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SIGNIFICANT NATURAL AREAS OF THE OTOROHANGA DISTRICT: TERRESTRIAL AND WETLAND ECOSYSTEMS

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ABSTRACT

Waikato Regional Council identifies and prioritises significant natural areas (SNA) as an important part of protecting natural areas, to maintain indigenous biodiversity and to safeguard the life-supporting capacity of ecosystems. This process is required under (Section 6(c) of RMA) to maintain and enhance biodiversity. This report provides the background and summary of a baseline inventory and ranking of SNA covering terrestrial (including islands and sand dunes) and wetland ecosystems in the Otorohanga District. The SNA inventory will provide a regional context for biodiversity assets and priority sites for management and monitoring. Nine hundred and fifty-five sites that potentially contained indigenous vegetation were identified in a desktop study of the Otorohanga District. Using a combination of aerial photographs, published and unpublished reports, and digital data from various agencies, these 955 potential sites were evaluated against the Waikato Regional Council significance criteria. Information collated on the sites included vegetation pattern, condition, and extent; the presence of Threatened or At Risk indigenous plant and animal species within a site; notable landforms or areas of historical significance, and; information on the management of the site including presence and impact of pest animal and pest plant species. Of the 955 sites evaluated, 512 sites covering *c.*58,050 hectares (ha) (28%) of the Otorohanga District were evaluated as meeting one or more of the Waikato Regional Council SNA criteria. Of the remaining 443 sites evaluated, 289 sites (covering *c.*3,656 ha) were identified as likely to meet one or more of the Waikato Regional Council criteria; forty-five sites (covering *c.*113 ha) did not meet any of the Waikato Regional Council criteria and were determined to be not significant. For the remaining 109 sites (covering *c.*619 ha), there was insufficient existing information to determine whether they met any Waikato Regional Council significance criteria.

Forty-three Threatened, At Risk, or notable animal species, one Threatened fungus species, and 42 Threatened, At Risk, or notable vascular plant species have been recorded in the Otorohanga District, although some of these records are historic and may not reflect current distributions. Threatened animal species recorded in the District include forest and wetland birds, bats, lizards, frogs, freshwater fish, and terrestrial invertebrates. Threatened plant species include small trees, shrubs, and herbs that occupy forest, scrub, shrubland, duneland, estuarine wetland, and freshwater wetland habitats. Opportunities for protection and enhancement of indigenous vegetation on private land are present throughout the Otorohanga District, but are concentrated in the Kawhia Ecological District and Waitomo Ecological District. Key unprotected SNA on private land that have high ecological function and biodiversity values have been identified for each ecological district in the report and opportunities for protection and enhancement of some of these areas have been identified.

EXECUTIVE SUMMARY

This report provides the background and summary of a baseline inventory and ranking of significant natural areas (SNA) of terrestrial (including islands and sand dunes) and wetland ecosystems in the Otorohanga District. The report accompanies an SNA data set that forms part of a comprehensive inventory of SNA throughout the Waikato Region. SNA that contain karst features are included in the current project, but rivers and lakes are being assessed as part of other projects and are being published in separate reports and data sets. Karst features will also be looked at separately in more detail. When complete, the full set of inventories will provide a regional context for biodiversity assets and priority sites for management and monitoring.

The Otorohanga District covers *c.*206,454 hectares (ha) of land spreading northwest and southeast from the township of Otorohanga. It extends from the margins of the Kawhia Harbour and Mount Pirongia in the north and west to the Waikato River and Barryville in the east and south. The Otorohanga District contains large parts of the Kawhia, Waipa, and Ranginui Ecological Districts (EDs), as well as smaller parts of the Pureora, Waitomo, and Tokoroa EDs. Ecological values within the Otorohanga District are described according to Ecological District.

Five hundred and twelve (512) SNA were identified within the Otorohanga District. These areas cover *c.*58,050 ha, or 28% of the District. Approximately 38,002 ha (*c.*65%) of SNA are protected, including DOC-administered lands, Otorohanga District reserves, QEII covenants, and Ngā Whenua Rāhui land management agreements. The remaining *c.*20,048 ha (35%) of SNA are located on private, unprotected lands.

Forty-three Threatened, At Risk, or notable animal species, one Threatened fungus species, and 42 Threatened, At Risk, or notable vascular plant species have been recorded in the Otorohanga District, although some of these records are historic and may not reflect current distributions. The numbers of Threatened and At Risk species listed in the report are based on the threat ranking documents that were current at the time of the initial study (Hitchmough *et al.* 2007 for invertebrates, fungi, and bats, Miskelly *et al.* 2008 for birds, de Lange *et al.* 2009 for vascular plants, Hitchmough *et al.* 2010 for reptiles, Newman *et al.* 2010 for frogs, and Allibone *et al.* 2010 for freshwater fish). The threatened species rankings have been updated to reflect the most recent threat rankings for each group of species[1] but the species records for the District have not been reassessed using the new threat rankings; therefore species that have changed ranking from not threatened to a threat ranking status between 2014 and 2018 will not be present within the lists of threatened and at risk species. Threatened animal species recorded in the District include forest and wetland birds, bats, lizards, frogs, freshwater fish, and terrestrial invertebrates. Threatened plant species include small trees, shrubs, and herbs that occupy forest, scrub, shrubland, duneland, estuarine wetland, and freshwater wetland habitats.

Of the 955 sites evaluated in this project, 512 sites (58,050 ha) are considered to meet the Waikato Regional Council criteria for significant indigenous vegetation or habitats of indigenous fauna. Important or large SNA are located on the Rangitoto Range and foothills, and in the hills to the south and west of Kawhia Harbour near the Otorohanga District boundary. Examples on the Rangitoto Range include Pureora Forest Park, Cowan Wildlife Refuge Reserve, and Waipa mires which, together with numerous other protected and unprotected areas, form a large, complex area of

[1] Threat rankings have been updated for all taxa within this report and follow the following threat classification publications: O'Donnell *et al.* 2018 for bats, Robertson *et al.* 2017 for birds, Goodman *et al.* 2014 for freshwater fish, Newman *et al.* 2013 for frogs, Hitchmough *et al.* 2007 for fungi, Mahlfeld *et al.* 2012 for gastropods, Buckley *et al.* 2012 for other invertebrates, de Lange *et al.* 2013 for vascular plants, and Hitchmough *et al.* 2016 for reptiles.

indigenous forest, scrub, and wetland spanning lowland, submontane, and montane bioclimatic zones. Examples on the hills to the southeast of Kawhia Harbour include the Hauturu Conservation Area, Awaroa Scenic Reserve, and Otuatakahi forest and limestone pinnacles. The areas of vegetation within the Hauturu and Awaroa SNA mentioned above, along with other protected and unprotected areas, form a large area of indigenous forest and scrub that extends beyond the Otorohanga District into the Waitomo District.

A further 289 sites (*c.*3,656 ha) were identified as likely to meet one or more of the Waikato Regional Council criteria. Forty-five sites (*c.*113 ha) were determined to be not significant. For the remaining 109 sites (*c.*619 ha), there was insufficient existing information to determine whether they met Waikato Regional Council significance criteria. Field assessment will be required to identify vegetation cover, determine habitat quality, and assess threats - such as development, fragmentation, pest species, surrounding land use, stock trespass, and drainage (for wetland sites) - in order to make an informed ecological evaluation of these sites.[1]

[1] The provisional "Significant Natural Areas of the Otorohanga District" data set described in this report was derived from analysis and interpretation of aerial photography and/or satellite imagery, along with relevant scientific reports and data (where available), local ecological knowledge, and limited field surveys. The data set is an extensive yet provisional inventory and ranking of SNA of terrestrial and wetland ecosystems of the Otorohanga District, and is subject to revision through consultation with the Otorohanga District Council or other appropriate sources. The Waikato Regional Council strongly advise that the data will be used only in conjunction with subsequent field surveys, especially if the data will be used to help with decisions on resource consents, the development of District Plan and Regional Plan schedules, or funding priorities. The data have been captured at scales of 1:10,000 or smaller and should not be used at greater scales (e.g. 1:5,000) without detailed field survey. The absence of an existing natural terrestrial or wetland ecosystem area from the "Significant Natural Areas of the Otorohanga District" data set does not imply that such an area is not, or cannot be considered, a significant natural area, a significant area of indigenous vegetation, or significant habitat for indigenous species. Such areas should be assessed when and if required.

1. INTRODUCTION

Waikato Regional Council has a statutory responsibility to manage, maintain, and enhance biodiversity in the Waikato Region. Consequently, a Significant Natural Areas (SNA) project has been in operation at Waikato Regional Council since 2006, the aim of which is to identify, rank, and determine the management requirements of sites of high biodiversity value in the Region. In 2003, Wildland Consultants was engaged to compile an inventory of the natural heritage of Otorohanga District and to identify sites known to be, or likely to be significant natural areas (Wildland Consultants 2003). The current project, started in 2014, updated the 2003 data set and was restricted to a desktop exercise undertaken by collating and assessing existing information. No field surveys were undertaken.

This natural heritage inventory of Otorohanga District has been derived from analysis and interpretation of aerial photography and/or satellite imagery, along with scientific reports and data (where available), and local ecological knowledge. The data set is an extensive yet provisional inventory and ranking of SNA in the Otorohanga District, and is subject to revision through consultation with the Otorohanga District Council or other local authorities. Waikato Regional Council strongly advise that the data be used only in conjunction with subsequent field assessments, especially if the data will be used to help with decisions on resource consents, or in the development of district and regional plan schedules, or funding priorities.

The absence of an existing natural area from this data set does not imply that such a site is not, or cannot be considered, a significant natural area, a significant area of indigenous vegetation, or significant habitat for indigenous species. Such areas should be assessed when and if required. The data have been captured at scales of 1:10,000 or broader and should not be used at finer scales (such as 1:5,000) without detailed field survey.

2. OBJECTIVES

1. To complete a literature review to update the natural heritage of the Otorohanga District as described in Wildland Consultants (2003), including an inventory of sites that are known or likely to be significant natural areas (SNA). The scope of the review includes freshwater wetlands, estuarine wetlands and terrestrial indigenous vegetation (including sand dunes) on public and private land. Significance is assessed using the 11 criteria in Appendix 3 of the previous Waikato Regional Policy Statement (RPS)[1]. Please note that at the start of this SNA assessment project, the RPS criteria were in a proposed state and became operative during the course of the project. Appendix II and III outline the two sets of RPS criteria which are practically the same, but more detail will be provided on this in section 3.4 below

   Each site known or likely to be an SNA is to be assessed against each of the 11 criteria and a determination made regarding which, if any, of the criteria are met, with appropriate justification and level of confidence.

[1] Criterion 3 of the significance assessment criteria was revised in 2009 by Wildland Consultants Ltd in consultation with Waikato Regional Council and with input from Kessels & Associates Ltd. The revised Criterion 3 was used in this project when assessing sites for significance (Appendix 2).

2. To rank all SNA sites of International, National or Regional significance using the Waikato Regional Council ecosystem ranking criteria as described in 'References and Keys for Scoring Ecosystems', EWDOCS #1663431.

3. METHODS

3.1 Introduction

This was a desk-top exercise and no field work was undertaken. The assessment was carried out using aerial photography and existing information sourced from reports, databases, and GIS layers provided by Waikato Regional Council.

3.2 GIS mapping and analysis

- A base Significant natural areas (SNA) data set was provided by the Waikato Regional Council for the identification of potential natural areas for review. This base data set was derived from a number of digital resources including the 2007 Biodiversity Vegetation GIS layer (BIOVEG 2007) and 2007 aerial photographs (WRAPS 2007) (see Appendix I for a detailed list of all data sets used).

- Indigenous vegetation polygons were identified and extracted from the Biodiversity Vegetation GIS layer.

- Terrestrial and wetland polygons, in most cases, were separated into different sites.

- The protection status of the identified areas of indigenous vegetation was determined, and the resultant layer formed the first version of the SNA layer, which was divided into protected and unprotected sites. Parts of legally protected areas that were not indigenous vegetation were excluded.

- Final geographic analyses for this report are based on pivot tables of raw data from a union of the following GIS data: SNA, the Biodiversity Vegetation layer, the LCDB2 layer (Ministry for the Environment 2004), the protected areas layers, the Otorohanga District boundary layer and the Ecological District layer.

3.3 Literature review and assessment of ecological information

A set of information sources of ecological information was compiled, which included published and unpublished reports, online data sets, GIS data sets, and hard copy data sets and files. Requests were sent out in February 2010 for information sources that were not already held. Some of the information sources were outdated, amalgamated, or inaccessible, or did not contain information relevant to the Otorohanga District. Details on the data sets were compiled and are presented in Appendix I. Other reports used are listed in the references list.

The numbers of Threatened and At Risk species listed in each Ecological District within the report are based on the threat ranking documents that were current at the time of the 2014 update of this project (Hitchmough *et al.* 2007 for invertebrates, fungi, and bats, Miskelly *et al.* 2008 for birds, de Lange *et al.* 2009 for vascular plants, Hitchmough *et al.* 2010 for reptiles, Newman *et al.* 2010 for frogs, and Allibone *et al.* 2010 for freshwater fish). The threat rankings for species within the 2014 report have been updated, where necessary, to

reflect current threat rankings but it was beyond the scope of the 2018 review to reassess all species records against new threat ranking literature[1]. Consequently, species present within the Otorohanga District which have moved from Not Threatened to a threat ranking between 2014 and 2018 have not been included within this report.

Ecological information was entered into a Master Spreadsheet in a systematic manner. Significance assessments were carried out for each site once all records on the site were compiled. If it was considered that site boundary changes needed to be made, then this sometimes required reorganising the ecological information.

3.4 Significance assessment and level of significance

Significance assessments were carried out according to the guidelines described in Waikato Regional Council and Wildland Consultants (2002), which are reproduced in Appendix II. This is a two-step process by which a site is first assessed to determine whether it is significant, and then if it is found to be significant, it is then assessed to determine its level of significance - Local, Regional, National, or International.

3.5 Ranking

Sites of International, National, or Regional significance were then further ranked against eight criteria including ecological values, vulnerability, and restoration potential, according to contract specifications and guidelines supplied by Waikato Regional Council in 'References and Keys for Scoring Ecosystems' (EWDOCS #-1663431).

