

Napier Significant Natural Areas Assessment



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Executive summary

Napier City Council (NCC) contracted the University of Waikato's Environmental Research Institute (ERI) in early 2019 to identify areas of significant indigenous vegetation, habitats of indigenous fauna and/or ecologically significant wetlands (hereafter referred as significant natural areas – SNAs) within Napier City boundaries. SNA identification aligns with the NCC District Plan review, NCC's responsibilities under the Resource Management Act 1991 (RMA), the Hawke's Bay Resource Management Plan (including Regional Policy Statement (RPS)), and the direction provided by the draft National Policy Statement for Indigenous Biodiversity (NPSIB). Identification of SNAs provides an opportunity for strategic ecological management and restoration of indigenous ecosystems in biodiversity depleted landscapes.

Surveys of potential significant natural areas were conducted during February 26th to March 4th, 2019 by an ERI terrestrial ecology team. Each site was assessed for habitat representativeness and pattern, indigenous species diversity, rarity and distinctiveness, and ecological context. These criteria are based on guidance from the draft NPSIB Appendix 1 and previous SNA assessments in New Zealand. The criteria were considered at both an ecological district scale (as specified by the draft NPSIB) and a city scale. The survey employed standard methodology focused on vegetation types and likely habitat for indigenous fauna.

In total, 32 SNAs that met the criteria for ecological significance were identified out of 52 surveyed sites. Fourteen sites met these criteria at an ecological district scale and 18 met the criteria at a city scale. The total area of the 32 Napier SNAs was 628.8 hectares, the median SNA area was 1.5 hectares and 96.7% of the SNA area was represented by sites of significance at an ecological district scale. Significant natural areas were distributed unevenly across the city and landform types. Most SNAs were located on hills or saline plains. Less than 1% of the coastal margin and plains were identified as SNAs and urban Napier City had very few SNAs.

This survey identified 5.94% of Napier City Council land area as SNAs. This proportion includes saline plain SNAs, which exist outside of the built-up matrix of urban Napier. Both scientific research and the draft NPSIB indicate that at least 10% of indigenous habitat is required in biodiversity depleted environments to avoid an accelerating rate of biodiversity loss and local extinctions.

It is recommended that management resources be directed towards the legal protection of existing SNAs, the restoration and reconstruction of missing and poorly represented local ecosystems and the linking of SNAs across Napier to ensure ecosystem buffering and ecological connectivity. Protection and restoration priorities should be focused on the sites that are significant at an ecological district scale but it is also important to protect and restore those that are significant at a city scale. These goals should be focused on improving ecological integrity and may be planned best through the development of a Napier City biodiversity strategy.

Introduction

Policy and planning context

In early 2019 the University of Waikato's ERI was contracted by Napier City Council (NCC) to identify areas of significant indigenous vegetation, habitats of indigenous fauna and/or ecologically significant wetlands (hereafter referred as significant natural areas – SNAs) within Napier City boundaries.

During this period, NCC was in the early stages of a full District Plan review, which provided an opportunity to consider protection options for SNAs under the revised Napier District Plan. The Napier District Plan review also provided the opportunity to recommend possible ecological restoration targets to promote the recovery of indigenous ecosystems that have been degraded, damaged or destroyed.

Identifying Napier SNAs also fulfils part of Napier City Council's obligation under the Resource Management Act 1991 (RMA) Section 6, which includes:

- The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development S6(a),
- Recognising and providing for the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna S6(c), and
- Having particular regard to the intrinsic value of ecosystems S7(d), and the responsibility for the maintenance of indigenous biodiversity S31(1).

SNA identification achieves RPS objectives for implementing the RMA in the Hawke's Bay region, including Objective 15: the preservation and enhancement of remaining areas of significant indigenous vegetation, significant habitats of indigenous fauna and ecologically significant wetlands.

The recent release of the draft NPSIB indicates new requirements, methods and recommendations such as:

- Standardised criteria for the identification of SNAs,
- A target of minimum 10% indigenous vegetation cover in biodiversity depleted environments to prevent biodiversity loss, and
- Opportunities to incentivise restoration or enhancement of areas that provide important connectivity or buffering functions and of indigenous biodiversity depleted environments.

Separate to this report, NCC commissioned mana whenua to identify locally indigenous species and ecosystems that are taonga. This work will enable Council to develop objectives, policies, and methods to protect values of identified taonga where appropriate.

Napier City Council also separately commissioned a landscape study to:

- Describe and evaluate Napier's landscapes,
- Identify any outstanding natural features and landscapes, special character landscapes, or areas of outstanding or high natural character, and
- Recommend measures for the District Plan based on identification of potential threats to landscape values (valued characteristics and qualities), capacity to accommodate different land uses, and opportunities to enhance such values.

Napier City

Napier City (Figure 1) is located on the east coast of New Zealand's North Island in the Hawke's Bay region and borders the Hastings District Council. It lies within the Heretaunga plains and has a total territorial area of 10582 hectares. The City is within the Heretaunga Ecological District (Lee 1994).

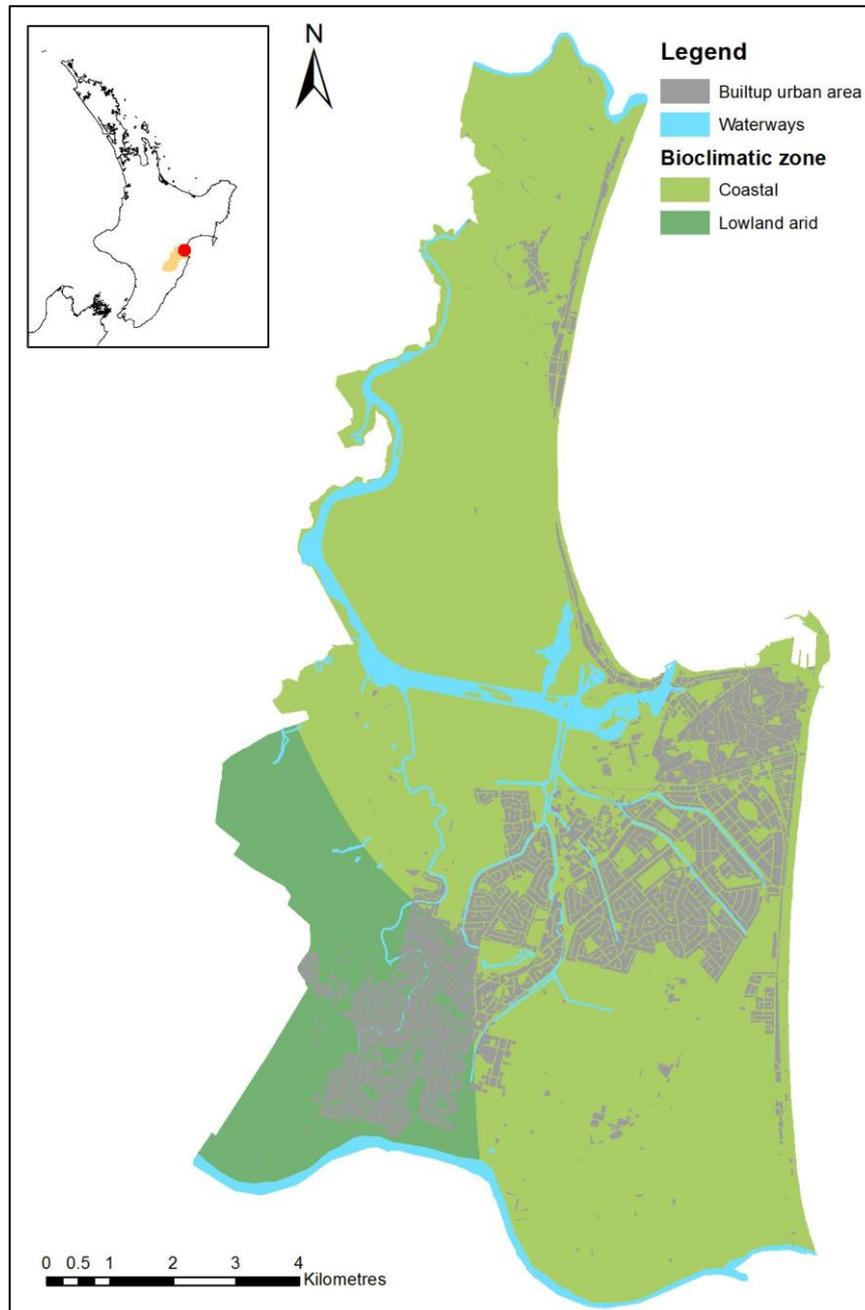


Figure 1. Napier City Council territory. Heretaunga Ecological District (orange) shown in inset.

Climate

The climate of Hawke's Bay is influenced largely by the orography and airstreams crossing New Zealand. The area experiences variable and sporadic rainfall, as well as large and occasionally sudden temperature fluctuations. Hawke's Bay receives less than 800 mm annual rainfall and is regularly prone to drought. Much of the region's rainfall occurs when wind directions are primarily easterly or

southerly. The region is less windy than many other coastal areas of New Zealand and as a result, a large number of frosts occur during the cooler months of the year, especially in inland areas. Hawke's Bay receives 2200+ sunshine hours annually and its average annual temperature range is 3°C to 23°C (Ministry of Works 1971; Chappell 2013).

Napier city encompasses two bioclimatic zones. The coastal zone extends to 5 km from the sea and has a strong maritime influence. Inland, the lowland arid zone has extreme moisture deficits during the growing season (Lee 1994).

Geology and soils

The geology of the Heretaunga Plains is dominated by Late Quaternary alluvial and marine sediments overlying older Quaternary sediments that in turn overlie Pliocene mudstone, sandstone and limestone (Lee et al. 2011).

Four soil types are found within Napier City; raw (29% of the city), recent (18%), gley (6%) and pallic (21%) Other areas of the city were classed as river (1%), built-up urban (23%) or without soil (2%) (Newsome, Wilde and Willoughby 2000; Hewitt 1998).

Raw soils are the youngest type and do not have a distinct top soil due to active deposition. These soils are found on the coastal strip, plains and saline plains. They range from gravels deposited by the sea along the northern part of the coast to areas of periodic or permanent flooding around the saline plains and part of the plains.

Recent soils are young soils with a distinct top soil. These have also derived from materials deposited by the rivers and flooding but have had longer to develop than the raw soils. These occur from alluvial sand deposits in the north, poorly drained areas of the plains, and deposits from flowing water on the lower part of hills.

Gley soils found in Napier are all recent gley soils. These are poorly drained soils exposed to prolonged periods of saturation and are prone to flooding. They are derived from alluvial material and are less than 60cm from the mineral soil surface. These are found in the south-eastern part of the city.

Pallic soils are well developed soils with topsoil (A horizon) and a B horizon. They are drought prone in summer and have a moderate to high base content. This soil type is common on the seasonally dry areas of the North Island's east coast. The majority of pallic soils are found on the hills. The hills were mostly perched gley pallic soils both with and without pans but with an argillic horizon. These are periodically saturated in winter and spring. The Esk Hills and the south west hills of Napier have immature pallic soils without duripans or argillic horizons. Two types of pallic soils were found on the plains. The perched gley pallic soil, which was also found on the hills, and the clay-enriched B horizon argillic pallic soil only found on the plains.

Napier City landforms

Napier City comprises four main landform types: coastal margin, saline plain, plain and hills. The city is bordered by Esk River in the north and Tutaekuri in the south (Figure 2).

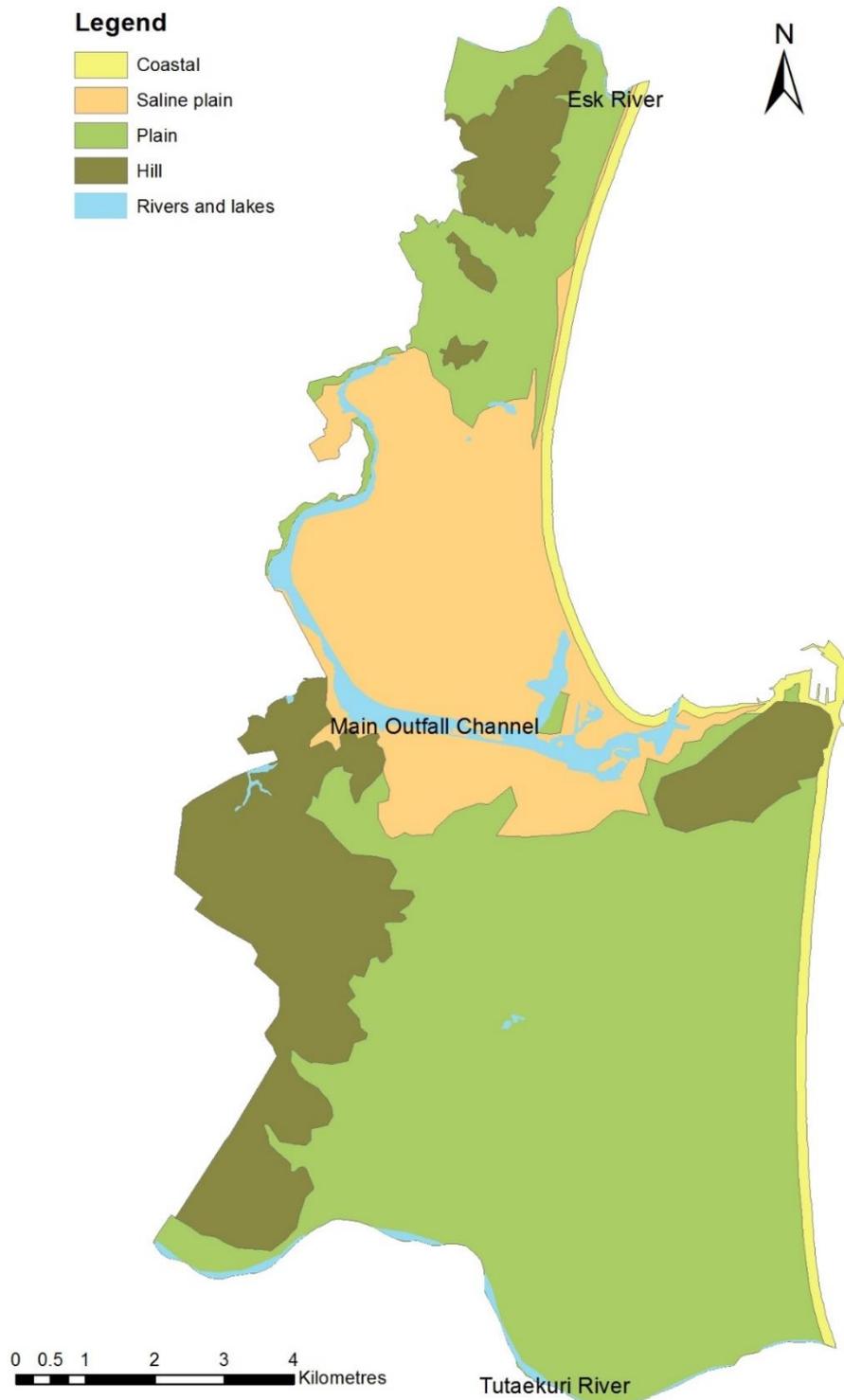


Figure 2. Landforms of Napier City.

