Naultinus* spp.) are highly detectable in sunny 10 degree plus weather conditions in mid-winter, but only in coastal, low altitude populations (generally <50 kilometres from the coast and <400 metres in elevation). At inland or higher altitude sites they appear to retreat below ground level to escape the cold and can be difficult to detect in winter.

Examples of species and sites where *Naultinus* geckos are highly detectable in winter include jewelled geckos (*Naultinus gemmeus*) on Otago Peninsula, where jewelled geckos are detectable throughout the year and detection rates are higher in winter than in summer (Knox, 2010). In addition, Marlborough green geckos (*Naultinus manukanus*; C. Knox pers. obs.), barking geckos (*Naultinus punctatus*) in Wellington City (T. Bell pers. obs.), rough geckos (*Naultinus rudis*) near Kaikoura (C. Knox pers. obs.), and elegant geckos (*Naultinus elegans*) on the Waikato coastline (C. Knox pers. obs.) have been observed in winter, often in good numbers – such as 10 *N. manukanus* in two person hours (C. Knox, pers. obs.). In addition, there are winter reports of starred gecko (*Naultinus stellatus*) on Farewell Spit and Aupouri green gecko (*Naultinus flavirictcus*) near Cape Reinga (DOC Herpetofauna database).

Winter can be a good time for *Naultinus* surveys when appropriate sunny weather is targeted. In summer often it gets too hot for *Naultinus* to bask in the foliage and they retreat into the shade or high into the forest canopy where they are very hard to find. In winter, *Naultinus* geckos often bask on forest edges or low to the ground where they are more detectable. For example, at a tall kanuka forest site on the Otago Peninsula between 2009 and 2014 the average number of jewelled geckos found on the forest edge over the course of a survey day (five hours) was more than twice as high in winter than in summer (average of 13 per day in winter (20 surveys) versus an average of six per day in summer (eight surveys); C Knox, unpub. data.).

Carey Knox
July 2022

REFERENCE

Knox C. D. 2010: Habitat requirements of the jewelled gecko (*Naultinus gemmeus*): effects of grazing, predation and habitat fragmentation. MSc thesis, University of Otago, Dunedin, New Zealand. 107 pp.

Wildlands

*Providing outstanding ecological services to sustain and improve our environments*

Call Free 0508 WILDNZ
Ph: +64 7 343 9017
Fax: +64 7 3439018
ecology@wildlands.co.nz

99 Sala Street
PO Box 7137, Te Ngae
Rotorua 3042,
New Zealand

Regional Offices located in
Auckland, Hamilton, Tauranga,
Whakatane, Wellington,
Christchurch and Dunedin

**ECOLOGY RESTORATION BIODIVERSITY SUSTAINABILITY**

**www.wildlands.co.nz**