3.6 Review and revision process

A draft of this report and the accompanying ranking spreadsheet and GIS layer was provided to the Waikato Regional Council and the Department of Conservation, Waikato Conservancy for comment. The Waikato Regional Council made some changes to the geometry of the GIS layer. Department of Conservation staff collaborated to produce comments, critiques, and valuable additional information on the draft of the report and data files. After Wildland Consultants had reviewed this feedback, a meeting was held between Wildlands, Waikato Regional Council, and Department of Conservation staff. All issues raised during the review process were resolved and addressed at this meeting, and the DOC review document was incorporated into the report, ranking spreadsheet, and GIS layer.

4. ECOLOGICAL CHARACTER OF THE OTOROHANGA DISTRICT

4.1 General overview

The Otorohanga District covers *c.*206,454 hectares (ha) of land spreading northwest and southeast from the township of Otorohanga between latitudes 38° and 38°30S. It extends from the margins of the Kawhia Harbour and Mount Pirongia in the north and west to the Waikato River and Barryville in the east and south. Otorohanga township lies at the

[1] Threat rankings have been updated for all taxa within this report and follow the following threat classification publications: O'Donnell *et al.* 2018 for bats, Robertson *et al.* 2017 for birds, Goodman *et al.* 2014 for freshwater fish, Newman *et al.* 2013 for frogs, Hitchmough *et al.* 2007 for fungi, Mahlfeld *et al.* 2012 for gastropods, Buckley *et al.* 2012 for other invertebrates, de Lange *et al.* 2013 for vascular plants, and Hitchmough *et al.* 2016 for reptiles.

approximate centre of the District within the Waipa Basin, which is characterised by flat to rolling hillcountry with some narrow valleys. The Waipa Basin merges with the heavily dissected Waikato Western Uplands and hills in the west, the rolling to steep Eastern Volcanic Uplands in the east, and the Hamilton Basin in the north (Edbrooke 2005).

The Otorohanga District includes parts of six ecological districts, which are located within four different ecological regions (Table 1 and Figure 1), and covers a wide range of physical and biological characteristics from coastal wetland and sand dunes on sedimentary sandstones and siltstones, to montane forest and shrubland on extinct volcanoes. Descriptions of key elements of each ecological district are provided in Sections 4.2-4.7 below.

Other than a relatively old Protected Natural Areas Programme (PNAP) report for the Tainui Ecological Region (Regnier and Clarkson 1988), there are no PNAP reports, or large scale ecological reports for any of the ecological districts within the Otorohanga District. Consequently, the information summarised below is largely based on McEwen (1987) and other relevant sources (see References).

Table 1: Areas of Ecological Districts (EDs) within the Otorohanga District (OD).

Ecological Region	Ecological District	Total Area (ha) of ED	Area (ha) of ED Within OD	% of ED Within OD
Tainui	Kawhia	130, 641	64, 338	49.25
Waikato	Waipa	69, 145	37, 474	54.20
King Country	Waitomo	162, 847	5, 318	3.27
Western Volcanic Plateau	Tokoroa	110, 183	140	0.13
	Ranginui	112, 543	71, 511	63.54
	Pureora	112, 800	21, 372	18.95

The Otorohanga District extends from coastal habitats, such as sand dunes and estuaries around the Kawhia and Aotea coastlines, to submontane and montane environments, and includes parts of the catchments of the Waipa River and Waikato River. The western Waikato Uplands and hills, and the Rangitoto Range span the lowland and submontane bioclimatic zones, and roughly divide the District into thirds. Montane environments are present on the highest points of Mount Pirongia (959 m a.s.l) and the Rangitoto Range (978 m a.s.l). However, the majority of the District lies within the lowland and submontane bioclimatic zones (61% and 31% of the District respectively)[1] (Table 2).

Table 2: Proportion of the Otorohanga District by bioclimatic zone.

Bioclimatic Zone	Area of District (ha)	% of District
Coastal	8, 244	4.0
Lowland	127, 945	61.2
Submontane	62, 889	30.5
Montane	971	0.5
No data	6, 404	3.1

[1] Bioclimatic zones are based on the broad distribution of vegetation along both altitudinal and coastal to inland gradients. This project uses the bioclimatic zone boundaries of Leathwick *et al.* (1995): Coastal: <300 m above sea level (a.s.l.) and <1 km from the coast; Lowland: 0-300 m a.s.l. (excluding coastal zone); Submontane: from 300-800 m a.s.l.; Montane: from 800-1,300 m a.s.l.; Subalpine: from 1,300-1,800 m a.s.l.; Alpine: >1,800 m a.s.l.

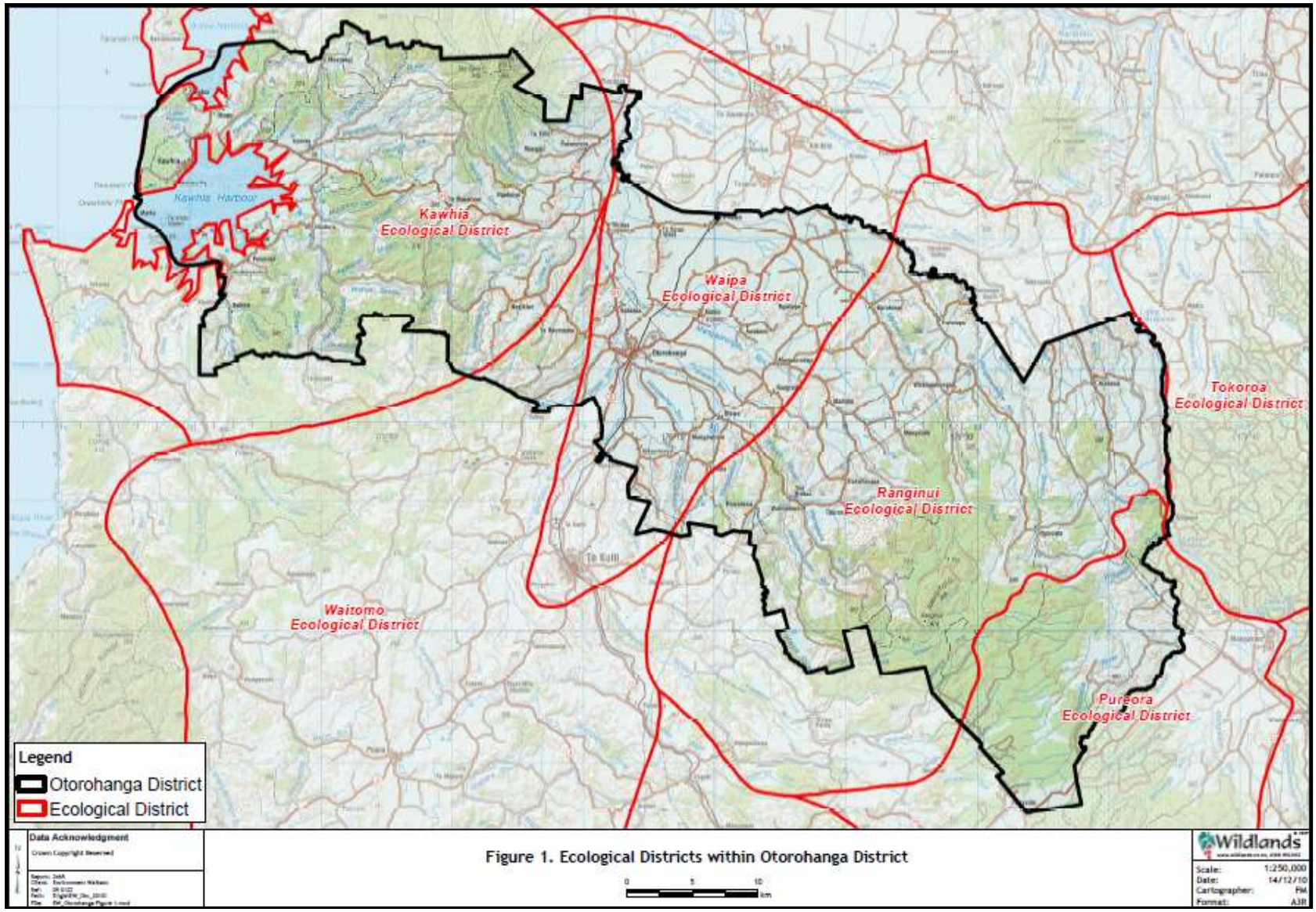

Figure 1. Ecological Districts within Otorohanga District

Mean annual rainfall for the District is 1,609 mm (mean annual range 1,205 mm to 2,250 mm), mean annual temperature is 12.3°C (mean annual range 10.6-13.6°C), with mean warmest month temperatures of 17-19°C (February) and mean coldest month temperatures of 5-8.5°C (July) (NIWA CliFlo database 2010).

Before European colonisation of New Zealand (*c.*1840), the Otorohanga District was almost entirely covered in indigenous vegetation: 70% of this was primary forest; 27% secondary forest, scrub and tussockland, 1.1% duneland habitat, and 1.4% wetland habitat (Leathwick *et al.* 1995). Since then, the combined effects of logging, land clearance, drainage, and fires have reduced indigenous vegetation cover in the District to approximately 28% of the 1840 extent (Leathwick *et al.* 1995). The most heavily reduced vegetation types are coastal, semi-coastal, and lowland forests, which have been widely cleared for farming.

The extent of primary forest has fared better than secondary vegetation, although the extent of both habitat types has been severely reduced within the District (primary and logged primary forest have been reduced from *c.*70% in 1840 to *c.*22% in 1995, and secondary habitats from *c.*27% to *c.*5%) (Leathwick *et al.*1995). Most sites containing these habitat types (as well as the largest, best quality examples), are confined to the submontane areas of the District. Only 183 ha (6.3% of 1840 extent) of freshwater wetland remains in the District and natural duneland habitat has been reduced to 1.8% of its 1840 extent (Leathwick *et al.* 1995).

The current vegetation of the Otorohanga District includes examples of coastal vegetation and habitats and semi-coastal, lowland, submontane, and montane forest. Coastal areas support salt marshes as well as dune vegetation, both of which extend into coastal forest dominated by kohekohe (*Dysoxylum spectabile*), pūriri (*Vitex lucens*), and nīkau (*Rhopalostylis sapida*). The coastal forest grades into semi-coastal and lowland forest that is dominated by tawa (*Beilschmiedia tawa*) with northern rātā (*Metrosideros robusta*) and stands of podocarp species common. Submontane forest is dominated by kāmahi (*Weinmannia racemosa*) and hīnau (*Elaeocarpus dentatus*), with locally common stands of rimu (*Dacrydium cupressinum*). Montane forest types are the rarest in this District, being restricted to the tops of the highest hills in the east. This forest type is dominated by kāmahi and tāwheowheo (*Quintinia serrata*), with miro (*Prumnopitys ferruginea*) and mountain toatoa (*Phyllocladus alpinus*) common. Lowland floodplain forest was once extensive in the river valleys, comprising dense kahikatea (*Dacrycarpus dacrydioides*) stands. The vast majority of this forest type has now been cleared for farmland. Several rare and endangered plant species occur in the District, such as the holoparasite *Dactylanthus taylorii* (pua o te reinga, wood rose) and *Veronica scopulorum* "Awaroa" (Awaroa hebe), which is found only on limestone cliffs and is endemic to the Otorohanga District.

Large parts of the forested habitats are protected as Department of Conservation (DOC) reserves. This includes all of the Pureora Conservation Area within the Otorohanga District, which receives extensive pest animal and pest plant control, and hence provides excellent habitat for a diverse range of forest bird species including the endangered kōkako (*Callaeas cinerea wilsoni*). Cave wētā (*Novoplectron serratum*) and other cave-dwelling invertebrates are found in the cave systems typical of the limestone karst country west of Otorohanga. Galaxiids and other fish species are present in many of the freshwater streams and rivers of the District, and the estuaries of Kawhia and Aotea Harbours are utilised by a wide range of estuarine and marine fauna including international migratory bird species such as the Eastern bar-tailed godwit (*Limosa lapponica baueri*).

4.2 Kawhia Ecological District

4.2.1 Overview

Total Area of Kawhia ED: *c.*130,641 ha
Area of ED within Otorohanga District: *c.*64,338 ha (49.25% of the ED)

The Kawhia Ecological District includes environments and habitats ranging from flooded coastal and estuarine valleys to lowland and montane hill country. Hillslopes vary between gentle rolling hills and broken, steep to moderately steep valleys associated with large streams. Extensive dune systems that reach a height of 140 m are present at the mouths of Aotea and Kawhia Harbours and continue along the southern coastline. Dune lakes, some of which are temporary, are present in the hollows of rear dunes that have not been planted in pine (Regnier and Clarkson 1988).

From north to south, the part of the ED that is within the Otorohanga District cuts a jagged line through Mount Pirongia and extends across steep to rolling hillcountry with numerous streams and valleys to just south of Te Koraha Station. At its eastern boundary, the boundary of the ED describes an arc southwest of Pirongia township to the end of Tapuae Road, and extends west over the western Waikato uplands and down to the Kawhia and Aotea Harbours.

4.2.2 Bioclimatic zones

Lowland habitat dominates the area of the Kawhia ED that is within the Otorohanga District, but the two large areas of this zone are bisected by the steep hills that connect Mount Pirongia and the Herangi Range. A convoluted band of coastal habitat follows the margins of Kawhia and Aotea Harbours, and this coastal influence affects some of the lowland habitat where the zones meet. This semi-coastal zone is marked by the southern limits of kauri (*Agathis australis*) on the western coast, at approximately 300 m a.s.l. at Te Kauri. A small area of montane habitat is present at the top of Mount Pirongia.

The ED has relatively warm, humid summers, and mild winters, with a strong westerly influence (average annual temperature 15.1°C; range 10.9°C-19.5°C) (McEwen 1987; NIWA CliFlo database 2010). Rainfall varies between 1,400 mm p.a. and 2,500 mm p.a. (McEwen 1987).