The coastal margin is delineated by a 150 metre margin along the eastern coastline. This area contains the gravel beaches and back-beaches of the city. Whilst raw gravel soils are present, much of the landform is without a true soil type (Newsome, Wilde and Willoughby 2000).

Saline plains are the result of the 1931 Napier Earthquake and are the uplifted remnants of the former Ahuriri Lagoon (Madarasz-Smith 2014). The groundwater of this landform type continues to be tidally influenced (Daly and Rijkse 1976). The majority of this landform is not part of the built-up urban matrix.

Plains were formed from Quaternary deposits during the last 250,000 years by river sediments, estuarine and embayment deposits (Dravid and Brown 1997).

Hills in the area belong mostly to the late Miocene - early Pleistocene Mangaheia rock group with some hills also having rock belonging to the middle Pleistocene kidnapers group (Bland and Kamp 2014).

Historic indigenous vegetation types

The indigenous vegetation of Napier City has been almost completely removed for agricultural and urban development and limited information is available on historic species assemblages or distribution. Furthermore, uplift from the 1931 earthquake significantly changed the Napier landscape and as a result, large areas of the current plains have no historic vegetation type. The following historic vegetation types were developed from broad scale vegetation studies in the Hawke's Bay and studies of similar landforms in neighbouring districts. This information takes into account current climate, soils and landforms:

Coastal forests dominated the hills and drier area of the plains, in some areas they extended to the coastline. These were dominated by a mosaic of native trees such as tōtara (*Podocarpus totara*), tawa (*Beilschmiedia tawa*), māhoe (*Melicytus ramiflorus*), māpou (*Myrsine australis*), nīkau (*Rhopalostylis sapida*), ngaio (*Myoporum laetum*), wharangi (*Melicope ternata*), akeake (*Dodonaea viscosa*) and tītoki (*Alectryon excelsus*). In disturbed areas (e.g. post-fire), native grasses, bracken (*Pteridium esculentum*), mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea robusta*) were the main colonisers (Yule 1958; Grant 1996; Clarkson and Clarkson 1991; Lee 1994; Whaley et al. 2002; Leathwick et al. 2017).

Swamp and semi-swamp forests were present on alluvial and flood plain areas as well as gullies and poorly-drained hillslopes. These areas had naturally higher soil water content and nutrient levels. Dominant species would have included kahikatea (*Dacrycarpus dacrydioides*), mataī (*Prumnopitys taxifolia*), rimu (*Dacrydium cupressinum*), cabbage tree (*Cordyline australis*), tōtara (*Podocarpus totara*), pukatea (*Laurelia novae-zelandiae*) and occasional tawa. In disturbed areas of forest, kahikatea, mānuka and raupō (*Typha orientalis*) were early colonisers (Yule 1958; Clarkson and Clarkson 1991; Whaley et al. 2002; Leathwick et al. 2017).

Freshwater wetlands were found in the poorest drained areas and margins of lakes and streams. These had an array of species including dwarf rush (*Juncus novae-zelandiae*), grass-leaved rush (*Juncus planifolius*), Māori sedge (*Carex maorica*), pūrei (*Carex secta*), giant umbrella sedge (*Cyperus ustulatus*), swamp kiokio (*Blechnum minus*), toetoe (*Austroderia toetoe*), burr-reed (*Sparganium subglobosum*), kūkuta (*Eleocharis sphacelata*), raupō (*Typha orientalis*), mānuka and extensive harakeke (*Phormium tenax*). Swamp forests were found on the margins of herbaceous wetlands (Yule 1958; Grant 1996; Clarkson and Clarkson 1991; Whaley et al. 2002).

Saline wetlands were present at the head of estuarine systems, a mix of salt marshes and salt meadows. These gave way to raupō and harakeke dominated freshwater wetlands. Salt marshes were often supported by sea rush (*Juncus kraussii* subsp. *australiensis*) and other rush-like plant colonies. Salt meadows existed in drier estuarine areas, supported by turf plants like glasswort (*Salicornia*

quinqueflora) and herbs remuremu (*Selliera radicans*) and māakoako (*Samolus repens*) (Clarkson and Clarkson 1991; NZPCN 2012). After the Napier earthquake, these vegetation types expanded into the new landscape.

Coastal vegetation was found on sand dunes, gravel beaches, plains or coastal cliffs. Coastal forests probably included tōtara, mataī, ngaio, *Olearia paniculata* (akiraho), akeake, kānuka, māpou, nīkau, tītoki and other native trees capable of tolerating wind, salt air and sand or gravel substrates (Geoff Walls pers. comms. 2019). The foredunes were dominated by spinifex (*Spinifex sericeus*) and pīngao (*Ficinia spiralis*) and transitioned to raised beaches dominated by herbfields and low wind-shaped shrubland. This shrubland would have also extended up the steeper coastal cliffs along with toetoe (*Austroderia fulvida*) (Clarkson and Clarkson 1991; Whaley et al. 2002).

Fauna

The Ahuriri Estuary (Te Whanganui a Orotū) provides critical habitat for many native and non-native fauna species (White 2004). The estuary supports over 70 species of waterbirds, 17 of which are migratory. Bird species of particular note, listed in order of their conservation status (Robertson et al. 2017; HBRC 2018), include:

- Australasian bittern (*Botaurus poiciloptilus*) - Nationally Critical
- Black-billed gull (*Chroicocephalus bulleri*) - Nationally Critical
- Reef heron (*Egretta sacra*) - Nationally Endangered
- Wrybill (*Anarhynchus frontalis*) - Nationally Vulnerable
- Banded dotterel (*Charadrius bicinctus*) - Nationally Vulnerable
- Caspian tern (*Hydroprogne caspia*) - Nationally Vulnerable
- Bar-tailed godwit (*Limosa lapponica*) - Declining
- Marsh crake (*Porzana pusilla*) - Declining
- New Zealand dabchick (*Poliiocephalus rufopectus*) - Recovering
- Black-fronted dotterel (*Elseyaornis melanops*) - Naturally Uncommon
- Royal spoonbill (*Platalea regia*) - Naturally Uncommon

Invertebrate sampling recorded 33 species in the Ahuriri Estuary and approximately 29 species of fish that are supported by the estuary at some stage of their life cycle (HBRC 2018). In a ranking of native fish values using the River Values Assessment System (RiVAS) system, the Napier coast was ranked as being of 'Local significance' (Hughey et al. 2012) while the rest of the Hawke's Bay coast was ranked as being of 'Regional significance'. The pest species mosquito fish (*Gambusia affinis*) and tubeworm (*Ficopomatus enigmaticus*) are known to be present in Ahuriri Estuary (HBRC 2018).

Outside of the Ahuriri Estuary, there is limited literature on the fauna of Napier City. The New Zealand garden bird survey found a common suite of garden birds in the Hawke's Bay region including blackbird (*Turdus merula*), fantail (*Rhipidura fuliginosa*), house sparrow (*Passer domesticus*), myna (*Acridotheres tristis*), silveryeye (*Zosterops lateralis*), song thrush (*Turdus philomelos*), tūī (*Prosthemadera novaeseelandiae*), bellbird (*Anthornis melanura*), chaffinch (*Fringilla coelebs*), dunnoek (*Prunella modularis*), goldfinch (*Carduelis carduelis*), magpie (*Gymnorhina tibicen*) and starling (*Sturnus vulgaris*) (Spurr 2012). Kererū (*Hemiphaga novaeseelandiae*), grey warblers (*Gerygone igata*), welcome swallows (*Hirundo neoxena*), greenfinch (*Carduelis chloris*) and kingfishers (*Halcyon sancta*) have also been recorded on Napier Hill (MacLeod et al. 2015). Kārearea and kākā occasionally visit in winter (Geoff Walls pers. comm. 2019).

The area of Napier City is known to host the usual suite of pest animals (possums, mustelids and rodents) as well as goats and livestock in agricultural areas (HBRC 2014; MacLeod et al. 2015; various landowners pers. comms. 2019; Raúl Johnson pers. obs. 2019). Leopard seals (*Hydrurga leptonyx*) occasionally visit the Napier coastline for short periods (NZ Herald 2019) and Weddell seals (*Leptonychotes weddellii*) have been sighted in 2007 and 2018 (Stuff 2018). The Department of Conservation lists the common skink (*Oligosoma polychroma*) and spotted skink (*Oligosoma lineoocellatum*) as being present in the Napier region (DOC 2019).

Methodology

Identification of potential sites

The methodology used was a standard rapid reconnaissance survey based on the New Zealand Protected Natural Areas Programme (Myers, Park and Overmars 1987; Lee 1994). Sites for significant natural area assessment within Napier City boundaries were initially identified through a desktop exercise. This involved Geographic Information System (GIS) mapping and analysis, satellite image analysis, a literature review and consultation with Napier City Council, Hawke's Bay Regional Council and Department of Conservation staff. The potential SNA sites were selected using layers from the Land Cover Database version 4.1, Mainland New Zealand (Landcare Research 2015), Ecosystem Prioritization Dataset (Leathwick, Hashiba and Lynch 2017) and ortho-rectified satellite images (Land Information New Zealand 2018). Within the city, 52 potential SNA sites were selected to be field-assessed, based on vegetation cover and fauna habitat.

Field assessment of significance

Site visits were conducted between February 26th and March 4th, 2019. Where possible, site assessments were complemented by conversations with landowners, city and regional council staff, and conservation practitioners/coordinators. The 52 sites identified in the desktop exercise were assessed against significance criteria (habitat representativeness and pattern, indigenous species diversity, rarity and distinctiveness, and ecological context - see Appendix 1) at two different scales:

1. Ecological district scale. Based on the criteria in the draft National Policy Statement for Indigenous Biodiversity: draft NPSIB *Appendix 1: Criteria for identifying significant natural areas in accordance with Policy 4*. The draft NPSIB states that the spatial frameworks for assessment of significance (in terrestrial settings) are ecological districts or land environments.

McEwen (1987) provides the following definition of an ecological district:

“The definition of an ecological district depends on a thorough consideration of the topography, geology, climate, soils, vegetation and man-induced modifications of the area (Nicholls 1979). Thus an ecological district is a local part of New Zealand where the topographical, geological, climatic, soil and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities (Park et al. 1983).”

2. City scale. Assessment of significance using the same criteria as above but at the scale of Napier City Council's territory. These do not qualify for the draft NPSIB criteria because of the smaller scale but our approach has been guided by the ruling of Judge R. J. Bollard (NZRMA Decision No. A71/2001) who stated that in determining whether an area of indigenous vegetation or a habitat of indigenous fauna is significant, the area or habitat "is not required of itself, or in combination with other areas or habitats, to be nationally important. Neither does its importance have to be regional in character or otherwise exceed the bounds of the planning district. Rather it is a question of identifying and assessing (with the aid of qualified advice and assistance) those areas or habitats that are significant within the district as to require protection." Another factor Judge Bollard considered important in determining significance at a district level was the extent to which the biodiversity resource of the district had already been diminished. Any natural area or habitat in districts with greatly depleted natural resources would thus increase in importance.

When a site was deemed to meet one or more of the significance criteria at either scale, a full assessment was undertaken using the significant natural area (SNA) site assessment form (Appendix 1). If no significance criteria were met, the site was disregarded. The key sections of the assessment form are described below:

General information

General information for SNAs including tenure, protection status, fencing, and matrix land-use.

Site description

Site descriptions included but were not limited to: vegetation condition (canopy, understorey, leaf-litter), unusual (or common) characteristics, surrounding land use, presence of streams or rivers, dominant vegetation communities, uncommon species, history of site and landowner's comments.

Habitat and vegetation description

Habitat and vegetation descriptions were recorded for each individual SNA site. These descriptions, as explained below, included: site number, hydrological regime, category, code, character, area, and vegetation description. Criteria for the classification of hydrological regimes are given in Table 1. Category and code were used to describe the vegetation of the site. Each site was classified into category A, B, C, or D, which correlate to wooded/treefern habitats (e.g. podocarp forest), grass/herb/moss habitats (e.g. herbaceous), bare habitats (e.g. rocky coast), and other habitats (e.g. roads/railways), respectively (Table 2). Character refers to whether the site vegetation is indigenous or exotic based on an estimate of the abundance of indigenous and exotic species. A proportion of greater than 50% cover qualifies the site for classification into either one of these categories. The area of each site was visually estimated. Vegetation descriptions were based on Atkinson (1985) to give an indication of cover abundance, and presence or absence of tiers. Due to their rarity, in-depth descriptions were provided for sites with wetland or coastal shore ecosystems.

Table 1. Criteria for the classification of hydrological regime.