4.2.3 Geology and soils

The following information is derived entirely from McEwen (1987). Geologically, Kawhia ED is diverse, with large dune systems, inter-tidal flats, steep and deeply divided hill country, and two Pliocene basaltic and andesitic cones (Mount Pirongia and Mount Karioi) with lava flows extending from them. Surrounding the cones, the underlying geology is dominated by siltstone and sandstone from the Oligocene and Jurassic periods, Jurassic conglomerate, and areas of limestone. Pleistocene pumiceous alluvium and conglomerate occur near the coast and in the head of the Kawhia Harbour.

Hill and steepland soils are derived from siltstones, sandstones, conglomerates, basaltic and andesitic rocks which are, in the main, moderately deep and form a mosaic of weakly to moderately leached soils (dependent on the vegetation cover). Weathered, brown volcanic ash soils are present on easier country and are deep, well drained, and form a variably thick cover dependent on slope. Sand soils are present on the coastal dunes, ranging from unweathered sands, largely bare of vegetation near the coast, to those with well developed profiles in more consolidated dunes.

Large black sand dunes (titaniferous magentite) are present along the western edge of the ED between Kawhia Harbour and Aotea Harbour. Inter-tidal flats comprising the shallows of Kawhia and Aotea Harbours are comprised of undifferentiated fine silt (Kear 1960).

4.2.4 Vegetation

Prior to human settlement, almost the entire Ecological District would have been covered in tall podocarp-broadleaved species forest with dominant species composition varying with altitude. Small pockets of dense conifer forest would have occurred on poorly drained alluvial sites, and relatively large areas of duneland vegetation would have been present at the coast. Approximately 36% (*c.*46,555 ha) of the 1840 extent of indigenous vegetation remains (Leathwick *et al.* 1995), the majority of which is comprised of primary and logged primary indigenous forest (combined area of *c.*37,967 ha). The remainder of the ED is predominantly high producing exotic grassland (67,735 ha, *c.*53%) (Ministry for the Environment 2004).

The following vegetation description is largely based on Regnier and Clarkson (1988). The forest and scrub on Pirongia form the most extensive tract of forest in the Kawhia ED and much of the inland portions of the ED are still covered in indigenous vegetation, although this is highly modified in places. The blocks of forest that contribute to Pirongia Forest Park provide an indication of the original composition of the lowland, submontane and montane zones. Elsewhere in the District, indigenous vegetation is very patchy and modified, with vegetation on alluvial flats having largely been cleared, and sand dune communities having been highly modified.

Kawhia Harbour and Aotea Harbour have extensive tidal mudflats and sandflats with a generally narrow fringe of sedges and rushes. Areas of estuarine wetland are still present in the arms of the harbours and extensive sea grass communities are present on mid-tide flats. Sand dunes are extensive, but have been highly modified by exotic plants such as marram grass (*Ammophila arenaria*) and lupin (*Lupinus arboreus*) (fore- and mid-dunes), or converted to plantation forestry (rear dunes). Spinifex (*Spinifex sericeus*) is still dominant in places on the foredunes and some indigenous shrubland is present.

Coastal freshwater wetlands adjoin some of the estuarine communities forming regionally uncommon estuarine-freshwater-terrestrial sequences of indigenous vegetation. Other areas of freshwater wetland are commonly associated with the numerous streams that flow down from the Waikato uplands to the coast. These wetlands retain a high degree of naturalness, but the majority are modified to some degree.

Coastal and semi-coastal forest is present on the lower slopes of the hill country, and is dominated by secondary podocarp-broadleaved species forest dominated by kohekohe, with pūriri, karaka (*Corynocarpus laevigatus*), māhoe (*Melicytus ramiflorus* subsp. *ramiflorus*), nīkau, tawa and rewarewa (*Knightia excelsa*) also present, although some small remnants of the original vegetation remain. Further from the coast, and below 450 m altitude, the forest

is dominated by tawa with scattered rimu, northern rātā, and miro. Between 450 m and 600 m, kāmahi and tāwheowheo replace tawa as the main canopy species, and rimu, northern rātā, miro, tawa, and rewarewa become less common as altitude increases. Above 600 m, submontane and montane forest and shrubland is present. On Mount Pirongia, tāwari (*Ixerba brexioides*) is abundant, with kāmahi, tāwheowheo, and toro (*Myrsine salicina*) common. Montane vegetation comprises stunted forest of similar composition to that found in the submontane zone with montane shrubs such as *Dracophyllum traversii*, whaririki (*Phormium cookianum*), *Hebe* and *Coprosma* species present on exposed spurs and pinnacles. Small areas of subalpine herbs, shrubs and grasses are also associated with pinnacle or cliff sites within this zone (Clarkson 2002).

4.2.5 Flora

Twenty-six nationally Threatened or At Risk indigenous vascular plant and fungus species, three Regionally threatened or uncommon plant species, six plant species with distributional limits within or near Kawhia ED, and two other notable plant species have been recorded in the part of the Kawhia ED that is within the Otorohanga District (Tables 3, 4, and 5).

Table 3: Threatened, At Risk, and notable vascular plant species (as per de Lange *et al.* 2013) that have been recorded in the part of the Kawhia ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Ophioglossum petiolatum	Stalked adder's tongue	Nationally Critical
Utricularia australis	Yellow bladderwort	Nationally Critical
Centipeda minima subsp. *minima*	Sneezeweed	Nationally Endangered
Dactylanthus taylorii	Pua-o-te-reinga, wood rose	Nationally Vulnerable
Libertia peregrinans	New Zealand iris	Nationally Vulnerable
Pimelea tomentosa	Native daphne	Nationally Vulnerable
Rorippa divaricata	New Zealand water cress	Nationally Vulnerable
Brachyglottis kirkii var. *kirkii*	Kirk's daisy	Declining
Cyclosorus interruptus		Declining
Euphorbia glauca	Shore spurge	Declining
Peraxilla colensoi	Scarlet mistletoe	Declining
Peraxilla tetrapetala	Red mistletoe	Declining
Pimelea villosa	Sand daphne	Declining
Poa billardierei	Sand tussock	Declining
Pterostylis paludosa	Swamp greenhood orchid	Declining
Ptisana salicina	King fern, para	Declining
Scandia rosifolia	Koheriki	Declining
Tupeia antarctica	White mistletoe	Declining
Ficinia spiralis	Pīngao	Declining
Bulbophyllum tuberculatum		Naturally Uncommon
Celmisia adamsii var. *rugulosa*		Naturally Uncommon
Veronica scopulorum 'Awaroa'		Naturally Uncommon
Korthalsella salicornioides	Leafless mistletoe	Naturally Uncommon
Pomaderris rugosa		Naturally Uncommon
Thismia rodwayi		Naturally Uncommon
Ranunculus macropus		Data Deficient
Mazus sp. aff. *pumilio*		Vagrant

Veronica scopulorum 'Awaroa' is endemic to the Waikato Region and is only known from half a dozen limestone outcrops in the head waters of the Awaroa River and northern

Taumatatotara Range (Brandon *et al.* 2004). *Ophioglossum petiolatum* is very uncommon in the Waikato Region, only recently being recorded from the Kawhia area and the Huntly Basin (Brandon *et al.* 2004).

Libertia peregrinans and *Centipeda minima* subsp. *minima* have not been recorded in the ED since the 1980s and may no longer be present at the recorded locations[1].

Kauri, mairehou (*Leionema nudum*), and māmāngi (*Coprosma arborea*) attain southern limits within the Kawhia ED. Tāwari, mangrove (*Avicennia marina* subsp. *australasica*), and *Coprosma spathulata* occur at their southern limits on the west of the North Island.

Table 4: Regionally threatened or uncommon vascular plant species (as per de Lange *et al.* 2001) that have been recorded in the part of the Kawhia ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Syzygium maire	Swamp maire, maire tawake	Regionally threatened
Asplenium lyallii	Lyall's spleenwort	Regionally uncommon
Asplenium trichomanes subsp. *trichomanes*		Regionally uncommon
Agathis australis	Kauri	Southern limit at Kawhia
Avicennia marina subsp. *australasica*	Mangrove	Near southern limit
Coprosma arborea	Māmāngi	Southern New Zealand limit (Regnier and Clarkson 1988)
Coprosma spathulata		Southern New Zealand limit (Regnier and Clarkson 1988)
Ixerba brexioides	Tāwari	Southern New Zealand limit (Regnier and Clarkson 1988)
Leionema nudum	Mairehau	Southern New Zealand limit (Regnier and Clarkson 1988)

Table 5: Threatened or At Risk indigenous fungus species (as per Hitchmough *et al.* 2007) that have been recorded in the part of the Kawhia ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Ganoderma sp. 'Awaroa'[1]	Pukatea bracket fungus	Nationally Critical

[1] Last seen 1972; could be extinct.

4.2.6 Fauna

Forty Threatened or At Risk indigenous fauna species have been recorded from the part of Kawhia ED that is within the Otorohanga District. This total comprises 29 bird species, six freshwater species, two herpetofauna species, one mammal, and two terrestrial invertebrate species (Table 6).

[1] Though *Juncus holoschoenus* var. *holoschoenus* has been recorded in the Kawhia ED, critical comparison of herbarium specimens has shown that most records are based on *J. holoschoenus* var. *multiflorus* (NZPCN 2010). Consequently, the records of this species at localities within the Kawhia ED require validation. Additionally, the vagrant species *Mazus* sp. aff. *pumilio* has often been confused with *M. novaezelandiae* (NZPCN 2010).

Table 6: Threatened or At Risk fauna species that have been recorded in the part of the Kawhia ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Birds (as per Robertson *et al.* 2017)		
Anas superciliosa superciliosa[1]	Pārera, grey duck	Nationally Critical
Botaurus poiciloptilus	Matuku, Australasian bittern	Nationally Critical
Himantopus novaezelandiae	Kakī, black stilt	Nationally Critical
Chlidonias albostriatus	Black-fronted tern	Nationally Endangered
Anarhynchus frontalis	Ngutuparore, wrybill	Nationally Vulnerable
Charadrius bicinctus bicinctus	Banded dotterel	Nationally Vulnerable
Egretta sacra sacra	Matuku-moana, reef heron	Nationally Vulnerable
Hydroprogne caspia	Taranui, Caspian tern	Nationally Vulnerable
Hymenolaimus malacorhynchos	Whio, blue duck	Nationally Vulnerable
Acanthisitta chloris granti	Tītipounamu, North Island rifleman	Declining
Anthus novaeseelandiae novaeseelandiae	Pīhoihoi, New Zealand pipit	Declining
Apteryx mantelli	North Island brown kiwi	Declining
Bowdleria punctata vealeae	North Island fernbird	Declining
Gallirallus philippensis assimilis	Banded rail	Declining
Haematopus finschi	Tōrea, New Zealand pied oystercatcher	Declining
Larus novaehollandiae scopulinus	Tarāpunga, red-billed gull	Declining
Limosa lapponica baueri	Eastern bar-tailed godwit	Declining
Porzana tabuensis tabuensis	Pūweto, spotless crake	Declining
Sterna striata striata	White-fronted tern	Declining
Anas chlorotis "North Island"	Pāteke, brown teal	Recovering
Callaeas wilsoni	North Island kōkako	Recovering
Charadrius obscurus aquilonius	Northern New Zealand dotterel	Recovering
Falco novaeseelandiae ferox	Bush falcon	Recovering
Nestor meridionalis septentrionalis	North Island kākā	Recovering
Phalacrocorax varius varius	Pied shag	Recovering
Poliocephalus rufopectus	Weweia, New Zealand dabchick	Recovering
Eudynamys taitensis	Koekoeā, long-tailed cuckoo	Naturally Uncommon
Phalacrocorax carbo novaehollandiae	Black shag	Naturally Uncommon
Platalea regia	Royal spoonbill	Naturally Uncommon
Freshwater Fish Species (as per Goodman *et al.* 2014)		
Galaxias postvectis	Shortjaw kōkopu	Nationally Vulnerable
Geotria australis	Lamprey	Nationally Vulnerable
Anguilla dieffenbachii	Tuna, longfin eel	Declining
Galaxias brevipinnis	Kōaro	Declining
Galaxias maculatus	Inanga	Declining
Gobiomorphus huttoni	Redfin bully	Declining
Herpetofauna Species (as per Hitchmough *et al.* 2016 (reptiles) and Newman *et al.* 2013 (frogs))		
Leiopelma hochstetteri	Hochstetter's frog	Declining
Naultinus elegans elegans	Auckland green gecko	Declining
Bat Species (as per O'Donnell *et al. 2018*)		
Chalinolobus tuberculata	North Island long-tailed bat	Nationally Critical

[1] No recent records of this species within the Otorohanga District. Grey duck may be locally extinct due to hybridisation with mallards but further research and testing is required to confirm.

Scientific Name	Common Name	Threat Status
Terrestrial Invertebrate Species (as per Mahlfeld *et al.* 2012 (Gastropods) and Buckley *et al.* 2012 (other invertebrates))		
Rhytida greenwoodi webbi	Greenwood's snail	Nationally Critical
Peripatoides suteri[1]	Peripatus, ngāokeoke	

4.2.7 Protected significant natural areas

Approximately 9,294 ha (15%) of the part of Kawhia ED which is in Otorohanga District is administered by DOC. Another 165 ha (0.3%) is protected under QEII Covenants, and 1,451 ha (2.3%) is protected under Ngā Whenua Rāhui Land Management Agreement. Approximately 175 ha (0.3%) is protected in Otorohanga District reserves.

Within the part of Kawhia ED in Otorohanga District, extensive protected areas are present on steep to undulating hillcountry along a roughly northeast-southwest orientation between Mount Pirongia and Te Koraha. The largest (and/or most significant) sites are OT0100 - Pirongia Forest Park (Part) (4,404.71 ha; Nationally Significant), OT0744 - Te Kauri Park Scenic Reserve (985.85 ha; Nationally Significant), OT0746 - Te Rauamoa Block (Part)- Pirongia Forest Park (1,835.09 ha; Nationally Significant), OT0920 - Awaroa Scenic Reserve (692.84 ha; Nationally Significant), OT0920j - Hauturu Conservation Area (East block) (238.57 ha; Nationally Significant), and OT0921n - Hauturu Conservation Area (West block) (387.50 ha; Nationally Significant).

These areas form a substantial part of the Karioi-Herangi forest sequence (Department of Conservation 2008), a regionally significant, almost continuous ecological corridor of public and private land that extends from near Mahoenui north towards the volcanic cones of Pirongia Forest Park and out to the coast at Mount Karioi. These sites all contain primary and logged primary podocarp-broadleaved species forest, provide important habitat to Threatened and At Risk flora and fauna, and provide catchment protection to the Kawhia Harbour. Many support multiple vegetation assemblages (including regionally and nationally significant vegetation types), span multiple bioclimatic zones, and include historically rare ecosystems (e.g. karst).

Te Kauri Park Scenic Reserve comprises kauri, podocarp, and broadleaved species forest, with kauri forest close to its southern distributional limit. Te Kauri Park Scenic Reserve also includes a good example of a wetland system, and a selection of threatened plants. Pirongia Forest Park is an important site for the conservation of *Dactylanthus taylorii.* Awaroa Scenic Reserve and Hauturu Conservation Area are important sites for the conservation of the Waikato endemic plant species, *Veronica scopulorum*. Forest habitat within Hauturu Conservation Area also provides an important buffer for Lake Koraha, a priority wetland ecosystem and lake. Scenic Reserves around the Kawhia Harbour contain intact sequences from estuary to terrestrial habitats and karst formations, and provide habitat for regionally and nationally threatened species.

Other significant protected areas in the Kawhai Ecological District include OT0921 - Te Toi Bush (1462.01 ha; Regionally Significant), OT0921h - Te Toi Stream forest (914.96 ha;

[1] Not formally listed as indeterminate in the most recent New Zealand Threat Classification listings but remains listed as a Vulnerable species on the IUCN red list. The latest New Zealand threat ranking publication for terrestrial invertebrates notes that this species is locally abundant and is likely to be a genetic polymorphism with an extra pair of legs, and is probably a synonym of *P. novaezealndiae* (not threatened). Oliveira *et al.* 2012 notes that his species recquires revision.

Regionally Significant, unprotected), and OT1000 - Oparau Kawenata (146.17 ha; Nationally Significant). Te Toi Bush and Te Toi Stream forest represent the largest area of privately-owned forest in the District. Oparau Kawenata includes a large estuarine and freshwater wetland complex on the Tiritirimatangi Peninsula of Kawhia Harbour. It supports a mosaic of vegetation and habitat types, including under-represented estuarine wetlands and, with hundreds of individuals of Threatened and At Risk indigenous bird species having been observed at this site, it is likely to play an important role in maintaining populations of some of these species in the Kawhia ED and the Waikato Region.

4.2.8 Other key significant natural areas

There are more than 200 SNA within the Kawhia ED that are not legally protected. Like the protected significant natural areas, the majority of these are located on the hills and ranges between the Herangi Range and Mount Pirongia. However, there are also a number of sites around the Kawhia Harbour that provide important habitat for Threatened and At Risk species, buffer the internationally significant harbour from surrounding land uses, and contribute to the biodiversity of the Waikato Region.

For example Lake Parangi and Shrubland (Regionally Significant) comprises a relatively large natural dune lake with areas of reed swamp and a narrow band of indigenous vegetation encircling most of the lake. Natural dune lake habitat is nationally uncommon and this lake is considered to be a representative example of its type. It also provides habitat for Threatened and At Risk flora and fauna species, and has been identified as an important roost site for black shag and little shag, and a breeding site for little shag.

Otuatakahi Forest and Limestone Pinnacles (Nationally Significant) supports indigenous forest, areas of cliff face shrublands and herbfields, and contains the distinctive limestone pinnacles Ngawhakatara (The Lady), Hauturukanekeneke (The Dome), and Otuatakahi (Knob Head). It also provides habitat for a Waikato endemic plant species (*Veronica scopulorum*) and several other Threatened and At Risk indigenous species. In addition, several indigenous plant species reach distributional limits in or around this site.

Several privately-owned areas of forest that are contiguous with Pureora Forest Park are complementary to the Park, for example - Tauraroa forest, Puniu River submontane forest, Tolley Road-Pureora Forest Outlier A, and Pureora Forest Park-Waipapa River Extension shrubland and forest margin. These areas provide additional habitat for the Threatened and At Risk species present within Pureora Forest Park and provide a protective buffer to the Park.

Sites OT0919 (unnamed; Regionally Significant) and Ngahuinga Stream wetland (Regionally Significant) in the Awaroa Valley area provide habitat for the regionally endemic *Veronica scopulorum*. The Rakaunui Peninsula Karst Lakes (Regionally Significant) contain lakeshore turf and herbfield and include ephemeral ponds and lakes overlying limestone.

Lake Road Wetland A (Nationally Significant) comprises a coastal, freshwater wetland that provides habitat for Threatened and At Risk fauna and flora, and forms part of a regionally uncommon terrestrial shrubland-freshwater wetland ecological sequence.

The southern-most natural kauri occurs in Te Awaiti Stream forest (Regionally Significant).

Other high value unprotected SNA within the ED include Awaroa River Block (Regionally Significant), Ahititi forest and shrubland (Regionally Significant), Awaroa River valley forest

(Regionally Significant), Pirorua Stream forest (Regionally Significant), Raglan Road Forest (Regionally Significant), Kawhia coastline dunes (Regionally Significant), Mangakotukutuku Stream Forest (Regionally Significant), Te Kauri Shrubland and Forest Extension A (Regionally Significant), and Pukerau Bush (ha; Regionally Significant).

4.3 Waipa Ecological District

4.3.1 Overview

Total Area of Waipa ED: *c.*69,145 ha
Area of ED Within Otorohanga District: *c.*37,474 ha (54.20% of the ED)

The Waipa Ecological District is roughly triangular, and covers the inland basin of the Waipa River, at the southern extension of the Waipa Graben. It lies entirely within the lowland bioclimatic zone and is located between karst hill country to the west and higher altitude volcanic plateau country to the southeast. The topographic relief of the ED is predominantly flat with gently rolling hillslopes to the south, east, and west of Otorohanga township.

The central part of the ED is located within the Otorohanga District and extends from Te Kawa in the north to Puketawai trig in the south, from just east of Te Raumauku in the west to just east of Waikeria, and includes the township of Otorohanga.

4.3.2 Bioclimatic zones

The part of Waipa ED that is within the Otorohanga District is entirely within the lowland bioclimatic zone, ranging from *c.*40 m to *c.*230 m a.s.l. It experiences warm summers, and relatively cool winters (average annual temperature 13.5°C; range 8.4°C-18.7°C) (NIWA CliFlo database 2010), and rainfall varies between 1,100 mm p.a. and 1,500 mm p.a. (McEwen 1987).

4.3.3 Geology and soils

The area of Waipa ED within Otorohanga District consists mostly of the Waipa River floodplain, with low-lying hills in the south, east, and west. Most soils are silt loams of alluvial floodplain origin, although clay loams are found on the hills and peat loams in the former peat bogs. Pumice alluvium forms most of the substrate of the alluvial terraces and floodplains, with local peat soils (Kear 1960). Small areas of sandstone mostly occur between 50 m a.s.l and 400 m a.s.l. in the south, east, and west.

4.3.4 Vegetation

Prior to European colonisation (*c.*1840), the Waipa ED supported extensive areas of secondary vegetation on alluvium dominated by kahikatea, flax, and mānuka, as well as extensive wetlands along the river margins and smaller areas of podocarp-broadleaved species forest on the gentle hillslopes in the south (Leathwick *et al.* 1995). However, the Waipa ED has suffered from drastic clearance of indigenous vegetation with just 1.1% (*c.*768 ha) of the 1840 extent remaining (Leathwick *et al.* 1995). This vegetation is principally comprised of scattered remnants of logged primary and secondary tawa forest with occasional podocarps, and small stands of kahikatea within a landscape dominated by high producing exotic grassland (64,459 ha; *c.*93%) (Ministry for the Environment 2004).

Wetland vegetation has largely disappeared, and what does remain is a mixture of indigenous and exotic species. Exotic specimen trees are scattered across the agricultural land.

4.3.5 Flora

There are no records of Threatened, At Risk, regionally uncommon, or otherwise notable plant species from the part of the Waipa ED that is within the Otorohanga District. This reflects the extensive loss of indigenous vegetation cover. However, the absence of records does not necessarily indicate the absence of such species.

4.3.6 Fauna

Three Threatened and At Risk indigenous fauna species have been recorded in the part of Waipa ED that is within the Otorohanga District. The records comprise one bird species, one freshwater fish species, and one bat species (Table 7).

Table 7: Threatened or At Risk fauna that have been recorded in the part of the Waipa ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Bird Species (as per Robertson *et al. 2017)*		
Falco novaeseelandiae ferox	Bush falcon	Recovering
Freshwater Fish Species (as per Goodman *et al.* 2014)		
Anguilla dieffenbachii	tuna, longfin eel	Declining
Mammal Species (as per O'Donnell *et al.* 2018)		
Chalinolobus tuberculata	North Island long-tailed bat	Nationally Critical

Although the NI long-tailed bat has been recorded from one site in the ED, this record has not been confirmed.

4.3.7 Protected significant natural areas

Approximately 8 ha (0.02%) of the part of Waipa ED which is in Otorohanga District is administered by DOC. Another 16 ha (0.04%) is protected under QEII Covenants, and 0.4 ha (<0.01%) is protected in Otorohanga District reserves. There are no Ngā Whenua Rāhui Land Management Agreements within the part of the Waipa ED within the Otorohanga District.

Protected areas within the part of Waipa ED in Otorohanga District comprise four small, isolated areas of forest and shrubland totalling 19.56 ha (OT0334 - Mangamahoe Road Scenic Reserve, 8.35 ha, Regionally significant; OT0785 - Otorohanga protected Forest Fragment, 6.3 ha, Locally significant; OT0785b - Otorohanga Protected Forest Buffer B, 0.82 ha, Locally significant; and OT0845 - Waipa River Protected Kahikatea Forest Remnants, 4.09 ha; Regionally Significant), and one small wetland (OT0371 - Bush Road Protected Wetland, 4.49 ha; Locally significant).

Due to the drastic, historic clearance of indigenous vegetation in the Waipa ED (*c.*1.1% of the 1840 extent remains; Leathwick *et al.* 1995), these sites are significant simply by virtue of containing indigenous vegetation. However, SNA OT0845 - Waipa River Protected Kahikatea Forest Remnants also provides habitat for Threatened fauna (long-tailed bat and NZ bush falcon).

4.3.8 Other key significant natural areas

Seventy-five percent of the natural areas within the part of Waipa ED that lies in the Otorohanga District are not protected. However, there are no large natural areas that lie solely within the ED and there is little reliable information on biodiversity values of the sites that are present.

Mangawhero Road Remnants and Hangatiki Kahikatea Remnants, although comprised of multiple small forest remnants, are important sites for the continued presence of kahikatea within the Waipa ED. Otorohanga protected forest buffer A provides an important buffer to a regionally significant site and includes wetland habitat (reduced to *c.*0.3% in the Waipa ED). Waipa River-Otorohanga Wetlands provide a limited buffer to the Waipa River and may provide habitat for At Risk indigenous species.

4.4 Ranginui Ecological District

4.4.1 Overview

Total Area of Ranginui ED: *c.*112,543 ha
Area of ED Within Otorohanga District: *c.*71,511 ha (63.54% of the ED)

The Ranginui ED covers the hill country of the upper Waipa River catchment and includes lowland alluvial plains and rolling hills in the north and west of the District that rise steeply into the Rangitoto Range in the southwest. The ED stretches from Puniu River in the north to the Mangatutu Ecological Area in the south and spans the area between the Waipa River Basin to the west and the Waikato River to the east.

The part of the ED that is within the Otorohanga District is roughly delineated in the north by the Puniu River, while in the south it roughly follows the Waipa River from near Pururu. The Waikato River between Lake Arapuni and Lake Waipapa forms the eastern border of the ED and the western border passes through farmland between Rangiatea and Maihiihi.

4.4.2 Bioclimatic zones

The Ranginui ED spans three bioclimatic zones: lowland, submontane, and montane. Submontane habitat dominates the area of the ED that is within the Otorohanga District, with the lowland zone principally found in the north and west of the District, although small areas of lowland habitat are present alongside the Waikato River. The montane zone is only represented on the highest tops of the Rangitoto Range in the southeast.

The ED has a generally mild climate in the northwest with a westerly influence, and is cooler in the southeast with frequent frosts. Rainfall varies between 1,500 mm p.a. and 2,000 mm p.a. (McEwen 1987).

4.4.3 Geology and soils

The Ranginui ED comprises rolling to hilly ignimbrite country to about 600 m a.s.l., which rises steeply to the Rangitoto Range (high point of 978 m), which is comprised of Jurassic greywacke and argillite (McEwen 1987). The hill country is dissected by streams and rivers, forming moderate slopes that are prone to erosion. Small areas of pumiceous alluvial flats

are present in the northwest of the ED and are associated with major streams and rivers (Kear 1960).

Soils in the District are predominantly volcanic in origin over indurated sedimentary rocks and ignimbrite, and range from moderately leached to podzolised. Silty, brown, weathered ashes with a thin cover of younger Taupo rhyolitic ash are present in the northwest, while in the south, the Taupo ash thickens. Coarse textured pumice soils form thick deposits of pumiceous sands and gravels in river valleys (McEwen 1987).

4.4.4 Vegetation

Historically (*c.*1840) approximately 90% of the Ranginui ED would have been covered in primary indigenous species forest. The majority of this would have been characterised by rimu-tawa forest associations (*c.*95%), with areas of montane podocarp-broadleaved species forest at higher altitudes (Leathwick *et al.* 1995). Rimu-mataī-broadleaved species forest was reasonably extensive, particularly in the southeast on pumice soils, and dense podocarp forest would have been present at lower altitude sites on alluvial flats (Harding 1997).