Code	Character	Explanation
1	Terrestrial	All dry areas of land not covered by a wetland hydroclass (see below)
2	Estuarine	Coastal waters semi-enclosed by land and partially diluted with fresh water
3	Riverine	Flowing waters contained within a channel: rivers, streams, and their margins.
4	Lacustrine	Lakes or dammed rivers with open water
5	Palustrine	All other non-tidal wetlands, small open water bodies, and vegetated wet ground.

Table 2. Criteria for the classification of vegetation (modified from Atkinson 1985; Cornes, Thomson, Clarkson 2012).

Code	Wooded / Treefern habitats A	Code	Herbaceous habitats B	Code	Bare habitats C
1	Podocarp forest	20	Herbfield wetland	40	Rocky coast
2	Broadleaved forest	21	Flaxland (<i>Phormium</i>)	41	Sand coast, Dunes
3	Beech forest	22	Reedland (<i>Typha</i>)	42	Lagoon
4	Podocarp-broadleaved forest	23	Sedgeland (Cyperaceae)	43	River mouth
5	Podocarp-broadleaved-beech forest	24	Rushland (Juncaceae)	44	River, Riverbed
6	Kānuka–Mānuka forest (<i>Kunzea</i> , <i>Leptospermum</i>)	25	Grassland (Ammophila, Spinifex, Bush rice grass, Poaceae)	45	Lake
7	Exotic forest (Pinus, Eucalyptus)	26	Tall grasses > 1 m (<i>Cortaderia</i>)	46	Pond
8	Deciduous woodland (exotic)	27	Tussockland (<i>Chionochloa</i>)	47	Stream
9	Parkland (spaced plants)	28	Agricultural land (pasture, cropping)	48	Cliff, Bluff, Gorge
10	Wetland forest (pukatea, kahikatea, swamp maire)	29	Saltmarsh (<i>Apodasmia similis</i> , <i>Salicornia quinqueflora</i> , <i>Juncus kraussii</i> subsp. <i>australiensis</i> , <i>Cyperus ustulatus</i>)	49	Rockland
11	Shrubland (<i>Olearia</i> , <i>Hebe</i>)	30	Eelgrass meadow (<i>Zostera</i>)	50	Stone/Gravel fields
12	Scrub (regeneration)	31	Algaefield	51	Sand flats
13	Treefern forest (<i>Cyathea</i> , <i>Dicksonia</i>)	32	Cushionfield	52	Mud flats
		33	Fernland (<i>Pteridium esculentum</i>)	53	Island
		34	Moss and Clubmossfield	54	Peatland
		35	Lichenfield		Others D
		36	Herbfield	60	Roads, railways
				61	Urban subdivisions
				62	Others

Flora and fauna

Lists of the flora and fauna present at the site were compiled from surveying, literature review and/or landowner observations. Special note was made of rare, threatened or distinctive species at each site. Vegetation was described in as much detail as possible, with particular reference to the condition of each tier.

Threats

This section of the survey referred particularly to ecological pest plants (e.g. invasive exotic vines) and animals (e.g. livestock), which are, or have the potential to become significant threats. For each unit a ranking of first to fourth was given for the abundance or cover of ground cover weeds, vine weeds, shrub or tree weeds and animal pests. A ranking of first indicates a very common pest. A ranking of fourth indicates extremely low abundance, or none present. Dominant species were noted and comments or suggestions for potential management were given.

Human associated activities

Evidence of human associated activities were recorded and given a rating for impact of the activity, and for the attitude of the involved parties toward remediation. Activity examples include: rubbish dumping, drainage, earth works, erosion, top dressing, fire, vegetation clearing, herbicide application, harvest/vegetation clearing, planting, animal pest control, domestic pets, and fencing. These activities could have a positive or negative ecological impact. Recommendations for action were given.

Context/nearby site information was recorded if applicable. If this included scrub, forest, or wetland areas, information about dominant vegetation types, size and the condition was recorded.

Management recommendations

Management recommendations for ecological restoration were provided for each site, based predominantly on vegetation condition. These recommendations are underpinned by an ecological successional framework with the use of eco-sourced indigenous plants and high planting densities (see Appendix 5 for further detail).

Limitations

The assessment of significant natural areas in this survey was based on a rapid reconnaissance level survey primarily focussed on vegetation communities. Fauna data was recorded where possible from field observations, literature and land owner information. A more comprehensive fauna survey would require year-round avian, fish, invertebrate, bat and reptile surveys which was outside the scope of this contract. Reviewers have suggested that additional coastal systems in particular dunelands and shingle beaches could meet SNA criteria. In particular, sites just north of the airport (both sides of the highway), at Bay View, on the Broadbeach immediately south of the Esk River mouth and at Awatoto-Tutaekuri River mouth. These sites may warrant a more detailed duneland and shingle beach survey, which was outside the scope of this contract. Neither Lee (1994) nor Partridge (1992) identified any significant coastal systems in these locations. Variable access to potential SNA sites influenced the detail of flora and fauna that could be recorded. The accuracy of spatial boundaries and the analysis of spatial layers were dependant on the source data. Accuracy of these layers was improved with ground-truthing of sites.

The significance of the Ahuriri Estuary, including the Main Outlet Channel, was assessed in its entirety due to its strong ecological connectivity. The estuary system was physically visited at six different sites (Upper Ahuriri Estuary, Lower Ahuriri Estuary, Mid-Ahuriri Estuary, Taipo Stream, Westshore Reserve ponds and Westshore Reserve wetland) to account for differences in physical characteristics, surrounding land uses and current/historic management. As a result, six different site sheets that relate to the Ahuriri Estuary are provided in Appendix 6. The significance of the Esk Hills sites was assessed separately due to varying land cover between Esk hill sites.

Ecological restoration and connectivity opportunities

Following the assessment of significant natural areas, a GIS spatial analysis of Napier City was performed to highlight areas for potential ecological restoration and indigenous habitat corridor creation. We assigned a 50 m buffer to delineate viable space for landscape connectivity. To do this we used multiple GIS layers, including our own generated SNAs and walkways layers as well as available rivers and waterways layers (Land Information New Zealand database). Small areas of natural vegetation suffer from edge effects and a 50 m habitat buffer creates the possibility of a more sustainable internal environment (Norton 2002). A union analysis was performed which joined these buffered layers with the Land Cover Database version 4.1, Mainland New Zealand (Landcare Research 2015). This Land Cover Database layer excluded rivers, open water and exotic grasslands. This was called Layer 1.

A new layer was created, which consisted of generated lines between the polygons of Layer 1. The lines were created by using Generate Near Table followed by an XY to Line. This approach is used to find the shortest distance between two neighbouring polygons and allows for a continuous link between patches of vegetation, the waterways and the coast. In some cases redundant lines between the same polygons existed, which were then manually deleted. This process resulted in generation of Layer 2 for the next step.

Using Layer 2, a 100 m buffer analysis was then performed to delineate the width of the potential habitat corridors. This was to give a better idea of the area these corridors would take up on the landscape. This resulted in creation of Layer 3, which was unioned with Layer 1 and three additional layers: the Ecosystem Prioritization Dataset (Leathwick, Hashiba and Lynch 2017), the Napier City Council land dataset, and the Department of Conservation land dataset to create Layer 4.

Finally, a union analysis was conducted to join Layer 4 with the publicly available roads dataset (Land Information New Zealand) the urban built up area dataset, and the industrial areas of Napier City dataset (Napier City Council 2019). In the areas where the latter three layers overlapped with Layer 4, these areas were removed, as they are not viable for corridor restoration. This resulted in a final 'Eco_connectivity' Layer provided to the NCC with this report. Polygons in this layer were scored from 1 to 7 to prioritize areas for corridor reconstruction. The score was created by adding together the number of overlapping layers that were used in creation of Layer 4.

Results

Extent of Napier SNAs

Thirty two sites in Napier City appear to meet the significant natural area criteria at either an ecological district or city scale. The total area covered by SNAs was 628.76 hectares (Table 3) with a median size of 1.53 hectares. Significant natural areas comprise approximately 5.94% of the Napier City territory.

A summary of all SNAs is given in Appendix 2 and lists of flora and fauna species recorded during surveys, recorded in literature, or noted by landowners across all SNAs is provided in Appendix 3 & 4.

Table 3. City-wide extent of Napier SNAs.

Total SNA area (ha)	628.76
Mean SNA area (ha)	19.65
Median SNA area (ha)	1.54
Total area of Napier City (ha)	10581.74
City area occupied by SNAs (%)	5.94

Significance scales

Of the 32 SNAs, 14 sites met one or more SNA criteria at an ecological district scale (i.e. draft NPSIB level). The total area of the 14 sites is 608 hectares which represents 5.75% of Napier City. The remaining 18 sites met one or more SNA criteria at a city scale. The total area of the city scale sites is 20.8 hectares which represents 0.2% of Napier City (Table 4).

Table 4. Summary of SNA sites assessed at two significance scales.

Significance	Ecological district scale	City scale	Total
Number of sites	14	18	32
Area of sites (ha)	608.0	20.8	628.8
City area occupied by SNAs (%)	5.75	0.20	5.94

Of the 14 sites that met significance criteria at an ecological district scale, one (Ahuriri Estuary) met nine of the 14 criteria, two (Lake Rotokaramu and Bayview wetland) met three criteria, one (Ahuriri Plain wetland) met two criteria and ten (Esk Hill 1, Esk Hill 2, Esk Hill 3, Esk Hill 5, Esk Hill 7, Esk Hill 9, Esk Hill 10, Esk Hill 11, Esk Hill 12, Esplanade herbfield) met one criterion.

Of the 18 sites that were significant at a city scale, nine sites met four or more of the significant natural area criteria. The remaining nine sites met two or three significance criteria.

Spatial distribution of SNAs

The northern half of Napier City had the largest number and area of SNAs. These were along the Main Outlet Channel, on the saline plains and in the Esk Hill area. Although the SNAs are spread across the city from north to south and east to west, large areas of the city had no SNAs within them. As expected, built-up urban Napier and southern Napier had the least SNAs (Figure 3).

Legend

 Rivers, lakes, drains

Vegetation type

 Forest

 Forest + freshwater wetland

 Freshwater wetland

 Herbfield

 Salt marsh

 Salt meadow + Salt marsh

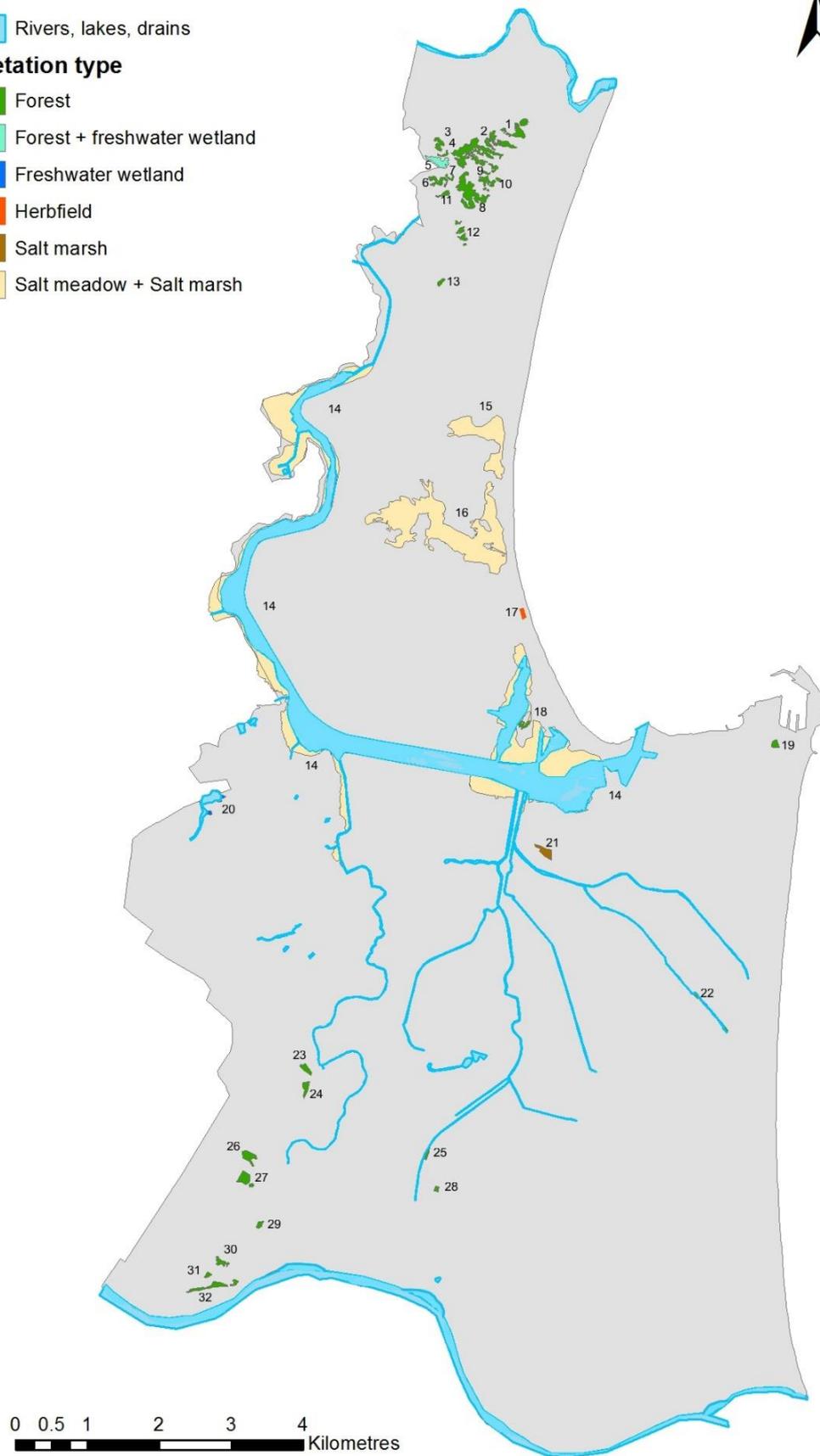


Figure 3. Location of SNAs within Napier City.