Approximately 25% (*c*.27,681 ha) of the 1840 extent of indigenous vegetation remains today (Leathwick *et al.* 1995), the majority of which is comprised of primary and logged primary indigenous forest (combined area of *c.*23,120 ha) which is concentrated in the south-eastern sector on the Rangitoto Range. The remainder of the ED is predominantly covered in high producing exotic grassland (76,841 ha; *c.*69%) (Ministry for the Environment 2004). Although primary forest represents one of the larger indigenous habitat types remaining, it has none-the-less been reduced to *c.*26% of its original extent, with dense primary conifer forest in particular having been dramatically reduced in area (*c.*2.3% of 1840 extent remaining) (Leathwick *et al.* 1995).

4.4.5 Flora

Six Threatened or At Risk indigenous vascular plant species have been recorded in the part of the Ranginui ED that is within the Otorohanga District (Table 8)[1].

Table 8: Threatened or At Risk vascular plant species (as per de Lange *et al.* 2013) that have been recorded in the part of the Ranginui ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Dactylanthus taylorii	Pua-o-te-reinga, wood rose	Nationally Vulnerable
Pimelea tomentosa	Native daphne	Nationally Vulnerable
Myriophyllum robustum	Stout water milfoil	Declining
Pimelea villosa	Sand daphne	Declining
Prasophyllum hectorii	Swamp leek orchid	Declining
Ptisana salicina	King fern, para	Declining

4.4.6 Fauna

Nineteen Threatened or At Risk indigenous fauna species have been recorded from the part of Ranginui ED that is within the Otorohanga District. This is comprised of eleven bird

[1] Although *Juncus holoschoenus* var. *holoschoenus* has been recorded from the District, critical comparison of herbarium specimens has shown that most records (recent and historic) are based on *J. holoschoenus* var. *multiflorus* (NZPCN 2010). Consequently, the records of this species within the ED require validation.

species, two freshwater species, four herpetofauna species, and two bat species (Table 9). Although four threatened indigenous herpetofauna species have been recorded from this ED, three of these records are regarded as historical, and those species may no longer be present at the recorded sites.

Table 9: Threatened or At Risk fauna that have been recorded in the part of the Ranginui ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Bird Species (as per Robertson *et al.* 2017)		
Anas superciliosa superciliosa[1]	Pārera, grey duck	Nationally Critical
Hymenolaimus malachorhynchos	Whio, blue duck	Nationally Vulnerable
Apteryx mantelli	North Island brown kiwi	Declining
Bowdleria punctata vealeae	North Island fernbird	Declining
Callaeas wilsoni	North Island kōkako	Recovering
Falco novaeseelandiae ferox	Bush falcon	Recovering
Nestor meridionalis septentrionalis	North Island kākā	Recovering
Phalacrocorax varius varius	Pied shag	Recovering
Porzana tabuensis tabuensis	Pūweto, spotless crake	Relict
Eudynamys taitensis	Koekoeā, long-tailed cuckoo	Naturally Uncommon
Phalacrocorax carbo novaehollandiae	Black shag	Naturally Uncommon
Freshwater Fish Species (as per Goodman *et al.* 2014)		
Geotria australis	Lamprey	Nationally Vulnerable
Anguilla dieffenbachii	Tuna, longfin eel	Declining
Herpetofauna Species (as per Hitchmough *et al.* 2016 (reptiles) and Newman *et al.* 2013 (frogs))		
Leiopelma hochstetteri	Hochstetter's frog	Declining
*Naultinus elegans elegans**	Auckland green gecko	Declining
*Oligosoma ornatum**	Ornate skink	Declining
*Oligosoma striatum**	New Zealand striped skink	Declining
Mammal Species (as per O'Donnell *et al.* 2018)		
Chalinolobus tuberculata	North Island long-tailed bat	Nationally Vulnerable
Mystacina tuberculata rhyacobia	Central lesser short-tailed bat	Declining

* Historical record

4.4.7 Protected significant natural areas

Approximately 11,703 ha (16%) of Otorohanga District is administered by DOC. Another 1,529 ha (2%) is protected under QEII Covenants, and 670 ha (0.9%) is protected in Otorohanga District reserves. There are no Ngā Whenua Rāhui Land Management Agreements in the part of the Ranginui ED within the Otorohanga District.

Within the part of Ranginui ED which is in Otorohanga District, the majority of protected areas are located on the Rangitoto Range and to the northeast towards Arohena and the Waikato River. The most significant protected areas that lie solely within the Ranginui ED are sites OT0814.01 - Cowan Wildlife Refuge Reserve (1,283.69 ha), OT0814.02 - Pureora Protected Forest (763.06 ha), OT0814.73 - Pureora Forest Park-Waipapa River Extension, and OT0814.52 - Pururu Forest (189.86 ha). Cowan Wildlife Refuge Reserve forms part of an extensive tract of indigenous forest that includes the northern block of the greater Pureora

[1] No recent records of this species within the Otorohanga District. Grey duck may be locally extinct due to hybridisation with mallards but further research and testing is required to confirm.

Forest Park. The site supports logged primary rimu-tawa forest, several flora and fauna species that are classified as Threatened, At Risk, or regionally significant, and provides critical buffering and linkage functions for contiguous SNA.

Pureora Protected Forest is contiguous with the northern boundary of Cowan Wildlife Refuge and therefore also forms part of the extensive tract of indigenous forest that includes the northern block of the greater Pureora Forest Park. It comprises a range of vegetation types, including representative examples of montane and sub-montane forest. The site also supports several flora and fauna species classified as Threatened, At Risk, and regionally significant, and provides critical buffering and linkage functions for contiguous SNA. Pureora Forest Park-Waipapa River Extension is contiguous with the core Pureora Forest Park site (OT0814) and provides critical buffering and linkage functions for the core Pureora Forest Park site, including providing additional habitat for Threatened indigenous avifauna. Pururu forest comprises mixed podocarp-broadleaved species forest, provides habitat for both common and Threatened flora and fauna, and buffers several tributaries and sections of the Waipa River.

The largest area of conservation estate within the District (Pureora Forest Park-Waipapa River Extension (OT0814; 17,631 ha)) straddles the Ranginui and Pureora Ecological Districts. This site encompasses a range of vegetation types and ecological sequences including rimu-tawa forest, tawa forest, kahikatea forest, monoao (*Dracophyllum subulatum*) scrub, montane forest, and montane mires. Unmodified primary forest is also present within the site, and thirteen Threatened or At Risk species are known to be present within the site. Site OT0814 contains Waipapa Ecological Area which contains a nationally significant example of unlogged podocarp forest with associated shrublands and wetlands, and nationally important populations of North Island kōkako and North Island kākā. Site OT0814.72 - Pureora Forest Park-Waipapa River Extension provides critical buffering and linkage functions for the core Pureora Forest Park site (OT0814) and also straddles the Ranginui and Pureora Ecological Districts; this site links the core Pureora Forest Park site (OT0814) with the Lake Waipapa (a hydro lake).

OT0820 - Pureora Forest Park B (183.45 ha) and OT0823 - Pureora Forest Park (Wairehi Road outlier) (405.7 ha) are large blocks of forest not contiguous with Pureora Forest Park which by virtue of their size and history of pest control are likely to contain good populations of common forest birds.

4.4.8 Other key significant natural areas

Key significant natural areas are located on the slopes and foothills of the Rangitoto Range, and provide important continuation of habitat from the conservation estate. Tauraroa Forest is the largest of these and comprises submontane and lowland indigenous forest on the western slopes of Mount Rangitoto. The site provides habitat for At Risk fauna species, and is contiguous with a number of protected natural areas of regional and national significance. In combination with Mangatutu Ecological Area, this site provides habitat for the largest North Island kōkako population in the Waikato Region. Puniu River submontane forest comprises submontane forest, shrubland, and fernland on the northeastern foothills of the Rangitoto Ranges. The site provides an important buffer to the Puniu River and the northern section of Pureora Forest Park.

Tolley Road-Pureora Forest Outlier A comprises submontane forest and shrubland that provides a substantial buffer to the southeastern margin of Pureora Forest Park. The site is likely to support some of the Threatened and At Risk species present in the contiguous

protected area. Waipa River Forest Fragments A forms part of the corridor of vegetation extending northwest from the Rangitoto Range towards Otorohanga. The site comprises lowland forest and shrubland that provides an important buffer to Pururu Forest and likely provides additional habitat to the Threatened and At Risk species present within the aforementioned site.

4.5 Pureora Ecological District

4.5.1 Overview

Total Area of Pureora ED: *c.*112,800 ha
Area of ED Within Otorohanga District: *c.*21,372 ha (18.95% of the ED)

The Pureora Ecological District covers the eastern flank of the Hauhungaroa Range west of Lake Taupo, and the lower ignimbrite plateau country to the north (Harding 1997). It stretches from the Waikato River in the northeast to the end of the Hauhungaroa Range in the south, with the summit of the Hauhungaroa Range forming its eastern boundary, and the Ongarue River its western boundary. The District includes environments and habitats spanning three bioclimatic zones, which include lowland freshwater wetland and scrub, montane mires, and tall, scarcely modified, primary podocarp-broadleaved species forest.

The northern border of the ED is a convoluted line that trends southwest and begins just north of the Arapuni power station. The boundary winds through rolling to steep hill country south of Mangawhio Road near Ngaroma to the southeastern flanks of the Rangitoto Range where it cuts a convoluted, southward line across numerous headwaters of streams towards Pukeokahu. The southern and eastern boundaries of this part of the ED also form the southeastern boundary of the Otorohanga District, which runs roughly parallel with Waitaramoa Road to Barryville, follows the pasture/forest interface to the east of Barryville, then more or less follows the course of the Waiteti Stream to its confluence with the Waipapa River, and then follows the Waipapa River to its confluence with the Waikato River. This part of Pureora ED is the only catchment in Otorohanga District that drains directly into the Waikato River.

Extensive areas have been cleared for farmland or the establishment of exotic plantation forest. Nevertheless, there are still significant areas of indigenous forest of high ecological value, due to their relative intactness and the presence of various rare species, including birds, bats, and plants.

4.5.2 Bioclimatic zones

The part of Pureora ED within the Otorohanga District is dominated by submontane habitat but includes lowland habitat extending up river and stream valleys from the Waikato River in the east, and two small areas of montane habitat on the ridges that extend northeast of Pukeokahu (844 m a.s.l.).

The ED has a temperate, westerly influenced climate, with moderate summers and cool winters (average annual temperature 10.6°C; range 5.7°C-15.8°C) (NIWA CliFlo database 2010), although severe conditions can occur at higher altitudes, including occasional snow on Mount Pureora. Rainfall varies between 1,600 mm p.a. and 2,400 mm p.a. (McEwen 1987).

4.5.3 Geology and soils

The part of the ED that is within the Otorohanga District comprises ignimbrite from the Taupo eruption of 186 AD that overlies earlier flows. Hillslopes are characterised by steep-sided gullies eroded from the pumice substrate and deeper steep-sided river valleys that have been eroded through older ignimbrite layers. Sedimentary rock formations (siltstone and sandstone) are present in hill country to the north and west. Rolling hills in the north-east, adjacent to the Waikato River, are commonly dissected by small pumice washouts (Kear 1960).

The soils are mainly strongly leached and podzolised volcanic ash soils from thick deposits of coarse textured rhyolitic ash (Taupo) over older brown silty ashes. On steeper slopes, ash cover is thinner and more variable, lain over sedimentary rocks and ignimbrite. Coarse textured pumice soils from thick deposits of pumiceous sands and gravels occur in river valleys (McEwen 1987).

4.5.4 Vegetation

By 1840, secondary indigenous vegetation covered approximately half of the part of the Pureora ED located within the Waikato Region (Leathwick *et al.* 1995). This vegetation class was present on rhyolite plateaux, moderate to rolling hillslopes, and river valleys, and was dominated by silver tussock (*Poa cita*) with other native grasses common, and woody species such as pātōtara (*Leucopogon fraseri*) scattered throughout (Leathwick *et al.* 1995). Mānuka (*Leptospermum scoparium*) and monoao shrubland would go on to succeed this habitat as time since burning lapsed (Leathwick *et al.* 1995). Rimu-tawa forest covered approximately 25% of the ED (Leathwick *et al.* 1995), and was dominant on the hill country surrounding the Hauhangaroa Range, and in the northwest of the Ecological District (Harding 1997). Rimu-mataī-broadleaved species forest was also relatively common and was the dominant forest cover on the flanks of the Hauhungaroa Range and on the gentle country north of the range (Harding 1997). Smaller areas of dense podocarp forest were also present. The higher altitude parts of the range supported montane podocarp-broadleaved species forest, and monoao scrub and mire vegetation was present in frost-prone basins (Harding 1997).

Extensive areas of forest and shrubland habitat remain within Pureora District (indigenous vegetation covers approximately 49% of the entire ED (Ministry for the Environment 2004), which represents *c.*42% of 1840 extent (Leathwick *et al.* 1995)), but most forests have been modified to some extent by logging. Substantial areas were cleared for farming and exotic forest plantations, and these land uses currently cover *c.*27% and *c.*21% of the ED respectively (Ministry for the Environment 2004).

4.5.5 Flora

Four Threatened or At Risk indigenous vascular plant species have been recorded in the part of the Pureora Ecological District that is within the Otorohanga District (Table 10)[1].

[1] *Juncus holoschoenus* var. *holoschoenus* has been recorded in the ED, but critical comparison of herbarium specimens has shown that most records (recent and historic) are based on *J. holoschoenus* var. *multiflorus* (NZPCN 2010). Consequently, the records of this species within the ED require validation.

Table 10: Threatened or At Risk vascular plant species (as per de Lange *et al.* 2009) that have been recorded in the part of the Pureora ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Dactylanthus taylorii	Pua-o-te-reinga, wood rose	Nationally Vulnerable
Pimelea tomentosa	Native daphne	Nationally Vulnerable
Myriophyllum robustum	Stout water milfoil	Declining
Prasophyllum hectorii	Swamp leek orchid	Declining

4.5.6 Fauna

Fourteen Threatened or At Risk indigenous fauna species have been recorded in the part of Pureora ED that is within the Otorohanga District. This is comprised of seven bird species, one freshwater species, four herpetofauna species, and two bat species (Table 11). Although four threatened indigenous herpetofauna species have been recorded from the ED, three of these records are regarded as historical, and those species may no longer be present at the recorded sites.

Table 11: Threatened or At Risk fauna that have been recorded in the Pureora ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Bird Species (as per Robertson et al. 2017)		
Hymenolaimus malachorhynchos	Whio, blue duck	Nationally Vulnerable
Apteryx mantelli	North Island brown kiwi	Declining
Bowdleria punctata vealeae	North Island fernbird	Declining
Callaeas wilsoni	North Island kōkako	Recovering
Falco novaeseelandiae ferox	Bush falcon	Recovering
Nestor meridionalis septentrionalis	North Island kākā	Recovering
Eudynamys taitensis	Koekoeā, long-tailed cuckoo	Naturally Uncommon
Freshwater Fish Species (as per Goodman *et al.* 2014)		
Anguilla dieffenbachii	Tuna, longfin eel	Declining
Herpetofauna Species (as per Hitchmough *et al.* 2016 (reptiles) and Newman *et al.* 2013 (frogs))		
Leiopelma hochstetteri	Hochstetters frog	Declining
*Naultinus elegans elegans**	Auckland green gecko	Declining
*Oligosoma ornatum**	Ornate skink	Declining
*Oligosoma striatum**	New Zealand striped skink	Declining
Mammal Species (as per O'Donnell *et al*. 2018)		
Chalinolobus tuberculata	North Island long-tailed bat	Nationally Vulnerable
Mystacina tuberculata rhyacobia	Central lesser short-tailed bat	Declining

* Historic record.

4.5.7 Protected significant natural areas

Approximately 12,213 ha (57%) of the part of Pureora ED that is in Otorohanga District is administered by DOC. Another 15 ha (<0.1%) is protected under QEII Covenants, and 32 ha (0.2%) is protected in Otorohanga District reserves. There are no Ngā Whenua Rāhui Land Management Agreements within the part of Pureora ED within the Otorohanga District.

Site OT0814 - Pureora Forest Park-Waipapa River Extension (17,631 ha) comprises the largest area of conservation estate within the part of Pureora ED that lies within Otorohanga

District (it also extends into Ranginui Ecological District). This site encompasses a range of vegetation types and ecological sequences including rimu-tawa forest, tawa forest, kahikatea forest, montane forest, monao scrub, and includes unmodified primary forest and a podocarp forest-montane forest sequence. Thirteen Threatened or At Risk species are known to be present within the site including nationally significant populations of North Island kākā and North Island kōkako. North Island fernbird, Hochstetter's frog, *Myriophyllum robustum*, *Pimelea tomentosa*, occasional short-tailed bats, whio and reintroduced *Dactylanthus taylorii* are also present.

Located within site OT0814 are two large submontane mires (OT0814.07-Taparoa Mire Wetlands, 107 ha; and OT0814.07-Waipa Mires, 27 ha), both of which contain vegetation types that are uncommon within the Otorohanga District and provide habitat for Threatened and At Risk indigenous flora and fauna. Additionally, Waipa mires provide habitat for species near their distributional limit, and contain unusual mire-podocarp forest ecotone vegetation.

4.5.8 Other key significant natural areas

Three large unprotected natural areas that lie solely in the Pureora ED provide important buffers to the nationally significant OT0814-Pureora Forest Park-Waipapa River Extension. These sites are Waipapa Ecological Area Private Forest, Pureora Forest Park-Waipapa River Extension Shrubland and Forest Margin, and Pureora Forest Park Northern Forest Extensions. All three of the sites comprise indigenous species forest, scrub, and shrubland, are contiguous with Pureora Forest Park, and are likely to provide habitat for the Threatened and At Risk flora and fauna found in the contiguous conservation estate. However, detailed information on the vegetation and habitat types present within these sites is scarce and field survey is recommended.

Other key natural areas include several small forest remnants on the southern boundary of the District, which provide a fauna corridor between the northern and southern blocks of Pureora Forest Park: Scott Road forest and shrubland remnants B, Scott Road kahikatea forest, Pureora Forest Lodge shrubland remnant C, and Scott Road forest and shrubland remnant A.

4.6 Waitomo Ecological District

4.6.1 Overview

Total Area of Waitomo ED: *c.*162,847 ha
Area of ED Within Otorohanga District: *c.*5,318 ha (3.27% of the ED)

A small part of Waitomo ED lies in the Otorohanga District, bound to the south by the Otorohanga District boundary, which is a line running northwest/southeast approximately 10 km north of the Waitomo Caves, and coming to a sharp point near Tihiroa, northwest of Otorohanga. In the west, the ED boundary describes an arc from near Tihiroa, and runs roughly parallel with Turitea Road to the end of Tapuae Road. In the east, the ED boundary runs roughly parallel to and west of SH31 and then SH3 south of Otorohanga. The part of the ED in Otorohanga District comprises moderate to steep hill country with numerous streams, and includes the Te Raumauku Caves and a small part of the Waitomo Valley. Karst landscapes, created by erosion of the limestone substrate, are a dominant feature.

4.6.2 Bioclimatic zones

The entire Waitomo ED that is located within the Otorohanga District lies within the lowland bioclimatic zone, and ranges from *c.*60 m a.s.l. to 289 m a.s.l. The area has warm, humid summers and mild winters, with up to 2,800 mm annual rainfall (range: 1,500 mm p.a. to 2,800 mm p.a.) (McEwen 1987).

4.6.3 Geology and soils

The underlying geology of the ED within the Otorohanga District is siltstone, sandstone, and limestone, which has formed hills and valleys dissected by streams, with extensive cave and sinkhole systems. Karst formations have formed where discrete areas of limestone are eroding faster than their surroundings, producing sinkholes and rocky outcrops.

The soils are clay loams, typically with a basic pH, that have formed from sedimentary rocks. Soils from Tertiary siltstones, sandstones and limestones are mainly fertile, with some slip erosion. A mantle of ash is present in varying thickness depending on slope, with a thin layer on steep slopes to deep, well drained volcanic ash soils from older brown silty ashes on terraces and rolling lands. In areas that experience lower rainfalls and are covered with hardwood forest, soils are moderately leached. At higher altitudes and high rainfall where podocarps are more extensive, soils are strongly leached and podzolised (McEwen 1987).

4.6.4 Vegetation

Historically, this area was almost totally covered with rimu-tawa forest. Secondary indigenous vegetation, dominated by mānuka and/or kānuka with broadleaved indigenous species hardwoods such as whauwhaupaku and kōhūhū, were present in areas affected by burning by Māori (Leathwick *et al.* 1995). Approximately 19% (*c.*30,446 ha) of the 1840 extent of indigenous vegetation remains (Leathwick *et al.* 1995), the majority of which comprises logged primary indigenous forest (*c.*15,600ha). The remainder of the ED is predominantly covered in high producing exotic grassland (123,265 ha, *c.*71%) (Ministry for the Environment 2004).

Typically, the lowland forest of the ED supports tawa-dominated forest with emergent rimu and mangeao (*Litsea calicaris*), mataī (*Prumnopitys taxifolia*), miro, kāmahi, hīnau, northern rātā, and rewarewa as common canopy components. Near streams and on river flats, kahikatea and mataī are prominent, with pukatea (*Laurelia novae-zelandiae*) present where they are not subjected to temperature inversions, which allow frosts to form. Other species found in the valleys include lacebark (*Hoheria sexstylosa*), kōtukutuku (*Fuchsia excorticata*), patē (*Schefflera digitata*), and kanono (*Coprosma grandifolia*). Parataniwha (*Elatostema rugosum*) often cloaks wet stream banks, gully sides and seeps. Ongaonga (*Urtica ferox*) and taurepo (*Rhabdothamnus solandri*) are common, especially at the bottom of slopes (Clarkson 2002).

On cliffs and outcrops, taurepo is common, as are a range of ferns that includes the true 'limestone ferns' *Asplenium lyallii* and *A. trichomanes*. A third fern that is characteristic of limestone substrates is *Asplenium cimmeriorum*, which is found at cave entrances (Brownsey and de Lange 1997). Other species frequently found at cave entrances are parataniwha, hen and chicken fern (*Asplenium bulbiferum*), maidenhair fern (*Adiantum* sp.), patē, māhoe, and nīkau (Clarkson 2002).

4.6.5 Flora

One Threatened and one regionally uncommon indigenous vascular plant species have been recorded in the part of the Waitomo Ecological District that is within the Otorohanga District (Table 12 and Table 13).

Table 12: Threatened or At Risk vascular plant species (as per de Lange *et al.* 2009) that have been recorded in the part of the Waitomo ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Ptisana salicina	King fern, para	Declining

Table 13: Regionally threatened or uncommon vascular plant species (as per de Lange *et al.* 2001) that have been recorded in the part of the Waitomo ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Asplenium trichomanes subsp. *trichomanes*		Regionally uncommon

4.6.6 Fauna

Six Threatened or At Risk indigenous fauna species have been recorded in the part of the Waitomo ED that is within the Otorohanga District. This comprises four bird species, one freshwater species, and one bat species (Table 14).

Table 14: Threatened or At Risk fauna that have been recorded in the part of the Waitomo ED that is within the Otorohanga District.

Scientific Name	Common Name	Threat Status
Bird Species (as per Robertson *et al.* 2017)		
Gallirallus philippensis assimilis	Banded rail	Declining
Falco novaeseelandiae ferox	Bush falcon	Recovering
Nestor meridionalis septentrionalis	North Island kākā	Recovering
Porzana tabuensis plumbea	Pūweto, spotless crake	Relict
Freshwater Fish Species (as per Goodman *et al.* 2014)		
Anguilla dieffenbachii	Tuna, longfin eel	Declining
Mammal Species (as per O'Donnell *et al.* 2018)		
Chalinolobus tuberculata	North Island long-tailed bat	Nationally Vulnerable

4.6.7 Protected significant natural areas

Approximately 43 ha (0.8%) of the part of Waitomo ED which is in Otorohanga District is administered by DOC. Another 157 ha (3%) is protected under QEII Covenants, and 0.07 ha (<0.1%) is protected in Otorohanga District reserves. There are no Ngā Whenua Rāhui Land Management Agreements within the part of the Waitomo ED located within the Otorohanga District.

The five main protected areas located within parts of Waitomo ED that lie in Otorohanga District are all near Te Raumauku Road. Four of these protect the Te Raumauku Caves, with a combined area of *c.*43 ha (Te Raumauku Caves Scenic Reserve A (OT0875a; 3.45 ha), Te Raumauku Caves Scenic Reserve B (OT0774; 7.9 ha), Te Raumauku Caves Scenic Reserve C

(OT0775; 8.5 ha), and Te Raumauku Caves Scenic Reserve D (OT0776; 23.8 ha)). These reserves are characterised by indigenous-dominant forest located on nationally uncommon karst landforms, which provides habitat for Threatened and At Risk indigenous species. The fifth site is a large area of privately owned indigenous forest (OT0290-Turitea-Whakariawaka Forest; 131 ha) that provides habitat for Threatened and At Risk flora and fauna and also contains limestone caves of national significance (Wildland Consultants 2003).

Sites OT0290d - Bromley Road forest remnant (7.11 ha) and OT0290e - Bromley Road protected forest (11.07 ha) also contain indigenous forest over karst and these areas are some of the northern-most forested examples of karst landscape in the Waikato Region.

4.6.8 Other key significant natural areas

Two large areas of tawa dominated forest (Honikiwi Forest Remnants and Turitea Stream Forest Remnants A) provide habitat for At Risk indigenous species present in contiguous natural areas and provide important corridors between the protected areas with which they are contiguous (Honikiwi Forest Remnants links Bromely Road Protected Forest and Turitea-Whakariawaka Forest, and Turitea Stream Forest Remnants A links Honikiwi Forest Remnants and Turitea-Whakariawaka Forest).

A small area of broadleaved species forest (Te Raumauku Caves Southern Remnants) effectively doubles the size of a nationally significant, protected site (OT0774-Te Raumauku Caves Scenic Reserve B) and thereby acts as an important buffer for the contiguous protected area. Te Raumauku Caves Southern Remnants also provides additional habitat to Threatened and At Risk species present within the protected site. Both of these areas contain indigenous forest on karst, which is a nationally uncommon ecosystem type.

Waiteti Stream Marginal Strip buffer is contiguous with the Waiteti Stream Marginal Strip (OT0843). Both of these areas contain indigenous forest on karst, which is a nationally uncommon ecosystem type.

Murchies cave forest comprises a medium-sized area of indigenous forest that is contiguous with a much larger area of indigenous forest (Waitomo Forest Stewardship Land) outside of the Otorohanga District Boundary. There is a cave entrance present within the site, indicating that this area is an important site with karst formations (DOC 2010a). The site provides an important ecological corridor between the Otorohanga and Waitomo Districts.

4.7 Tokoroa Ecological District

4.7.1 Overview

Total Area of Tokoroa ED: *c.*110,183 ha
Area of ED Within Otorohanga District: *c.*140 ha (0.13% of the ED)

A very small part of the Tokoroa ED, alongside the western banks of the Waikato River, lies within the Otorohanga District. This area mainly comprises river flood plains, but a small area of moderate hillslope is present at the Waipapa dam.

4.7.2 Bioclimatic zones

The part of the Tokoroa ED that is located within the Otorohanga District lies within the lowland bioclimatic zone, and ranges from *c.*100 m a.s.l. to *c.*220 m a.s.l. Tokoroa ED has

mild summers and cool winters with frequent frosts; rainfall varies from 1,400-2,000 mm p.a. (McEwen 1987).

4.7.3 Geology and soils

The following information is derived entirely from McEwen (1987). The Mamaku Plateau is capped by 0.14 million year old Mamaku Ignimbrite, underlain by older ignimbrites; Whakamaru Ignimbrite forms the topographically lower surface west and south of the Plateau, overlain by superficial fluvial and lacustrine beds along the Waikato River valley system. Volcanic ash soils are dominant, formed from thin to thick cover of young rhyolitic ash (Taupo) over older brown silty and sandy ashes. In the north, loam soils are deep, silty, well drained and moderately leached with only a thin cover of younger ash, while southward coarser younger ash thickens and soils become more strongly leached with some podzolised as altitude and rainfall increase. On hilly and steep slopes, ash mantle thickness is variable over ignimbrite. Coarse-textured pumice soils from thick deposits of pumice sands and gravels occur in valleys.