Extent of Napier SNAs by landform

Most SNAs were located in the hills (71%). Saline plain sites however, were the dominant landform by area (569.45 ha), covering 90.57% of the total surveyed SNAs. In contrast, hill sites covered 8.67% of the total surveyed area. Coastal margin made up the lowest number of sites and smallest land area (Table 5).

Table 5. Frequency and extent of Napier SNAs by landform.

Landform	Total number of SNA sites	% No. of Sites	Area of Sites (ha)	% Total SNA Area
Coastal margin	1	3	0.80	0.13
Saline plain	4	13	569.45	90.57
Plain	4	13	4.02	0.64
Hill	23	71	54.49	8.67
TOTAL	32	100	628.76	100

Analysis of representativeness

The largest proportion of SNA cover was on the saline plain which totalled 24.16% of the identified SNA area. While the plains are the most dominant landform (56.45%), they had the lowest proportion of SNA cover by area (0.07%). Sites on the hills covered less than 3% and both the cover of SNA sites on the plains and coastal margin were under 1%. Of the landform types, the plains are the most dominant landform (56.45%) and coastal margin the least (3.31%) (Table 6).

Table 6. Extent of landforms across Napier City.

Landform	Total Landform area (ha)	% City covered by landform	% City area covered by SNAs	% Area of SNA per Landform
Coastal margin	349.87	3.31	0.01	0.23
Saline plain	2357.42	22.28	5.38	24.16
Plain	5973.85	56.45	0.04	0.07
Hill	1900.60	17.96	0.51	2.87
TOTAL	10581.74	100	5.94	

Vegetation of Napier SNAs

Vegetation types found in this survey were coastal herbfield, salt meadow, salt marsh, freshwater wetland and native forest such as kānuka forest and mixed broadleaved forest (Table 7). The dominant vegetation types were either salt meadow/salt marsh or native forest. Only two examples of freshwater wetland and one of coastal herbfield were recorded.

Table 7. Vegetation types found in Napier City landforms.

Coastal margin	Saline plain	Plain	Hill
Coastal herbfield	Salt marsh	Mānuka-kānuka forest	Mānuka-kānuka forest
	Salt meadow	Mixed broadleaved forest	Mixed broadleaved forest
			Freshwater wetland

Threatened plant species found in proposed SNAs, listed in order of their conservation status (de Lange et al. 2014; 2018):

- *Clianthus maximus* (kakabeak) - Nationally Critical (planted)
- *Lophomyrtus obcordata* (rohutu) - Nationally Critical (planted)
- *Ricciocarpos natans* (liverwort) - Nationally Endangered
- *Kunzea robusta* (kānuka) - Nationally Vulnerable
- *Coprosma acerosa* (sand coprosma) - Declining
- *Pseudopanax laetus* - Declining (planted)
- *Ptisana salicina* (para, king fern) - Declining (planted)
- *Teucrium parvifolium* (teucrium) - Declining (planted)
- *Carmichaelia williamsii* (William's Broom) - Relict (planted)
- *Pseudopanax ferox* (fierce lancewood) - Naturally Uncommon (planted)
- *Thyridia repens* (native musk) - Naturally Uncommon

Of the 11 species in this list, seven had been planted. The only naturally occurring threatened species recorded were *Ricciocarpos natans*, *Thyridia repens*, *Kunzea robusta* and *Coprosma acerosa*. *Kunzea robusta* has recently been assigned "Nationally Vulnerable" status due to the potential threat of wholesale dieback from myrtle rust infection. This species was recorded in relatively high abundance, especially on Esk Hill (Appendix 6).

Fauna

Due to the short-term nature of these surveys no additional indigenous fauna species were seen and recorded beyond those already listed in available literature. The fauna that were recorded included water birds that are well-known in the Ahuriri Estuary as well as a common assemblage of native and exotic urban bird species such as tūī, fantails, blackbirds and sparrows. A list of Napier City fauna from surveys, landowner information and literature is provided in Appendix 4.

A number of sites were found to be accessible to livestock and in four of the SNAs livestock were having a detrimental effect on vegetation condition. Control of possums, and in some areas rats, was

being undertaken in at least eleven of the SNAs with a notable community-led operation covering the Esk Hill area.

Discussion

Significance of natural areas in Napier

The 32 significant natural areas in Napier City occupied 628.8 hectares with a median size of 1.5 hectares. Of these 32 SNAs that were identified, 18 met the significance criteria at the city scale. However, the remaining 14 SNAs that met significance criteria at the ecological district scale represented a much greater area (608 hectares, 96.7% of total SNA area). This was often due to larger sites having greater ecological integrity and connectivity than smaller sites. However, as per the finding of Judge R.J. Bollard (NZRMA Decision No. A71/2001 (see methodology section)) the Napier landscape is greatly diminished in biodiversity resources and thus every SNA is an important natural capital asset. Within the context of the draft NPSIB, these sites are important nuclei for reconstructing indigenous habitat.

Napier's SNA ecosystems

The main SNA vegetation types were found to be salt marsh and salt meadow, mixed native forest and kānuka forest. Other vegetation types also recorded were coastline vegetation and freshwater wetland vegetation.

Salt marshes and salt meadows were present on saline plains. For all but one site these vegetation types formed a matrix where the margins of the wetland were salt meadows (usually comprised of the two glasswort herbs *Selliera radicans* and *Samolus repens*) and the interior was salt marsh (which hosted primarily sea rush). This sequence of vegetation types represents the best match to an indigenous ecosystem that probably would have been historically present in Napier. These saline plains are part of the Ahuriri Estuary, which is listed as 1) a Significant Conservation Area under the Regional Coastal Environment Plan, 2) a Wetland of Ecological and Representative Importance (WERI), and 3) a Site of Special Wildlife Interest (SSWI) (HBRC 2018). This recognition relates to the support function that the estuary provides to 29 species of fish and over 70 species of water birds (HBRC 2018).

All terrestrial vegetation types surveyed in Napier (i.e. not saline or freshwater systems) have species compositions that differ from historic ecosystems because they have either been planted (e.g. almost all of the forests) or highly modified (e.g. Esk Hills and the coastal herbfield). The planted forests were found to be predominantly either mixed broadleaved forest or kānuka forest. Mixed broadleaved forests were generally planted with high species richness, including some New Zealand species not historically found in Hawke's Bay and the occasional exotic species (e.g. avocado, *Persea americana*). Kānuka forests were a mix of naturally regenerating secondary forest and native tree plantings and were the dominant vegetation on Esk Hill. Kānuka and broadleaved forests were present on plains and hills landforms. The fauna of these ecosystems represents a common assemblage of urban species.

Indigenous coastline vegetation types in Napier City are limited to one coastal herbfield SNA (Esplanade herbfield). The site is dominated by exotic vegetation with a few indigenous species that are now rare or uncommon within Napier City. It is important as an SNA because it is the sole representative of this vegetation type and shingle beach ecosystem, and potentially provides habitat for indigenous invertebrates.

Freshwater wetland vegetation can be found in the hills topographic unit of Napier City as a small part of an Esk Hill SNA and at Lake Rotokaramu where kuta and raupō are the dominant species. Lake Rotokaramu is known to be a significant habitat for indigenous birds with species observed including pūkeko, tūī, swamp harrier, royal spoonbill, New Zealand dabchick, grey teal, Australasian bittern, white-faced heron, fantail, Australasian shoveller and brown teal (Nathan Burkepile pers. comm. 2019).

Missing and poorly-represented ecosystems

As a result of systematic land clearance, multiple historic ecosystems are missing or poorly-represented in Napier City and those that are still present are often highly modified. These ecosystems should be considered wherever possible for ecological restoration efforts.

The absent forest types include coastal forest (tōtara, tawa, ngaio, māhoe) from the hills and drier plains, and semi-swamp forest (kahikatea, mataī, rimu, tōtara, pukatea) from the alluvial plains, floodplains and poorly-drained hillslopes (Figure 4).

Freshwater wetlands were historically present in Napier City in areas of periodic or permanent flooding on the plains and hills. Along with the sedgeland-dominant wetlands there were extensive flaxlands. Only two freshwater wetlands remain and there is no flaxland in the region. Also absent is the ecological succession and ecotones which should progress from wetland sedges and grasses to flaxland and then eventually to swamp forest.

Indigenous coastal ecosystems are poorly represented in Napier City with only one significant natural area (“Esplanade Herbfield”) identified in this study. The limestone coastal cliffs of Bluff Hill/Mataruahou would have historically been dominated by native vegetation that provided habitat for forest fauna, including burrowing seabirds (Geoff Walls pers. comm. 2019). This unique historic ecosystem has however been almost completely replaced by exotic weeds. Gravel fields dominate the Napier coastline (Hashiba et al. 2014) and would have formerly existed in close association with low dune systems. These are still evident just north of the airport (both sides of the highway), at Bay View, on the beach immediately south of the Esk River mouth, also down to Awatoto (and beyond). These ecosystems are potentially important habitat for native birds, lizards and invertebrates as well as plants that are now rare and/or threatened (e.g. sand coprosma (*Coprosma acerosa*), pingao (*Ficinia spiralis*) and *Muehlenbeckia ephedroides*). However, these ecosystems are now heavily modified by anthropogenic developments and invasive species. This is a similar situation to much of the Heretaunga Ecological District (Lee 1994). As noted earlier more detailed surveys of duneland and shingle beach habitats in Napier City may reveal areas worthy of restoration.

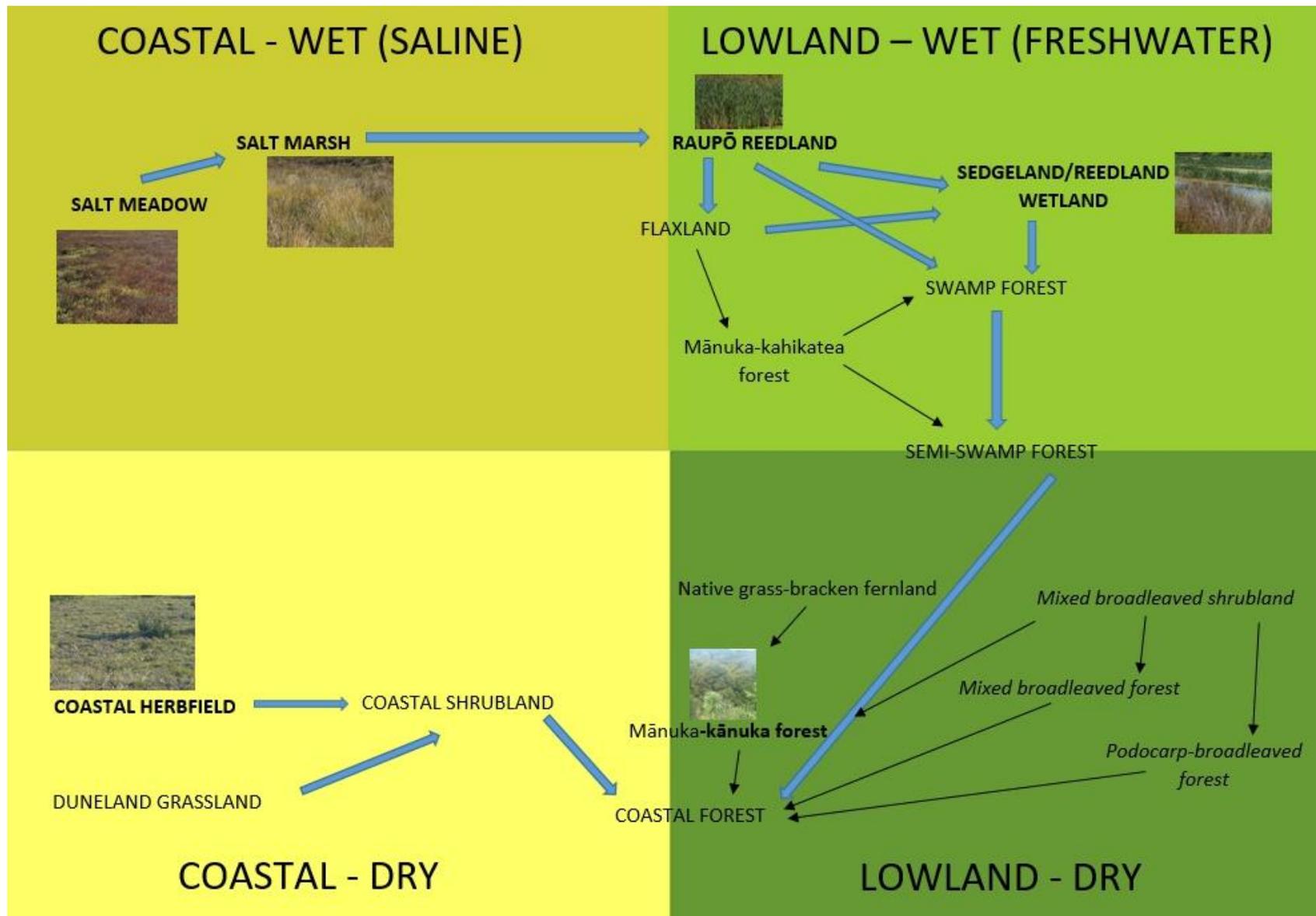


Figure 4. Napier City's current and historic indigenous vegetation types grouped by landform and salt and flood tolerance. Historic vegetation types are capitalised. Historic secondary succession vegetation types are in smaller, lower case font. Current vegetation type for SNAs that are similar to historic vegetation types are bold and associated with pictures. Novel current vegetation types found in SNAs are italicized. Arrows represent successional pathways or potential development of vegetation across gradients.

Significant natural areas and restoration targets

The total land area covered by SNAs in Napier City is 628.76 hectares. This represents approximately 5.94% of the Napier City territory. This includes both remaining indigenous vegetation cover and restored/replanted indigenous vegetation cover.

The draft National Policy Statement for Indigenous Biodiversity states that an urgent nationally coordinated response is required to halt the decline of Aotearoa New Zealand's biodiversity and ensure native species, habitats and ecosystems can thrive. This includes the identification of SNAs (Policy 4) but also the restoration of environments with depleted indigenous biodiversity (Policy 19). The draft NPSIB indicates that any areas (urban, peri-urban or other heavily modified areas) where remaining indigenous cover is below 10 per cent are to be considered *indigenous biodiversity depleted environments*. According to these criteria, the territory of Napier City is an indigenous biodiversity depleted environment.

Policy 19 also recommends that:

"2. For all indigenous biodiversity depleted environments, identified in accordance with Policy 19(1), establish in regional plans:

a) A target for indigenous cover, which in urban areas and peri-urban areas must be at least 10 per cent.

b) Restoration and reconstruction objectives for indigenous cover that prioritise: i. representation of ecosystems naturally and formerly present, in particular nationally threatened ecosystem types and indigenous vegetation in threatened land environments; ii. species richness; iii. connectivity between, and buffering of, existing habitats; and iv. ecological restoration at a landscape scale across the region.

c) Timeframes for achieving the indigenous cover target and restoration and reconstruction objectives.

3. Specify in each regional biodiversity strategy, actions to achieve the objectives of the relevant regional plan established in accordance with Policy 19(2)(b)."

For Napier City to reach the recommended minimum 10% target of indigenous cover, 429.41 hectares of new indigenous cover needs to be created through ecological restoration and reconstruction (based on the 5.94% SNA cover figure).

Ecological restoration and connectivity opportunities

The SNAs identified in this report highlight an opportunity to promote and direct ecological restoration/reconstruction activity to link existing natural assets and restore missing indigenous ecosystems. This "linking" has many potential benefits, including:

- Increasing Napier City's indigenous vegetation cover and thus moving toward the 10% minimum target for indigenous biodiversity depleted environments
- Buffering existing SNAs from edge effects and thus increasing ecological resilience
- Improving diversity of indigenous flora and fauna
- Providing ecosystem services for Napier residents
- Increasing opportunities for people to connect with nature
- Connecting the activities and energy of current restoration projects and groups

The importance of corridors to increase and sustain biodiversity has been identified at a regional scale (Leathwick, Hashiba and Lynch 2017). Indigenous New Zealand ecosystems have greater ecological integrity than exotic-indigenous mixes (also known as novel ecosystems) or exotic-dominated ecosystems. Restoring healthy ecosystems to Napier and connecting SNAs should be guided by the goal of improving local ecological integrity, the key elements of which are indigenous dominance, species occupancy and environmental representation (Lee et al. 2005).

Opportunities for linking Napier SNAs are illustrated and ranked in the following map (Figure 5). Features that would increase the opportunity to develop a natural landform corridor or are on public land were considered positive linking features. Areas were scored from 1 to 7 (1 indicates little potential value, 7 most potential value for restoration) on how many positive features they contained e.g. current vegetation, distance between sites or along an existing ecological or landscape feature.

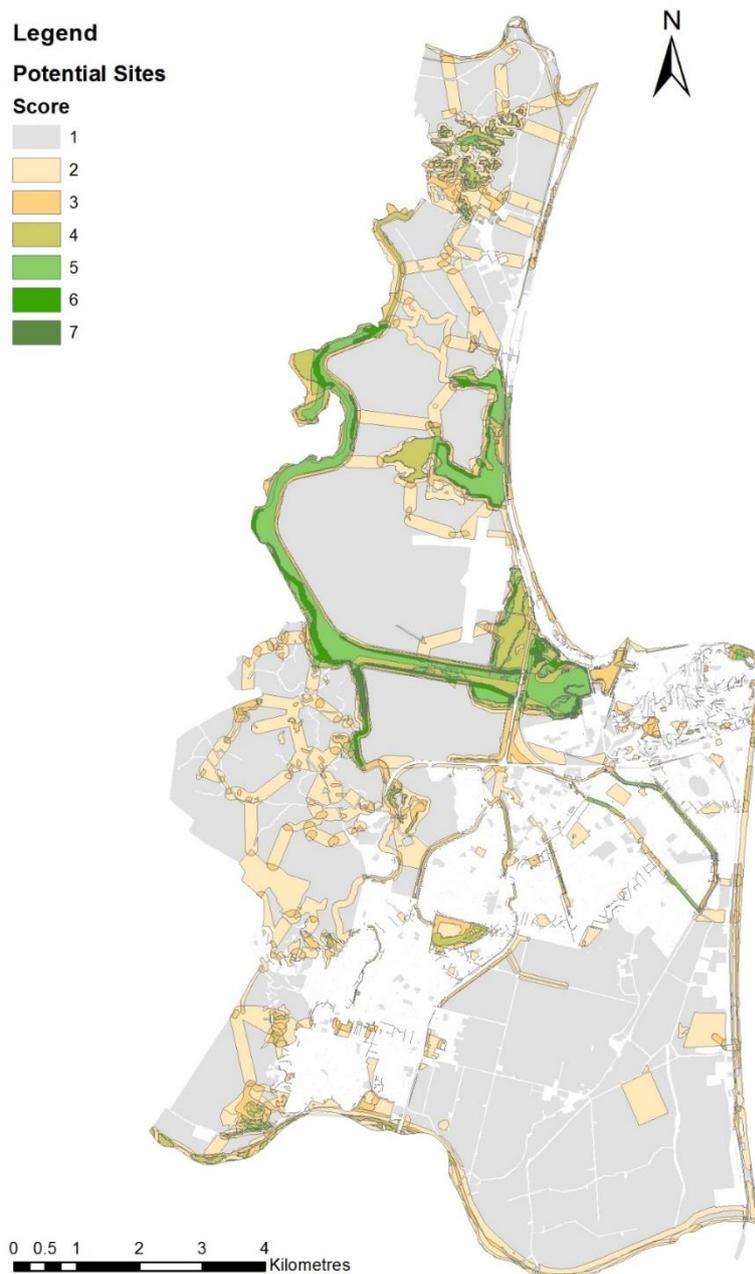


Figure 5. Opportunities for linking Napier SNAs and creating ecological connectivity. A ranking of 7 indicates high potential for linking SNAs while 1 indicates a low potential.

The main areas of potential ecological restoration/reconstruction are along the rivers/waterways, and in areas where exotic vegetation cover is currently dominant. Habitat along the Ahuriri Estuary SNA is a good example of a current corridor for flora and fauna. Ideally there could also be a corridor along the western hills to connect the hills with the rivers. For example, an ecological corridor could be created to link the Dolbel Reserve SNAs to the Tutaekuri River and then along the river to the coast. Another example is a link between the Esk Hill SNAs, the Esk River and the coast. In the built up urban areas there is the potential to transform areas currently in exotic dominant cover, such as on Bluff Hill, into a native dominant ecosystem by underplanting these areas with indigenous plants or replacing exotics as the opportunities arise (e.g. through death or dieback). Walkways, cycleways and waterways (i.e. drains) also hold potential for biodiversity corridor creation. Some specific methods for conducting ecological restoration/reconstruction in Napier are provided in Appendix 5.

Conclusion and recommendations

Thirty-two significant natural areas were identified in Napier City. This includes the nationally significant Ahuriri Estuary and 14 sites that meet significance criteria at an ecological district scale, as directed by the draft National Policy Statement for Indigenous Biodiversity. With only 5.94% of Napier City land covered by SNAs, ecological restoration and reconstruction is required to meet the draft NPSIB minimum 10% indigenous cover target for biodiversity depleted environments. Furthermore, the majority of current SNAs are not well protected from pressures such as livestock or urban development and a number of ecosystems that were historically present in Napier are now missing or very poorly represented.

It is recommended that management resources be directed towards the 1) protection of existing SNAs, 2) the restoration and reconstruction of missing ecosystems and 3) the linking via corridors of SNAs across Napier to ensure ecosystem buffering and ecological connectivity. Reflecting the two-tiered ecological district and city scale approach to significance assessment, the authors recommend the prioritisation of legal protection and ecological restoration efforts for the sites that reach significance at an ecological district scale. These should be protected, managed and restored in accordance with part two of the RMA and the draft NPSIB. However we also recommend that the city scale SNAs are legally protected and considered for ecological restoration as they will be critical in achieving the minimum 10% indigenous cover target and are often at higher risk of being lost due to a limited extent and high development pressure. Ecological restoration should be focused on ecological integrity and creation of functioning ecosystems, and may best be planned through the development of a Napier biodiversity strategy.

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Appendix 1: SNA – Site assessment form

Site number:

Site Name:

Recorder:

Grid Ref/GPS:

Date:

Area m²:

Landform:

General information for the site:

Tenure (tick all that apply)

<input type="checkbox"/>	Public	<input type="checkbox"/>	Private	<input type="checkbox"/>	Māori	<input type="checkbox"/>	Leased	<input type="checkbox"/>	Mixed
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Legal status and management (M = Managed, X = No management) management is fenced and/or pest controlled

<input type="checkbox"/>	No legal	<input type="checkbox"/>	Reserve (TA)	<input type="checkbox"/>	Covenant (QEII)	<input type="checkbox"/>	Reserve (DoC)	<input type="checkbox"/>	Agreement (RC)
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If mix of legal status estimate % of legally protected:

If managed what are the measures:

Fencing (tick one)

<input type="checkbox"/>	No fencing	<input type="checkbox"/>	Some fencing	<input type="checkbox"/>	Mostly fenced	<input type="checkbox"/>	Fully fenced
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Was entire fence seen? Yes/No

Year fenced (if known):

Surrounding land use (tick all that apply)

<input type="checkbox"/>	Urban subdivisions	<input type="checkbox"/>	Lifestyle blocks
<input type="checkbox"/>	Garden; parkland	<input type="checkbox"/>	Open space; Bare land; Recreation land
<input type="checkbox"/>	Dairying, cropping or horticulture	<input type="checkbox"/>	Sheep, beef or other agriculture
<input type="checkbox"/>	Plantation forestry	<input type="checkbox"/>	Permaculture tree lands; planted natives
<input type="checkbox"/>	Coastal dunes	<input type="checkbox"/>	Indigenous forest or scrub

Photos

Photo No.	GPS Longitude / Easting	GPS Latitude / Northing	Description

Site Map

Site Description

Significance Justification criteria to Identify SNA

(Source from Draft National Policy Statement for Indigenous Biodiversity: Biodiversity Collaborative Group 2018 pp. 72-76)

Significance criteria	Rating (1,2)	Describe why the criteria is met at the site. Leave blank if does not meet criteria.
Criteria_1 – Representativeness		
1A - Typical indigenous vegetation of the area		
1B –Habitat for typical suite of indigenous animals		
Criteria_2 – Diversity and Pattern		
2A – Indigenous species diversity		
2B – Presence of ecotones, gradients or sequences		
Criteria_3 – Rarity and Distinctiveness		
3A – Habitat for threatened indigenous plant or animal		
3B – Indigenous species at/near distributional limit		
3C – Reduced to <30% of past extent of area		
3D – Sand dunes, wetlands, or estuaries		
3E – Biogenic habitats in the marine environment.		
3F – An originally rare ecosystem type		
3G – Distinctive assemblage/community or has special ecological/scientific feature		
Criteria_4 – Ecological Context		
4A – Large site		
4B – Ecological buffer, linkage or corridor		
4C – Critical habitat for an indigenous animal species		

Habitat and Vegetation Description:

Unit Number	Hydrological Regime	Category	Code	Character	Habitat area estimate %	Vegetation description (Dominant species)

Flora and Fauna:

Include reference of rare, threatened or distinctive plant species seen or known to be, or have been present at the site (provide source and date of information e.g. SSBI, PNAP, botanical society. Also provide general comments on forest /vegetation composition e.g. dominant canopy species, understorey species etc.)

Vegetation condition

Rating information			(Tick appropriate level) for each unit.				Unit 1	Unit 2	Unit 3	Unit 4
Forest/scrub										
Canopy condition	1	Very sparse foliage, many large holes, dieback>20%.								
	2	Foliage sparse in some areas, canopy holes uncommon. Some dieback.								
	3	Foliage mostly dense, only occasional sparse areas, canopy holes rare, very occasional dieback.								
	4	Abundant dense foliage over whole canopy, no canopy holes or dieback.								
Mid Tier	1	No browse palatable species 45cm-1.35m. Understorey bare.								
	2	Very few browse palatable species 45cm-1.35m. Scattered seedlings of less palatable species.								
	3	Moderate browse palatable species 45cm-1.35m. Other species relatively abundant.								
	4	Abundant browse palatable species and other species present.								
Ground Cover	1	Bare soil, rock, >20% of forest floor. Ground vegetation (ferns, moss, seedlings etc <45cm tall) absent or uncommon. Leaf litter on remainder of forest floor.								
	2	Scattered bare soil & rock. Ground vegetation<20%. Leaf litter on remainder of forest floor.								
	3	Bare soil, rock absent or very uncommon. Ground vegetation 25%-50%. Leaf litter on remainder of forest floor.								
	4	No bare soil or rock, or eroding soil. Ground vegetation, abundant, 50%-100%. Leaf litter on remainder.								