4.7.4 Vegetation

Prior to human settlement, almost the entire Tokoroa Ecological District would have been covered in tall podocarp-broadleaved species forest. Hard beech (*Nothofagus truncata*) would have been common in gorges on the fringes of the Mamaku Plateau. Recent estimates of remaining vegetation within the Ecological District determined that only *c*.6.3% remains of these formerly extensive areas of tall indigenous forest (Leathwick *et al.* 1995). Some secondary forest, logged forest, and secondary scrub and shrubland are also present, making up a total cover of *c*.11% of indigenous vegetation in the Ecological District (Leathwick *et al.* 1995). Most of this vegetation is on the Mamaku Plateau, where there are several large reserves on Crown land managed by the Department of Conservation. The best remaining ecological corridor from the larger forest tracts on the Mamaku Plateau to the Waikato River is via small, fragmented areas of riparian vegetation along the Pokaiwhenua Stream and its tributaries. Another important corridor is from the headwaters of the Waihou River on the Mamaku Plateau down to the lowlands around Okoroire via riparian remnants (and ultimately onwards to the Firth of Thames).

4.7.5 Flora

No Threatened or At Risk indigenous vascular plant species have been recorded in the natural areas within the part of the Tokoroa ED that is in the Otorohanga District[1].

4.7.6 Fauna

No Threatened or At Risk indigenous fauna species have been recorded in the natural areas within the part of the Tokoroa Ecological District that is in the Otorohanga District.

4.7.7 Protected significant natural areas

Approximately 29 ha (21%) of the part of Tokoroa ED that is in Otorohanga District is administered by DOC, while 0.5 ha (0.3%) is protected in Otorohanga District reserves.

[1] *Juncus holoschoenus* var. *holoschoenus* has been recorded in the Tokoroa ED, but critical comparison of herbarium specimens has shown that most records (recent and historic) are based on *J. holoschoenus* var. *multiflorus* (NZPCN 2010). Consequently, the records of this species within the ED require validation.

There are no Ngā Whenua Rāhui Land Management Agreements or QEII Covenants within this portion of the Tokoroa ED.

All of the protected vegetation within the part of the Tokoroa ED that is within the Otorohanga District comprises small parts of much larger sites e.g. Pureora Forest Park-Waipapa River Extension (OT0814) and Arapnui Scenic Reserve (OT0831).

4.7.8 Other key significant natural areas

There are no unprotected natural areas in the Otorohanga District that lie solely within the Tokoroa Ecological District. The vegetation present within the two natural areas that straddle the Tokoroa ED-Ranginui ED border comprises shrubland and scrub on bluffs at the southern end of Lake Arapuni.

5. INDIGENOUS VEGETATION

5.1 General overview

The extent of the various indigenous land cover classes within each ecological district (or part thereof) within Otorohanga District is summarised in Table 16. This data has been derived from the Land Cover Database (LCDB2; Ministry for the Environment 2004) land cover classifications for terrestrial vegetation and wetlands over 0.5 ha, which has then been refined, first by Waikato Regional Council, and later by Wildland Consultants (WRC BIOVEG 2002). This layer does not include open water (e.g. river, lake, and pond), because it is not included in the WRC BIOVEG data. Therefore some large areas within Otorohanga District (e.g. all open water within Kawhia and Aotea harbours) are excluded from the table.

5.2 Protected indigenous vegetation

There is *c.*38,002 ha of legally protected land covered in natural vegetation in the Otorohanga District (this includes *c.*33,468 ha of land administered by the Department of Conservation, 2,060 ha in open space covenants under the QEII National Trust, and 1,588 ha of private land under a management agreement to Ngā Whenua Rāhui). There is also 886 ha of land protected within reserves administered by Otorohanga District Council (Table 15).

Table 15: Summary of protected SNA of the Otorohanga District by protection type and relative significance levels (excluding sites with indeterminate protection status), shown in area (hectares).

Significance	Department of Conservation	Otorohanga District Reserves	QEII Covenants	Ngā Whenua Rāhui Kawenata
National	27,470	392	743	138
Regional	5,870	374	995	1,424
Local	124	102	309	26
Likely	3	18	12	<1
Indeterminate			<1	
Not significant	1			
TOTAL	**33,468**	**886**	**2,060**	**1,588**

Table 16: Area (ha) and percentage cover (in brackets) of each indigenous land cover class (LCDB2) in each Ecological District (or part thereof) within Otorohanga District, based on the Waikato Regional Council Biodiversity Vegetation GIS layer.

Land Cover Class (LCDB2) *Indigenous terrestrial and wetland classes only* (*excludes open water*)	**Ecological Districts Area - hectares (% of Ecological District)**						**Total Area (ha)**
	Kawhia	**Pureora**	**Ranginui**	**Tokoroa**	**Waipa**	**Waitomo**	
Broadleaved Indigenous Hardwoods	848.8 (1.3%)	1, 184.8 (5.5%)	1, 631.7 (2.3%)	4.9 (3.5%)	182.4 (0.5%)	126.2 (2.4%)	3, 978.8
Deciduous Hardwoods	115.8 (0.2%)	35.4 (0.2%)	234.0 (0.3%)		302.4 (<0.1%)	2.4 (0.3%)	690.0
Fernland	88.8 (0.1%)	21.2 (0.1%)	32.6 (<0.1%)			0.6 (<0.1%)	143.2
Herbaceous Freshwater Vegetation	253.7 (0.4%)	9.7 (<0.1%)	26.2 (<0.1%)		9.8 (<0.1%)	2.8 (<0.1%)	302.1
Herbaceous Saline Vegetation	183.2 (0.3%)						183.2
Indigenous Forest	17, 329.8 (26.9%)	9, 693.8 (45.4%)	20, 991.7 (29.4%)		96.9 (0.3%)	621.7 (11.7%)	48, 734.0
Mānuka and/or Kānuka	3, 581.5 (5.6%)	2, 907.1 (13.6%)	1, 488.9 (2.1%)	74.3 (53.1%)	0.8 (<0.1%)	52.7 (1%)	8, 105.3
Sand Dunes	341.6 (0.5%)						341.59
Total Area (ha) of Indigenous Vegetation	22, 743.2 (35.4%)	13, 851.9 (64.8%)	24, 405.1 (34.1%)	79.2 (56.6%)	592.3 (1.6%)	806.4 (15.2%)	62, 478.1 (30.3%)

6. THREATENED, AT RISK, AND OTHER NOTABLE SPECIES

6.1 Flora

Twenty-eight nationally Threatened or At Risk vascular plant species have been recorded in the Otorohanga District (Tables 17[1] and 18) as well as three regionally threatened or regionally uncommon plant species. Eight vascular plant species are at or near their national distribution limits within the District. There are also records for one Data Deficient vascular plant species, one Vagrant vascular plant species, and one Threatened fungus species (Table 17). The numbers of Threatened and At Risk species within the district are based on the threat ranking documents that were current at the time of the initial study (Hitchmough *et al.* 2007 for invertebrates, fungi, and bats, Miskelly *et al.* 2008 for birds, de Lange *et al.* 2009 for vascular plants, Hitchmough *et al.* 2010 for reptiles, Newman *et al.* 2010 for frogs, and Allibone *et al.* 2010 for freshwater fish). The rankings have been updated to reflect the most recent threat rankings for these species[2] but the species records for the District have not been reassessed using the new threat rankings; therefore species that have changed ranking from not threatened to a threat ranking status between 2014 and 2018 will not be present within the lists of threatened and at risk species.

Table 17: Threatened, At Risk, and notable vascular plant species (as per de Lange *et al.* 2013) that have been recorded in the Otorohanga District.

Scientific Name	Common Name	Threat Status
Ophioglossum petiolatum	Stalked adder's tongue	Nationally Critical
Utricularia australis	Yellow bladderwort	Nationally Critical
Centipeda minima subsp. *Minima*	Sneezeweed	Nationally Endangered
Pimelea villosa	Sand daphne	Nationally Endangered
Dactylanthus taylorii	Pua-o-te-reinga, wood rose	Nationally Vulnerable
Libertia peregrinans	New Zealand iris	Nationally Vulnerable
Pimelea tomentosa	Native daphne	Nationally Vulnerable
Rorippa divaricata	New Zealand water cress	Nationally Vulnerable
Brachyglottis kirkii var. *kirkii*	Kirk's daisy	Declining
Cyclosorus interruptus		Declining
Euphorbia glauca	Shore spurge	Declining
Ficinia spiralis	Pingao	Declining
Myriophyllum robustum	Stout water milfoil	Declining
Peraxilla colensoi	Scarlet mistletoe	Declining
Peraxilla tetrapetala	Red mistletoe	Declining
Pimelea villosa	Sand daphne	Declining
Poa billardierei	Sand tussock	Declining
Prasophyllum hectorii	Swamp leek orchid	Declining
Pterostylis paludosa	Swamp greenhood orchid	Declining

[1] *Juncus holoschoenus* var. *holoschoenus* has been recorded from Otorohanga District, but critical comparison of herbarium specimens has shown that most records (recent and historic) are based on *J. holoschoenus* var. *multiflorus* (NZPCN 2010). Consequently, the records of this species within the District require validation.

[2] Threat rankings have been updated for all taxa within this report and follow the following threat classification publications: O'Donnell *et al.* 2018 for bats, Robertson *et al.* 2017 for birds, Goodman *et al.* 2014 for freshwater fish, Newman *et al.* 2013 for frogs, Hitchmough *et al.* 2007 for fungi, Mahlfeld *et al.* 2012 for gastropods, Buckley *et al.* 2012 for other invertebrates, de Lange *et al.* 2013 for vascular plants, and Hitchmough *et al.* 2016 for reptiles.

Scientific Name	Common Name	Threat Status
Ptisana salicina	King fern, para	Declining
Scandia rosifolia	Koheriki	Declining
Tupeia antarctica	White mistletoe	Declining
Bulbophyllum tuberculatum		Naturally Uncommon
Celmisia graminifolia		Naturally Uncommon
Veronica scopulorum 'Awaroa'		Naturally Uncommon
Korthalsella salicornioides	Leafless mistletoe	Naturally Uncommon
Pomaderris rugosa		Naturally Uncommon
Thismia rodwayi		Naturally Uncommon
Ranunculus macropus		Data Deficient
Mazus sp. aff. *pumilio*		Vagrant
Fungi Species (as per Hitchmough *et al. 2007*)		
Ganoderma sp. 'Awaroa'	Pukatea bracket fungus	Nationally Critical

Table 18: Regionally threatened or uncommon vascular plant species (as per de Lange *et al.* 2001[1]) and species that reach their limit of distribution that have been recorded in the Otorohanga District.

Scientific Name	Common Name	Threat Status
Syzygium maire	Swamp maire, maire tawake	Regionally threatened
Asplenium lyallii	Lyall's spleenwort	Regionally uncommon
Asplenium trichomanes subsp. *trichomanes*		Regionally uncommon
Agathis australis	Kauri	Southern limit near Kawhia
Zoysia paucifloria		Near southern limit on the west coast of the North Island
Avicennia marina subsp. *australasica*	Mangrove	Near southern limit
Gahnia rigida		Near northern limit (DOC 1986)
Ixerba brexioides	Tāwari	Southern New Zealand limit (Regnier and Clarkson 1988)
Coprosma spathulata		Southern New Zealand limit (Regnier and Clarkson 1988)
Leionema nudum	Mairehau	Southern New Zealand limit (Regnier and Clarkson 1988)
Coprosma arborea	Māmāngi	Southern New Zealand limit (Regnier and Clarkson 1988)

6.2 Fauna

Threatened and At Risk fauna species recorded in the Otorohanga District include 29 bird species, six freshwater species, four herpetofauna species, two bat species, and two terrestrial invertebrate species (Table 19). There are likely to be several more important invertebrate species within Otorohanga District, but information on their distribution is lacking and many species have not been described or had their threat status assessed.

[1] Regionally threatened or uncommon species were identified in 2001 (de Lange *et al.* 2001) by several local expert botanists. They used personal and professional experience and local knowledge to identify the species, rather than a criteria set.

Table 19: Threatened, At Risk, and other notable fauna that have been recorded in the Otorohanga District.

Scientific Name	Common Name	Threat Status
Bird Species (as per Robertson *et al.* 2017)		
Anas superciliosa superciliosa[1]	Pārera, grey duck	Nationally Critical,
Botaurus poiciloptilus	Matuku, Australasian bittern	Nationally Critical
Himantopus novaezelandiae	Kakī, black stilt	Nationally Critical
Chlidonias albostriatus	Black-fronted tern	Nationally Endangered
Anarhynchus frontalis	Ngutuparore, wrybill	Nationally Vulnerable
Charadrius bicinctus bicinctus	Banded dotterel	Nationally Vulnerable
Egretta sacra sacra	Matuku-moana, reef heron	Nationally Endangered
Hydroprogne caspia	Taranui, Caspian tern	Nationally Vulnerable
Hymenolaimus malacorhynchos	Whio, blue duck	Nationally Vulnerable
Acanthisitta chloris granti	Tītipounamu, North Island rifleman	Declining
Anthus novaeseelandiae novaeseelandiae	Pīhoihoi, New Zealand pipit	Declining
Apteryx mantelli	North Island brown kiwi	Declining
Bowdleria punctata vealeae	North Island fernbird	Declining
Gallirallus philippensis assimilis	Banded rail	Declining
Haematopus finschi	Tōrea, New Zealand pied oystercatcher	Declining
Larus novaehollandiae scopulinus	Tarāpunga, red-billed gull	Declining
Limosa lapponica baueri	Eastern bar-tailed godwit	Declining
Porzana tabuensis plumbea	Pūweto, spotless crake	Declining
Sterna striata striata	White-fronted tern	Declining
Anas chlorotis "North Island"	Pāteke, brown teal	Recovering
Callaeas wilsoni	North Island kōkako	Recovering
Charadrius obscurus aquilonius	Northern New Zealand dotterel	Recovering
Falco novaeseelandiae ferox	Bush falcon	Recovering
Nestor meridionalis septentrionalis	North Island kākā	Recovering
Phalacrocorax varius varius	Pied shag	Recovering
Poliocephalus rufopectus	Weweia, New Zealand dabchick	Recovering
Eudynamys taitensis	Koekoeā, long-tailed cuckoo	Naturally Uncommon
Phalacrocorax carbo novaehollandiae	Black shag	Naturally Uncommon
Platalea regia	Royal spoonbill	Naturally Uncommon
Freshwater Fish Species (as per Goodman *et al.* 2014)*		
Galaxias postvectis	Shortjaw kōkopu	Nationally Vulnerable
Geotria australis	Lamprey	Nationally Vulnerable
Anguilla dieffenbachii	Tuna, longfin eel	Declining
Galaxias brevipinnis	Kōaro	Declining
Galaxias maculatus	Inanga	Declining
Gobiomorphus huttoni	Redfin bully	Declining

[1] No recent records of this species within the Otorohanga District. Grey duck may be locally extinct due to hybridisation with mallards but further research and testing is required to confirm.