Wetland/Estuary		Unit:							
Description (tick appropriate category)									
Lake	Shallow water <2m	Swamp	Marsh	Fen	Bog	Shrub-carr			
Grass/sedge meadow	Deciduous margin	Saline	Other (describe)						
Water in the system?	Yes	No	Evidence of water level changes?		Yes	No	Unsure		
Degree of water turbidity	Clear		Water Quality		Algal blooms		Pollution		
	Translucent								
	Opaque								
Plant Communities (enter % cover)									
Wetland vegetation	Sedge/grass		Herbs		Shrubs		Trees		
Wetland margin vegetation	Sedge/grass		Herbs		Shrubs		Trees		Pasture
Wetland Hydrophyte %	OBL		FACW		FAC		FACU		UPL
Plant vigour in wetland		Wetland				Wetland margin			
		High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/>				High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/>			

Invasive species in wetland: cover %		Distribution (circle) single patch >1 patch continuous
Invasive species in margin: cover %		Distribution (circle) single patch >1 patch continuous
Source of water: spring <input type="checkbox"/> surface flows <input type="checkbox"/> stream/river <input type="checkbox"/> precipitation only <input type="checkbox"/>		
Erosion/Disturbance	Wetland	Wetland margin
Comments		
No disturbance		

Coastline habitat		Unit:	
Description %			
Sand binders		Grass/Sedges	
		Herbs	
		Shrubs	
		Trees	
Type (tick all that apply)	Fore dune	Second dune	Rear dune
	Rocky shore	Coastal cliff	Wetland
Substrate %	Boulders/rocks	Mud/Silt	Soil Sand
Native plant vigour in coastal habitat		High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/>	
Erosion/Disturbance (comments)			

Fauna

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Threats

Pest plants

Indicator	R a t i n g	Estimate (Tick appropriate level)	U n i t 1	U n i t 2	U n i t 3	U n i t 4	Notes for dominant Species etc	Comments & suggested management
Ground cover weeds	1	Very common, cover >50% ground area.						
	2	Common, 10%- 50% ground area.						
	3	Occasional, up to 10% ground area.						
	4	None present.						
Vine weeds	1	Very common, >50% canopy cover.						
	2	Common, 10%50% canopy cover.						
	3	Occasional, up to 10% canopy cover.						
	4	None present.						
Shrub/Tree Weeds	1	Very common, <50% understorey or canopy cover.						
	2	Common, 10%- 50% understorey or canopy cover.						
	3	Occasional, up to 10% understorey or canopy cover.						
	4	None present.						

Pest animals

If evidence of the same pest animal is present in different units, this needs to be indicated.

Indicator	R a t i n g	Estimate (Tick appropriate level)	U n i t 1	U n i t 2	U n i t 3	U n i t 4	Notes Species etc.	Comments suggested management
Stock	1	Abundant fresh signs (droppings, major tracks and hoof prints) Stock heard or seen throughout area.						
	2	Common fresh sign but sometimes scattered. Occasional stock heard or seen, confined to scattered areas on edge.						
	3	Sign uncommon. Sign is often old. Only near edges.						
	4	No damage.						

Human Associated Activities

(Rubbish (organic or inorganic) dumping, Stock grazing, Drainage, Earth works, Erosion, Top dressing, Fire, Vegetation clearing, Herbicide application, Harvest / vegetation clearing, Planting, Animal pest control, Domestic pets, Fencing)

Unit	Activity	Impact	Suggested Response
Notes			

Management recommendations

Comment on activities such as pest control, fencing, weed control, time, planting buffers, threatened species protection and/or habitat restoration within a site.

Notes

Appendix 2: Summary table of Napier significant natural areas

Site Number	Name *sites containing remnant vegetation in bold	Total m2 in Napier (excluding water)	Landform	Vegetation type 2019	Historic vegetation type	Significance criteria *ecological district scale in bold	Significance rank
1	Esk Hill 1	32400.7	Hill	1. <i>Kunzea robusta</i> forest 2. Mixed podocarp-broadleaved forest	Coastal forest	1A, 2A, 3A, 3C , 4B	1
2	Esk Hill 2	137521.8	Hill	1. <i>Kunzea robusta</i> forest 2. Mixed broadleaved-exotic dominated forest 3. <i>Kunzea robusta/Piper excelsum- Melicytus ramiflorus</i> forest 4. <i>Kunzea robusta- Myoporum laetum/Melicytus ramiflorus</i> forest 5. <i>Kunzea robusta/Ulex europaeus</i> forest	Coastal forest	1A, 2A, 3A, 3B, 3C , 4A, 4B	1
3	Esk Hill 3	14263.4	Hill	1. <i>Kunzea robusta</i> forest 2. <i>Sophora</i> spp.- mixed broadleaved forest	Coastal forest	1A, 2A, 3A, 3B, 3C , 4B	1
4	Esk Hill 4	4491.7	Hill	1. Mixed broadleaved shrubland	Coastal forest	3B, 3C, 4B	3
5	Esk Hill 5	27638.0	Hill	1. <i>Kunzea robusta/Piper excelsum</i> forest 2. <i>Typha orientalis/Paspalum distichum, Carex</i> spp. wetland	Coastal forest Freshwater wetland	1A, 2A, 2B, 3A, 3B, 3C , 3D, 4B	1
6	Esk Hill 6	2723.2	Hill	1. Mixed native -exotic broadleaved forest 2. Mixed broadleaved - <i>Kunzea robusta</i> forest	Coastal forest	1A, 2A, 3A, 3B, 3C, 4B	2

Site Number	Name *contains remnant vegetation in bold	Total m2 in Napier (excluding water)	Landform	Vegetation type 2019	Historic vegetation type	Significance criteria *regional scale in bold	Significance rank
7	Esk Hill 7	86138.1	Hill	1. <i>Kunzea robusta</i> / <i>Pteris tremula</i> forest 2. <i>Kunzea robusta</i> / <i>Carex</i> spp, <i>Cyperus ustulatus</i> forest	Coastal forest	1A, 2A, 3A, 3C , 4A, 4B	1
8	Esk Hill 8	4797.6	Hill	1. Mixed broadleaved shrubland	Coastal forest	2A, 3B, 3C, 4B	2
9	Esk Hill 9	18050.1	Hill	1. <i>Kunzea robusta</i> forest	Coastal forest	1A, 3A, 3C , 4B	1
10	Esk Hill 10	20849.7	Hill	1. <i>Kunzea robusta</i> forest	Coastal forest	1A, 3A, 3C , 4B	2
11	Esk Hill 11	7667.4	Hill	1. <i>Kunzea robusta</i> forest	Coastal forest	1A, 3A, 3C , 4B	2
12	Esk Hill 12	16461.2	Hill	1. <i>Pinus</i> spp./ <i>Kunzea robusta</i> forest	Coastal forest	1A, 3A, 3C , 4B	2
13	Kaiangaroa	5300.1	Hill	1. Mixed broadleaved shrubland	Coastal forest	3B, 3C	3

Site Number	Name *contains remnant vegetation in bold	Total m2 in Napier (excluding water)	Landform	Vegetation type 2019	Historic vegetation type	Significance criteria *regional scale in bold	Significance rank
14	Ahuriri Estuary	4540821.9	Saline plain	<ol style="list-style-type: none"> 1. <i>Salicornia quinqueflora</i>-pasture grass wetland 2. <i>Juncus kraussii</i> subsp. <i>australiensis</i>/<i>Salicornia quinqueflora</i>- Pasture grass wetland 3. Pasture grass- <i>Lolium arundinaceum</i>/<i>Salicornia quinqueflora</i> wetland 4. <i>Isolepis cernua</i>- <i>Puccinellia fasciculata</i>/<i>Selliera radicans</i>- <i>Spergularia tasmanica</i>- <i>Plantago cornopus</i> wetland 5. <i>Juncus kraussii</i> subsp. <i>australiensis</i>/ <i>Thyridia repens</i>- <i>Cotula coronopifolia</i> wetland 6. <i>Bolboschoenus</i>/<i>Samolus repens</i>- <i>Thyridia repens</i> wetland 	Saline wetland	1A, 1B, 2A, 2B, 3A, 3B, 3C, 3D, 4A, 4B, 4C	1
15	Bayview wetland	250107.0	Saline plain	<ol style="list-style-type: none"> 1. <i>Juncus kraussii</i> subsp. <i>australiensis</i>/<i>Salicornia quinqueflora</i> wetland 2. <i>Juncus kraussii</i> subsp. <i>australiensis</i>/pasture grass wetland 3. <i>Symphyotrichum subulatum</i>/<i>Cotula coronopifolia</i>, <i>Samolus repens</i>- <i>Thyridia repens</i>- <i>Juncus kraussii</i> subsp. <i>australiensis</i>- pasture grass wetland 4. <i>Juncus kraussii</i> subsp. <i>australiensis</i>/<i>Selliera radicans</i>- <i>Spergularia tasmanica</i> wetland 	Saline wetland	1A, 2A, 3A, 3C, 3D, 4A, 4B	1
16	Ahuriri plain wetland	882725.0	Saline plain	<ol style="list-style-type: none"> 1. <i>Juncus kraussii</i> subsp. <i>australiensis</i> - pasture grass/<i>Salicornia quinqueflora</i> wetland 	Saline wetland	1A, 2B, 3C, 3D, 4A, 4B	1
17	Esplanade herbfield	8037.4	Coastal margin	<ol style="list-style-type: none"> 1. <i>Chrysanthemoides monilifera</i>/<i>Agapanthus praecox</i> 2. <i>Cotoneaster glaucophyllus</i>/pasture grass/<i>Gazania linearis</i> herbfield 	Coastal herbfield	1A, 2A, 3A, 3C, 3D	1

Site Number	Name *contains remnant vegetation in bold	Total m ² in Napier (excluding water)	Landform	Vegetation type 2019	Historic vegetation type	Significance criteria *regional scale in bold	Significance rank
18	Westshore Reserve bush	12308.1	Plain	1. Mixed broadleaved- <i>Myoporum laetum</i> forest	Semi-swamp forest	2A, 3B, 3C, 4B	2
19	Bluff Hill (Mataruahou)	9196.4	Hill	1. Mixed broadleaved forest	Coastal forest	1A, 2A, 3C	3
20	Lake Rotokaramu	37171.9	Hill	1. <i>Eleocharis sphacelata</i> - <i>Typha orientalis</i> / <i>Juncus</i> wetland.	Freshwater wetland	1A, 1B , 2A, 3A, 3C, 3D	1
21	Embankment road wetland	20857.6	Saline plain	1. <i>Salicornia quinqueflora</i> -pasture grass wetland	Saline wetland	1A, 3C, 3D	3
22	Harakeke Reserve	19422.3	Plain	1. Mixed broadleaved- <i>Pittosporum</i> spp. forest 2. <i>Typha orientalis</i> / <i>Phormium tenax</i> - <i>Bolboschoenus</i> spp/ <i>Lemna</i> pasture grass wetland	Semi-swamp forest Freshwater wetland	2A, 2B, 3C	3
23	Halliwell Reserve 1	11338.8	Hill	1. Mixed broadleaved- <i>Dacrycarpus dacrydioides</i> forest	Coastal forest	1A, 2A, 3C	2
24	Halliwell Reserve 2	12149.2	Hill	1. Mixed broadleaved-podocarp shrubland	Coastal forest	1A, 2A, 3C	2

Site Number	Name *contains remnant vegetation in bold	Total m ² in Napier (excluding water)	Landform	Vegetation type 2019	Historic vegetation type	Significance criteria *regional scale in bold	Significance rank
25	SH50 planting	4776.8	Plain	1. Mixed podocarp-broadleaved forest	Semi-swamp forest	1A, 2A, 3C	3
26	Dolbel Reserve 1	22173.7	Hill	1. Mixed broadleaved forest	Coastal forest	1A, 2A, 3A, 3C	2
27	Dolbel Reserve 2	24591.6	Hill	1. Mixed broadleaved forest	Coastal forest	1A, 2A, 3C	3
28	Friend's Bush	3736.0	Plain	1. Mixed podocarp-broadleaved forest	Semi-swamp forest	1A, 2A, 3C	3
29	Otatara Park	6099.2	Hill	1. Mixed broadleaved forest	Coastal forest	1A, 2A, 3C	2
30	Otatara Pa 1	11213.2	Hill	1. <i>Kunzea robusta</i> forest	Coastal forest	1A, 3A, 3C, 4B	2
31	Otatara Pa 2	4543.4	Hill	1. <i>Myoporum laetum</i> forest.	Coastal forest	3C, 4B	3
32	Otatara Pa 3	28093.1	Hill	1. <i>Myoporum laetum</i> -mixed broadleaved forest. 2. <i>Sophora tetraptera</i> - <i>Cytisus proliferus</i> - <i>Coprosma robusta</i> forest.	Coastal forest	3A, 3C, 4B	2

Appendix 3: Flora species from surveys, literature and landowner information

Exotic species noted by asterisks. This list is not exhaustive.

Common Name	Species Name
<i>Abies</i> spp.*	<i>Abies</i> spp.*
<i>Acer</i> spp.*	<i>Acer</i> spp.*
<i>Actinidia</i> spp.*	<i>Actinidia</i> spp.*
Agapanthus*	<i>Agapanthus praecox</i> *
<i>Agave</i> spp.*	<i>Agave</i> spp.*
Akeake	<i>Dodonaea viscosa</i>
Akiraho	<i>Olearia paniculata</i>
<i>Alyssum</i> spp.*	<i>Alyssum</i> spp.*
American plum*	<i>Prunus americana</i> *
Apple of Sodom*	<i>Solanum linnaeanum</i> *
Apple tree*	<i>Malus x domestica</i> *
Asphodel*	<i>Asphodelus fistulosus</i> *
<i>Astelia</i> spp.	<i>Astelia</i> spp.
Avocado*	<i>Persea americana</i> *
<i>Azolla</i> spp.	<i>Azolla</i> spp.
Bachelor's button	<i>Cotula coronopifolia</i>
Banksia*	<i>Banksia integrifolia</i> *
Barnyard grass*	<i>Echinochloa crus-galli</i> *
Bay tree*	<i>Laurus nobilis</i> *
Beard grass*	<i>Polypogon monspeliensis</i> *
Bermuda grass*	<i>Cynodon dactylon</i> *
Bindweed*	<i>Calystegia silvatica</i> *
Black locust*	<i>Robinia pseudoacacia</i> *
Black maire	<i>Nestegis cunninghamii</i>
Black nightshade*	<i>Solanum nigrum</i> *
Blackberry*	<i>Rubus fruticosus</i> *
Blackwood	<i>Acacia melanoxylon</i> *
Blue morning glory*	<i>Ipomoea indica</i> *
Blue passionflower*	<i>Passiflora caerulea</i> *
<i>Bolboschoenus</i> spp.	<i>Bolboschoenus</i> spp.
Boneseed*	<i>Chrysanthemoides monilifera</i> *
Boxthorn*	<i>Lycium ferocissimum</i> *
Bracken fern/manehu	<i>Pteridium esculentum</i>
Broad-leaved dock*	<i>Rumex obtusifolius</i> *
Broad-leaved plantain*	<i>Plantago major</i> *
Broadleaf/kāpuka	<i>Griselinia littoralis</i>
<i>Bromelia</i> spp.*	<i>Bromelia</i> spp.*
Broomrape*	<i>Orobanche minor</i> *
Buck's horn plantain	<i>Plantago coronopus</i> *

Bur medick*	<i>Medicago nigra</i> *
Bush lawyer/ tātārāmoa	<i>Rubus schmidelioides</i>
Bushy starwort*	<i>Symphotrichum subulatum</i> *
Cabbage tree/tī	<i>Cordyline australis</i>
Californian poppy*	<i>Eschscholzia californica</i> *
<i>Callistemon</i> spp.*	<i>Callistemon</i> spp.*
Camellia*	<i>Camellia japonica</i> *
Canada bluegrass*	<i>Poa compressa</i> *
Candelabra aloe *	<i>Aloe arborescens</i> *
Catsear*	<i>Hypochaeris radicata</i> *
Century plant*	<i>Agave americana</i> *
Chicory*	<i>Cichorium intybus</i> *
Chinese windmill palm*	<i>Trachycarpus fortunei</i> *
Climbing asparagus*	<i>Asparagus scandens</i> *
climbing dock*	<i>Rumex sagittatus</i> *
Coastal tree daisy	<i>Olearia solandri</i>
Common barberry*	<i>Berberis vulgaris</i> *
Convolvulus*	<i>Convolvulus arvensis</i> *
<i>Coprosma crassifolia</i>	<i>Coprosma crassifolia</i>
Coprosma hybrid	Coprosma hybrid
<i>Coprosma propinqua</i>	<i>Coprosma propinqua</i>
<i>Coprosma spathulata</i>	<i>Coprosma spathulata</i>
<i>Corokia cheesemanii</i>	<i>Corokia x cheesemanii</i>
Cotoneaster*	<i>Cotoneaster coriaceus</i> *
Cotoneaster*	<i>Cotoneaster glaucophyllus</i> *
Crack willow*	<i>Salix fragilis</i> *
<i>Crassula</i> spp.*	<i>Crassula</i> spp.*
Creeping mallow*	<i>Modiola caroliniana</i> *
<i>Cupressaceae</i> spp.*	<i>Cupressaceae</i> spp.*
Cutty grass/rautahi	<i>Carex geminata</i>
<i>Deschampsia</i> spp.	<i>Deschampsia</i> spp.
Elephant ear*	<i>Alocasia brisbanensis</i> *
<i>Euphorbia</i> spp.*	<i>Euphorbia</i> spp.*
Exotic broom*	<i>Cytisus scoparius</i> *
Feathertop	<i>Cenchrus longisetus</i> *
Fennel*	<i>Foeniculum vulgare</i> *
Field madder*	<i>Sherardia arvensis</i> *
Field poppy*	<i>Papaver rhoeas</i> *
Fierce lancewood	<i>Pseudopanax ferox</i>
Fig*	<i>Ficus carica</i> *
Five finger	<i>Pseudopanax arboreus</i>
Flax/harakeke	<i>Phormium tenax</i>
Formosan lily*	<i>Lilium formosanum</i> *

Gazania*	<i>Gazania linearis</i> *
Gazania*	<i>Gazania rigens</i> *
<i>Geranium</i> spp.*	<i>Geranium</i> spp.*
German ivy*	<i>Delairea odorata</i> *
Gingko*	<i>Gingko biloba</i> *
Glasswort/ ureure	<i>Salicornia quinqueflora</i>
<i>Glossostigma elatinoides</i>	<i>Glossostigma elatinoides</i>
Gorse*	<i>Ulex europaeus</i> *
Grey sedge*	<i>Carex divulsa</i> *
Grey willow*	<i>Salix cinerea</i> *
Gum*	<i>Eucalyptus</i> spp.*
Hairy birdsfoot trefoil*	<i>Lotus suaveolens</i> *
Hard beech/hututawai	<i>Fuscospora truncata</i>
Harestail*	<i>Lagurus ovatus</i> *
Hawthorn*	<i>Crataegus monogyna</i> *
Hedge artemisia*	<i>Artemisia arborescens</i> *
Hen and chicken fern/ maku	<i>Asplenium bulbiferum</i>
Hīnau	<i>Elaeocarpus dentatus</i>
Horses mane weed	<i>Ruppia polycarpa</i>
Hound's tongue/ kōwaowao	<i>Microsorium pustulatum</i>
Houpara	<i>Pseudopanax lessonii</i>
Hydrangea*	<i>Hydrangea macrophylla</i> *
Smooth catsear*	<i>Hypochaeris glauca</i> *
Inkweed*	<i>Phytolacca octandra</i> *
<i>Iris</i> spp.*	<i>Iris</i> spp.*
Ivy*	<i>Hedera helix</i> *
Jerusalem cherry*	<i>Solanum pseudocapsicum</i> *
Jointed rush*	<i>Juncus articulatus</i> *
Jointed wire rush/ oioi	<i>Apodasmia similis</i>
<i>Juncus</i> spp.*	<i>Juncus</i> spp.*
Kahikatea	<i>Dacrycarpus dacrydioides</i>
Kaikomako	<i>Pennantia corymbosa</i>
Kakabeak	<i>Clianthus maximus</i>
Kanono	<i>Coprosma grandifolia</i>
Kānuka	<i>Kunzea robusta</i>
Karaka	<i>Corynocarpus laevigatus</i>
Karamū	<i>Coprosma robusta</i>
Karo	<i>Pittosporum crassifolium</i>
Karo	<i>Pittosporum ralphii</i>
Kauri	<i>Agathis australis</i>
Kawakawa	<i>Piper excelsum</i>
King fern/ mouku	<i>Ptisana salicina</i>
King Island melilot*	<i>Melilotus indicus</i> *

Kiokio	<i>Blechnum novae-zelandiae</i>
Kōhūhū	<i>Pittosporum tenuifolium</i>
Korokio	<i>Corokia cotoneaster</i>
Kōromiko	<i>Veronica stricta</i>
Kōwhai	<i>Sophora microphylla</i>
Kutakuta	<i>Eleocharis sphacelata</i>
Lacebark/ houhere	<i>Hoheria populnea</i>
Lacebark/ houhere	<i>Hoheria sexstylosa</i>
Ladder fern*	<i>Nephrolepis cordifolia</i> *
Lancewood/ hoheka	<i>Pseudopanax crassifolius</i>
Large-leaved kowhai/ kōwhai	<i>Sophora tetraptera</i>
<i>Lavendula</i> spp.*	<i>Lavendula</i> spp.*
Leather-leaf fern	<i>Pyrrhosia eleagnifolia</i>
<i>Lemna</i> spp.	<i>Lemna</i> spp.
Lemonwood/ tarata	<i>Pittosporum eugenioides</i>
<i>Libertia</i> spp.*	<i>Libertia</i> spp.*
Loquat*	<i>Eriobotrya japonica</i> *
<i>Lupinus</i> spp.*	<i>Lupinus</i> spp.*
Maderia vine*	<i>Anredera cordifolia</i> *
Māhoe	<i>Meliccytus ramiflorus</i>
Mamaku	<i>Cyathea medullaris</i>
Mānuka	<i>Leptospermum scoparium</i>
Māpou	<i>Myrsine australis</i>
Marble leaf/ putaputawētā	<i>Carpodetus serratus</i>
Mataī	<i>Prumnopitys taxifolia</i>
Mediterranean barley grass*	<i>Critesion hystrix</i> *
Mercer grass*	<i>Paspalum distichum</i> *
Mexican daisy*	<i>Erigeron karvinskianus</i> *
Miro	<i>Prumnopitys ferruginea</i>
Mondo grass*	<i>Ophiopogon japonicus</i>
Montpellier broom*	<i>Genista monspessulana</i> *
Moth plant*	<i>Araujia sericifera</i> *
Mountain flax/ wharariki	<i>Phormium cookianum</i>
<i>Muehlenbeckia</i> spp.	<i>Muehlenbeckia</i> spp.
Naked lady*	<i>Amaryllis belladonna</i> *
Narrow-leaved houhere/ houhi	<i>Hoheria angustifolia</i>
Narrow-leaved maire/ maire kōtae	<i>Nestegis montana</i>
Narrow-leaved plantain*	<i>Plantago lanceolata</i> *
Nasturtium*	<i>Tropaeolum majus</i> *
New Zealand giant umbrella sedge/ toetoe upokotangata	<i>Cyperus ustulatus</i>
New Zealand ice plant/ horokaka	<i>Disphyma australe</i>
New Zealand musk	<i>Thyridia repens</i>
New Zealand passionfruit/ kōhia	<i>Passiflora tetrandra</i>

New Zealand sea spurrey	<i>Spergularia tasmanica</i>
Ngaio	<i>Myoporum laetum</i>
Nīkau	<i>Rhopalostylis sapida</i>
Niniaio	<i>Helichrysum lanceolatum</i>
Northern rata/ rātā	<i>Metrosideros robusta</i>
Oak*	<i>Quercus</i> spp.*
<i>Olearia</i> spp.	<i>Olearia</i> spp.
Olive*	<i>Olea</i> spp.*
Orache*	<i>Atriplex prostrata</i> *
Orange firethorn*	<i>Pyracantha angustifolia</i> *
Oval sedge*	<i>Carex leporina</i> *
Oxtongue*	<i>Helminthotheca echioides</i> *
Pale flax*	<i>Linum bienne</i> *
Pampas*	<i>Cortaderia selloana</i> *
Paspalum*	<i>Paspalum dilatatum</i> *
Peppercress*	<i>Lepidium africanum</i> *
Periwinkle*	<i>Vinca major</i> *
<i>Phormium</i> spp.	<i>Phormium</i> spp.
Pig's ear*	<i>Cotyledon orbiculata</i> *
Pigeonwood/ porokaiwhiri	<i>Hedycarya arborea</i>
Pimelea	<i>Pimelea urvilliana</i> subsp. <i>urvilliana</i>
Pimpernel*	<i>Lysimachia arvensis</i> *
Pine*	<i>Pinus</i> spp.*
<i>Poa</i> spp.	<i>Poa</i> spp.
Pohuehue	<i>Muehlenbeckia australis</i>
Pōhutukawa	<i>Metrosideros excelsa</i>
Poroporo	<i>Solanum laciniatum</i>
Prostrate kowhai	<i>Sophora prostrata</i>
<i>Prunus</i> spp.*	<i>Prunus</i> spp.*
<i>Pseudopanax discolor</i>	<i>Pseudopanax discolor</i>
Pseudopanax hybrid	<i>Pseudopanax</i> spp. x
<i>Pseudopanax laetus</i>	<i>Pseudopanax laetus</i>
Puka / akapuka	<i>Griselinia lucida</i>
Puka	<i>Meryta sinclairii</i>
Pūrei	<i>Carex secta</i>
Purging flax*	<i>Linum catharticum</i> *
Pūriri	<i>Vitex lucens</i>
Purple-top*	<i>Verbena bonariensis</i> *
Ramarama	<i>Lophomyrtus bullata</i>
Rangiora	<i>Brachyglottis repanda</i>
Rasp fern	<i>Blechnum parrisiae</i>
Rat's-tail*	<i>Sporobolus africanus</i> *
Raupō	<i>Typha orientalis</i>

Red beech/ hututawai	<i>Fuscospora fusca</i>
Red horopito/ ōramarama	<i>Pseudowintera colorata</i>
Remuremu	<i>Selliera radicans</i>
Rengarenga	<i>Arthropodium cirratum</i>
Rewarewa	<i>Knightsia excelsa</i>
Ribbonwood/ mānatu	<i>Plagianthus regius</i>
<i>Ricciocarpos natans</i>	<i>Ricciocarpos natans</i>
Rimu	<i>Dacrydium cupressinum</i>
Ripgut brome*	<i>Bromus diandrus*</i>
Rōhutu	<i>Lophomyrtus obcordata</i>
Rose spp.*	<i>Rosa spp.*</i>
Rosemary*	<i>Rosmarinus officinalis*</i>
Round-leaved fern/ tarawera	<i>Pellaea rotundifolia</i>
Salt grass*	<i>Puccinellia fasciculata*</i>
Salt marsh ribbonwood/ mākaka	<i>Plagianthus divaricatus</i>
Sand coprosma/ tarakupenga	<i>Coprosma acerosa</i>
<i>Scirpus</i> spp.	<i>Scirpus</i> spp.
Scrub pohuehue/ pōhuehue	<i>Muehlenbeckia complexa</i>
Sea primrose/ māakoako	<i>Samolus repens</i>
Sea rush	<i>Juncus kraussii</i> subsp. <i>australiensis</i>
Shore bindweed/ rauparaha	<i>Calystegia soldanella</i>
Sickle spleenwort/ petako	<i>Asplenium polyodon</i>
Silver fern/ ponga	<i>Cyathea dealbata</i>
<i>Sisyrinchium</i> spp.*	<i>Sisyrinchium</i> spp.*
Slender birdsfoot trefoil*	<i>Lotus angustissimus*</i>
Slender clubrush	<i>Isolepis cernua</i>
Small-flowered cranesbill*	<i>Geranium pusillum*</i>
Small-flowered mallow*	<i>Malva parviflora*</i>
Smilax*	<i>Asparagus asparagoides*</i>
Smillograss*	<i>Piptatherum miliaceum*</i>
Soft brome*	<i>Bromus hordeaceus*</i>
Sow thistle/ pūhā*	<i>Sonchus oleraceus*</i>
Spanish dagger*	<i>Yucca gloriosa*</i>
Spider plant*	<i>Chlorophytum comosum</i>
Spurrey*	<i>Spergula arvensis*</i>
Star thistle*	<i>Centaurea calcitrapa*</i>
Stonecrop*	<i>Sedum acre*</i>
Storksbill	<i>Erodium cicutarium</i>
Strawberry clover*	<i>Trifolium fragiferum*</i>
Suckling clover*	<i>Trifolium dubium*</i>
Supplejack/ kareao	<i>Ripogonum scandens</i>
Sweet clover*	<i>Melilotus albus*</i>
Sweet fern	<i>Pteris macilenta</i>

Sweet vernal*	<i>Anthoxanthum odoratum*</i>
Tall fescue*	<i>Lolium arundinaceum*</i>
Tamarillo*	<i>Solanum betaceum*</i>
Tānekaha	<i>Phyllocladus trichomanoides</i>
Taraire	<i>Beilschmiedia tarairi</i>
Tasmanian ngaio*	<i>Myoporum insulare*</i>
Tauhinu	<i>Ozothamnus leptophyllus</i>
Taupata	<i>Coprosma repens</i>
Tawa	<i>Beilschmiedia tawa</i>
Tender brake/ turawera	<i>Pteris tremula</i>
<i>Teucrium parvifolium</i>	<i>Teucrium parvifolium</i>
Thin-leaved coprosma/ aruhe	<i>Coprosma areolata</i>
Thornapple*	<i>Datura stramonium*</i>
Titoki	<i>Alectryon excelsus</i>
Toad rush*	<i>Juncus bufonius*</i>
Toetoe	<i>Austroderia</i> spp.
Tōtara	<i>Podocarpus totara</i>
Tree lucerne*	<i>Chamaecytisus proliferus*</i>
Tree privet*	<i>Ligustrum lucidum*</i>
<i>Triglochin striata</i>	<i>Triglochin striata</i>
Tulip tree	<i>Liriodendron tulipifera*</i>
Veronica cultivar	<i>Veronica</i> spp. cultivar
<i>Veronica</i> spp.	<i>Veronica</i> spp.
Vetch*	<i>Vicia sativa*</i>
Viper's bugloss*	<i>Echium vulgare*</i>
Wandering Jew*	<i>Tradescantia fluminensis*</i>
Water speedwell*	<i>Veronica anagallis-aquatica*</i>
Wattle*	<i>Acacia</i> spp.*
Wharangi	<i>Melicope ternata</i>
Whau	<i>Entelea arborescens</i>
Whekī	<i>Dicksonia squarrosa</i>
White clover*	<i>Trifolium repens*</i>
White poplar*	<i>Populus alba*</i>
Wild parsnip*	<i>Pastinaca sativa*</i>
William's broom	<i>Carmichaelia williamsii</i>
Willow weed*	<i>Persicaria maculosa*</i>
Windmill grass*	<i>Chloris truncata*</i>
Wineberry/ makomako	<i>Aristotelia serrata</i>
Winged thistle*	<i>Carduus tenuiflorus*</i>
Wīwī/ knobby clubbrush	<i>Ficinia nodosa</i>
Woolly clover*	<i>Trifolium tomentosum*</i>
Woolly mullein*	<i>Verbascum thapsus*</i>

Appendix 4: Fauna species from surveys, literature and landowner information

Exotic species noted by asterisks. This list is not exhaustive.

Common name	Species name
Australasian bittern/matuku hūrepo	<i>Botaurus poiciloptilus</i>
Australasian gannet/tākapu	<i>Morus serrator</i>
Australasian shoveler/kuruwhengi	<i>Anas rhynchotis</i>
Australian magpie/makipae*	<i>Gymnorhina tibicen</i>
Banded dotterel/tūturiwhatu	<i>Charadrius bicinctus</i>
Barracouta	<i>Thrysites atun</i>
Bar-tailed godwit/kūaka	<i>Limosa lapponica</i>
Bellbird/korimako	<i>Anthornis melanura</i>
Black shag/kawau	<i>Phalacrocorax carbo</i>
Black swan/kakiānau	<i>Cygnus atratus</i>
Black-backed gull/karoro	<i>Larus dominicanus</i>
Black-billed gull/tarāpuka	<i>Larus bulleri</i>
Black-fronted dotterel	<i>Elsyornis melanops</i>
Blue mackerel	<i>Scomber japonicus</i>
Brown trout/Taraute *	<i>Salmo trutta</i>
California quail*	<i>Callipepla californica</i>
Canada goose*	<i>Branta canadensis</i>
Caspian tern/taranui	<i>Hydroprogne caspia</i>
Chaffinch/pahirini*	<i>Fringilla coelebs</i>
Cockabully	<i>Tripterygion nigripenne</i>
Cockles	<i>Austrovenus stutchburyi</i>
Common bully	<i>Gobiomorphus cotidianus</i>
Common myna*	<i>Acridotheres tristis</i>
Common pheasant/peihana*	<i>Phasianus colchicus</i>
Common redpoll*	<i>Carduelis flammea</i>
Common skink	<i>Oligosoma nigriplantare</i>
Common smelt	<i>Retropinna retropinna</i>
Common sole	<i>Pleuronchus novaezeelandiae</i>
Common starling*	<i>Sturnus vulgaris</i>
Dunnock*	<i>Prunella modularis</i>
Eurasian blackbird/manu pango*	<i>Turdus merula</i>
Eurasian skylark/kaireka*	<i>Alauda arvensis</i>
European goldfinch*	<i>Carduelis carduelis</i>
Fanworm*	<i>Ficopomatus enigmaticus</i>
Far-eastern curlew*	<i>Numenius madagascariensis</i>
Garfish	<i>Hyporhamphus ihi</i>
Green chiton	<i>Chiton glaucus</i>
Grey duck/pārera	<i>Anas superciliosa</i>
Grey mullet	<i>Mugil cephalus</i>
Grey teal/tētē moroiti	<i>Anas gracilis</i>
Grey warbler/riroriro	<i>Gerygone igata</i>

Greylag goose/kuihi*	<i>Anser anser</i>
Grey-tailed tattler	<i>Tringa brevipes</i>
Gurnard/puwahaiau	<i>Chelidonichthys kumu</i>
Hornshell	<i>Zeacumantus lutulentus</i>
House sparrow/ tiu*	<i>Passer domesticus</i>
Inanga (and juveniles= whitebait)	<i>Galaxius maculatus</i>
Kahawai	<i>Arripis trutta</i>
Kererū	<i>Hemiphaga novaeseelandiae</i>
Kingfish/Kahu	<i>Seriola grandis</i>
Lesser knot/huahou	<i>Calidris canutus</i>
Little black shag/kawau tūi	<i>Phalacrocorax sulcirostris</i>
Little egret	<i>Egretta garzetta</i>
Little penguin	<i>Eudyptula minor</i>
Little shag/kawau paka	<i>Phalacrocorax melanoleucos</i>
Little tern	<i>Sternula albifrons</i>
Long-finned eel/tuna	<i>Anguilla dieffenbachi</i>
Mallard duck*	<i>Anas platyrhynchos</i>
Marsh crane/koitareke	<i>Porzana pusilla</i>
Moki	<i>Latridopsis ciliaris</i>
Mudsnail	<i>Amphibola crenata</i>
Mute swan*	<i>Cygnus olor</i>
New Zealand dabchick/weweia	<i>Poliiocephalus rufopectus</i>
New Zealand fantail/pīwakawaka	<i>Rhipidura fuliginosa</i>
New Zealand pigeon/kererū	<i>Hemiphaga novaeseelandiae</i>
New Zealand scaup/pāpango	<i>Aythya novaeseelandiae</i>
Pacific golden plover	<i>Pluvialis fulva</i>
Paradise shelduck/pūtangitangi	<i>Tadorna variegata</i>
Parore	<i>Girella tricuspidata</i>
Pied stilt/poaka	<i>Himantopus himantopus</i>
Pectoral Sandpiper	<i>Calidris melanotos</i>
Pipi	<i>Paphies australis</i>
Pukeko	<i>Porphyrio melanotus</i>
Red cod/hoka	<i>Physiculus bachus</i>
Red-billed gull/tarāpunga	<i>Larus novaehollandiae</i>
Red-necked stint	<i>Calidris ruficollis</i>
Reef heron/matuku moana	<i>Egretta sacra</i>
River flounder	<i>Rhombosolea retiaria</i>
Rock pigeon*	<i>Columba livia</i>
Royal spoonbill/kōtuku ngutupapa	<i>Platalea regia</i>
Ruddy turnstone	<i>Arenaria interpres</i>
Sacred kingfisher/kōtare	<i>Todiramphus sanctus</i>
Sand flounder	<i>Rhombosolea plebia</i>
School shark/makohuarau	<i>Galeorhinus australis</i>
Sharp-tailed sandpiper	<i>Calidris acuminata</i>
Shining cuckoo/pipīwharauoa	<i>Chrysococcyx lucidus</i>

Short-finned eel/tuna	<i>Anguilla australis</i>
Silvereye/tauhou	<i>Zosterops lateralis</i>
Skate/uku	<i>Raja</i> spp.
Snapper/tamure	<i>Chrysophrys auratus</i>
Song thrush*	<i>Turdus philomelos</i>
South Island pied oystercatcher/tōrea	<i>Haematopus finschi</i>
Spiny dogfish/pioke	<i>Squalus</i> Sppr.
Spotless crane/pūweto	<i>Porzana tabuensis</i>
Spotty	<i>Pseudolabrus celidotus</i>
Spur-winged plover	<i>Vanellus miles</i>
Stargazer/kourepoua	<i>Genyagnus monopterygius</i>
Swamp harrier/kāhu	<i>Circus approximans</i>
Topshell	<i>Melagraphis aethiops</i>
Trevally/araara	<i>Caranx lutescens</i>
Tūī	<i>Prothemadera novaeseelandiae</i>
Tunnelling mud crab/pāpaka	<i>Austrohelice crassa</i>
Variable oystercatcher/tōrea pango	<i>Haematopus unicolor</i>
Wedge clam/hanikura	<i>Macomona liliana</i>
Welcome swallow/warou	<i>Hirundo neoxena</i>
Whelk/kawari	<i>Cominella glandiformis</i>
Whimbrel	<i>Numenius phaeopus</i>
White heron/kōtuku	<i>Ardea modesta</i>
White-faced heron/matuku moana	<i>Egretta novaehollandiae</i>
White-fronted tern/tara	<i>Sterna striata</i>
Whitehead/pōpokatea	<i>Mohoua albigilla</i>
Wrybill/ngutuparore	<i>Anarhynchus frontalis</i>
Yellow-bellied flounder/pātiki	<i>Rhombosolea leporina</i>
Yellow-eyed mullet/awa	<i>Aldrichetta fosteri</i>
Yellowhammer*	<i>Emberiza citrinella</i>

Appendix 5: Methods for conducting terrestrial ecological restoration/reconstruction

The main aim of the following management recommendations is to increase indigenous vegetation cover, which would in turn increase habitat for indigenous fauna. These recommendations would benefit the majority of SNAs, whether natural or planted.

Planting and site management

To create indigenous ecosystems the initial step is to plant an area in early successional native species. Initial plantings to create forest in pasture landscapes should be made up of a mixture of species with an average spacing between plants of one metre. This density provides quick canopy closure and hence benefits seedling growth through weed suppression (Laughlin and Clarkson 2018). Some of the previous plantings in the Napier area have been at a lower density, which has resulted in extra effort for weed control and replanting.

All plants should be eco-sourced from a variety of remnant vegetation seed sources. The aim is to collect seeds from species growing on the same landform type. The closer the seed source is to the site the better. However, sourcing from a large number of individual plants is a greater priority than proximity to site (e.g. aim to collect seed from 100 individuals not two close-by individuals). For forest ecosystems the later successional plants should be planted 5 - 20 years after early successional plantings, once herbaceous weed cover is <10%, and microclimate conditions are suitable (Wallace et al. 2017; Laughlin and Clarkson 2018). Enrichment planting of these late successional species can ensure succession into a long-lived forest ecosystem and avoid risk of canopy collapse when early successional species senesce. Further information on forest restoration/reconstruction is available on the resources tab of the People, Cities & Nature website (<https://www.peoplecitiesnature.co.nz/resources>). For freshwater wetlands the Wetland Restoration handbook is a useful guide (Peters and Clarkson 2010).

The SNA survey indicated that some previously planted species are native to New Zealand but do not belong in the Napier area. Their presence reduces the ecological fitness of the other indigenous vegetation and diminishes opportunity to bring back the unique ecosystems representative of the Napier area. It is also important to retain dead wood and other fallen vegetation within the SNAs because it increases habitat complexity (e.g. introduces spaces for fauna nesting and habitat for insects) (Marzluff and Ewing 2001).

Fencing

The exclusion of livestock will reduce vegetation loss and increase biodiversity within SNA sites. It is important that current sites are protected from further degradation so that the next generation of forest can regenerate.

Weed removal

Environmental, exotic weeds compete with native plants for habitat and undermine ecological integrity of the site. Removing weeds with help to protect indigenous biodiversity within the SNA and reduce the spread of weeds around the district.

Pest control

Removal of possums and rats occurs at some of the SNAs. This should continue and potentially be expanded. These pests harm indigenous fauna (Innes et al. 2010; Johnstone MacLeod et al, 2015) and browse vegetation and fruit of indigenous flora. This reduces vegetation regeneration and the

food availability for birds and other native fauna (Overdyck et al. 2013; Johnstone MacLeod et al. 2015; Byrom et al. 2016). Pest control can involve trapping and poisons and should be done in consultation with NCC to make sure it is carried out safely and effectively. There may be a need to control exotic birds to increase the success of native birds. Control of some exotic birds within the Hawke's Bay region has occurred in the past e.g. rooks (Porter, Clapperton and Coleman 2010).

Reducing size of margins

Sites where the ratio of habitat edge to habitat interior area is high (such as narrow linear sites) have relatively high exposure to environmental and biotic disturbance. Habitats with a low edge to area ratio tend to have less weed invasion, better habitat microclimate conditions, are more ecologically rich and complex, and are easier to maintain. This translates that large square or circular sites are better than narrow linear ones (Young and Mitchell 1994).