Scientific Name	Common Name	Threat Status
Herpetofauna Species (as per Hitchmough *et al.* 2016 (reptiles) and Newman *et al.* 2013 (frogs))		
Leiopelma hochstetteri	Hochstetter's frog	Declining
Naultinus elegans elegans	Auckland green gecko	Declining
Oligosoma ornatum	Ornate skink	Declining
Oligosoma striatum	New Zealand striped skink	Declining
Mammal Species (as per O'Donnell *et al.* 2018)		
Chalinolobus tuberculata	North Island long-tailed bat	Nationally Critical
Mystacina tuberculata rhyacobia	Central lesser short-tailed bat	Declining
Terrestrial Invertebrate Species (as per Mahlfeld *et al.* 2012 (Gastropods) and Buckley *et al.* 2012 (other invertebrates))		
Rhytida greenwoodi webbi	Greenwood's snail	Nationally Critical
Peripatoides suteri[1]	Peripatus, ngāokeoke	

* It is likely that some freshwater fish species occur in streams within SNA units both on and off public conservation land. These species are: giant kōkopu (*Galaxias argenteus*; At Risk-Declining), redfin bully (*Gobiomorphus huttoni*; At Risk-Declining), and torrentfish (*Cheimarrichthys fosteri*; At Risk-Declining) (DOC 2014).

7. OTHER SIGNIFICANT FEATURES

7.1 Geological features

Six significant geological sites/features (as per Kenny and Hayward 1996) are located within the Otorohanga District. Four of these sites are associated with areas of indigenous vegetation and habitats (Table 20).

Table 20: Significant geological features (as per Kenny and Hayward 1996) within the Otorohanga District.

Geological Site Name	Geological Significance Level	Description
Kaimango Road Jurassic Fossil Locality	National	This site comprises a holostratotype of the Mangaoran Substage along the Pirorua Stream near Kaimango Road. This site is not located within a natural area, but is present in farmland adjacent to OT0164.
Motutara Peninsula Jurassic and Oligocene sediments	National	This site comprises calcareous Oligocene siltstones overlying peneplain, dipping, moderately indurated Jurassic siltstones on the Motutara Peninsula, Kawhia Harbour, and is a very rich fossil locality for the Puaroan Stage. Spans three natural areas: OT0727, OT0729P and OT0731P.
Puaroa Creek Kawhia Jurassic Fossil Locality	National	This site comprises a holostratotype of the Puaroan Stage along the Puaroa Creek. This site is located within site OT0921.
Puti Point Jurassic fossiliferous	National	This is the type locality of the Puti Siltstone formation and is a fossil rich locality for the

[1] Not formally listed as indeterminate in the most recent New Zealand Threat Classification listings but remains listed as a Vulnerable species on the IUCN red list. The latest New Zealand threat ranking publication for terrestrial invertebrates notes that this species is locally abundant and is likely to be a genetic polymorphism with an extra pair of legs, and is probably a synonym of *P. novaezealndiae* (not threatened). Oliveira *et al.* 2012 notes that his species recquires revision.

Geological Site Name	Geological Significance Level	Description
siltstone, Kawhia		Puaroan Stage. The site is a massive area of blue-grey siltstone and thin sandstone exposed by road cutting beside SH31 at Puti Point. Spans two natural areas: OT0046 and OT0064.
Hautapu Hill Oligocene sediments	Regional	This site is the best exposure of the Aotea Formation in the Kawhia area, with Whaingaroa Formation beneath and Ohahiri Limestone above. Comprises a horizontally bedded sequence of calcareous siltstones, sandstone, and limestones on the eastern side of Hautapu Hill. Included within site OT0950.
Kawaroa Anticline	Regional	This site comprises an exposure of a lithologically well-defined anticlinal feature within the Kawhia Regional Syncline along the Kawaroa Stream. A small part of this feature is located on the boundary of OT0073.

7.2 Distinctive and uncommon habitat types

Distinctive landform features recorded in natural areas include karst landscapes, including caves and coastal karren[1]. Several nationally uncommon habitat types are represented, including wetland, coastal forest, duneland, and kahikatea forest on flat land. Forest over karst is generally uncommon in the North Island. Ecosystems and habitats within the Otorohanga District were not assessed against the status assessment of New Zealand's naturally uncommon ecosystems (Holdaway *et al.* 2012) because the report had not been published when the ranking of sites was undertaken.

8. RESULTS OF THE SIGNIFICANT NATURAL AREAS INVENTORY AND ASSESSMENT

An overview map showing the Significant Natural Areas identified within the Otorohanga District is presented in Figure 2.

8.1 Results of the assessment

Of the 955 sites in this study, 512 sites were considered to meet at least one of the Waikato Regional Council ecological significance criteria (see Tables 21 and 24, and Figure 3). A further 289 sites were assessed as likely to meet one or more of these criteria. Forty-five sites were assessed as not significant. For 109 sites, there was insufficient information available to determine whether they met the Waikato Regional Council criteria or not (scored as "Indeterminate"). Sites for which there was insufficient information available to assess ecological significance should all be regarded as potentially significant until field surveys are undertaken and they have been assessed. Field assessment of vegetation, habitat quality, and types and levels of threat (e.g. clearance, fragmentation, pests, surrounding land-use, stock trespass, or drainage for wetland sites) will be required in these

[1] Small scale sculpturing formed by solution processes on limestone and other soluble rock surfaces either exposed to the rain or buried beneath the soil (Grimes 1995).

sites. These sites should be included in lists/maps of sites requiring field survey and made available to Waikato Regional Council and Otorohanga District staff processing resource consents.

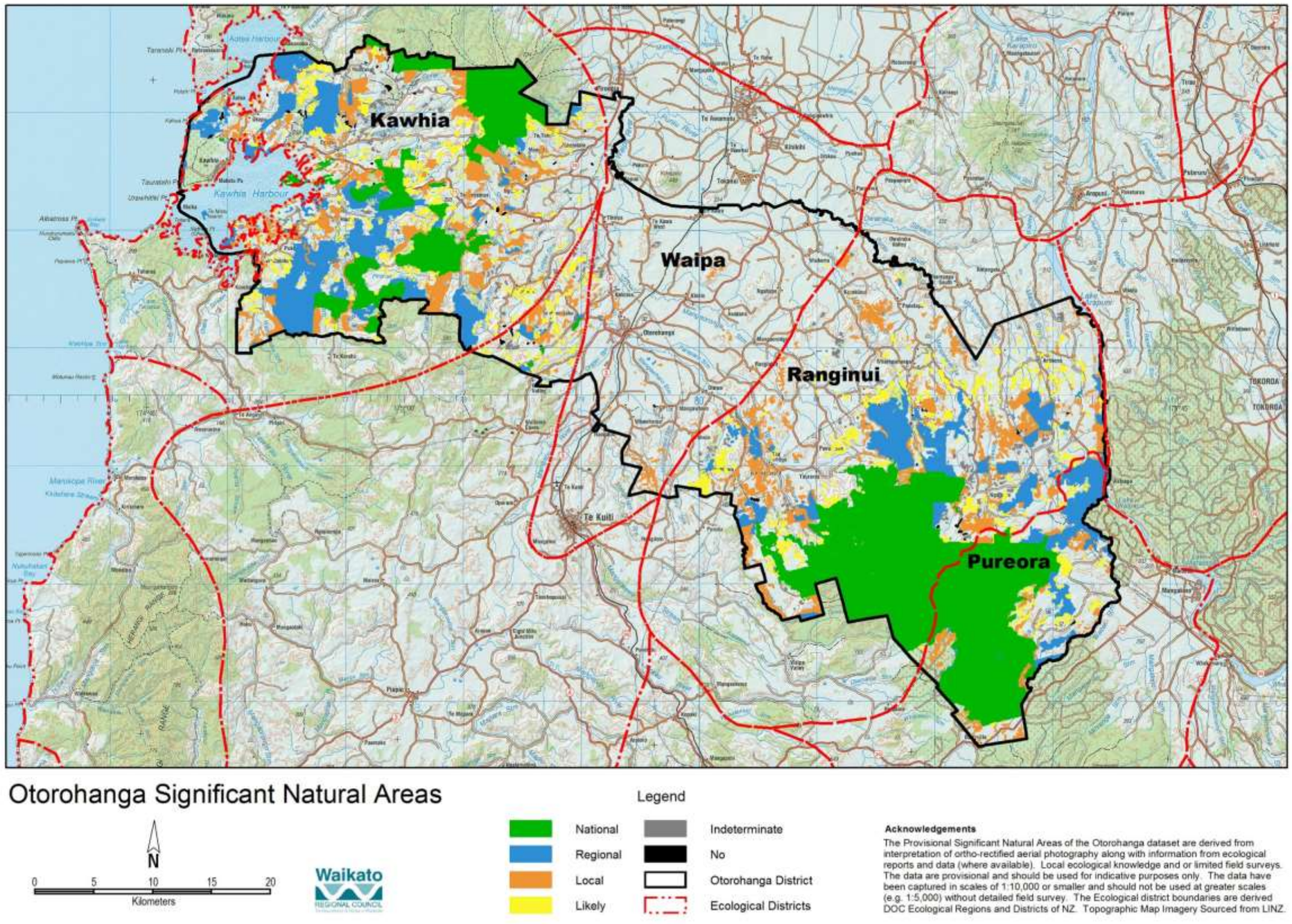

Figure 2. Map of Significant Natural Areas within the Otorohanga District.

Table 21: The number and area (hectares) of terrestrial and wetland sites assessed for significance in the Otorohanga District.

Significance	Number of Sites	Area (ha)
A. Significance Level Allocated		
National	20	33,336
Regional	96	15,800
Local	396	8,914
B. No Significance Level Allocated		
Likely	289	3,675
Indeterminate	109	619
Not significant	45	113
TOTAL	**955**	**62,456**

The level of confidence in the information available for significance assessments of Otorohanga natural areas varied substantially between sites (Table 22). Of the 955 sites in this study, there was a high degree of confidence in the site information and assessment for 39 sites, a medium level of confidence in the site information and assessment for 241 sites, and a low level of confidence in the site information and assessment for 675 sites. Field assessment of vegetation, habitat quality, and types and levels of threat (e.g. clearance, fragmentation, pests, surrounding land-use, stock trespass, or drainage for wetland sites) will be required for sites with low confidence that are of 'likely' or 'indeterminate' significance. These sites should be included in GIS data files or electronic/hard copy lists/maps of sites requiring field survey and made available to Waikato Regional Council and Otorohanga District staff processing resource consents.

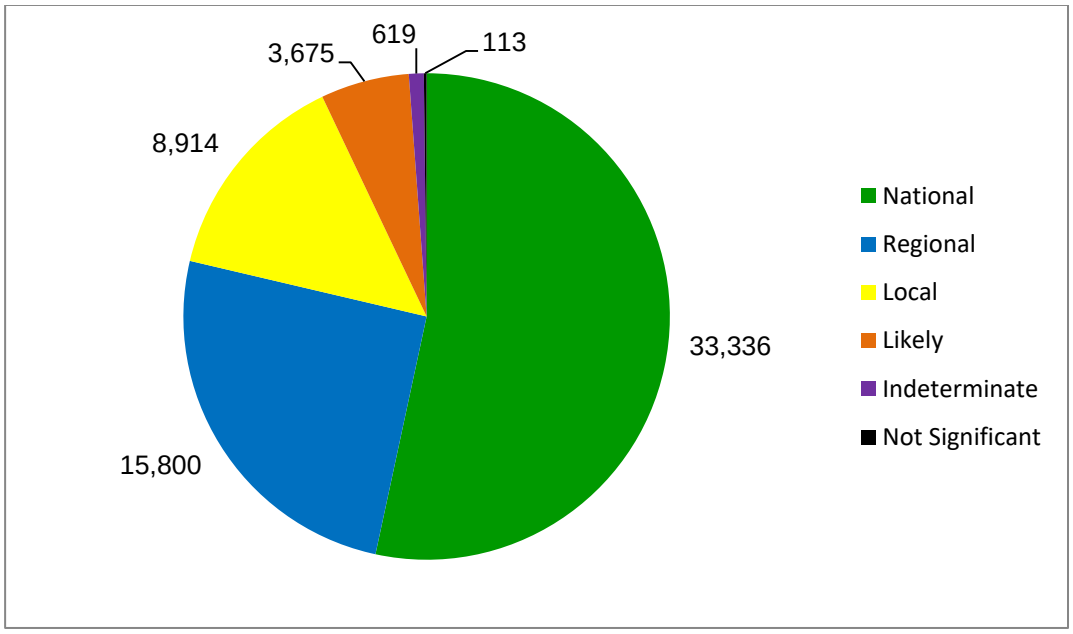

Figure 3: Proportion of total area (ha) contributed by sites in each significance level within the Otorohanga District.

Table 22: Levels of confidence in the information available for significance assessments of terrestrial and wetland ecosystem sites in the Otorohanga District.

Confidence Level	National	Regional	Local	Likely	Indeterminate	Not Significant	Total
High							
Number of sites	10	18	11				39
Area (ha)	26,683	2,707	339				29,730
Medium							
Number of sites	10	57	124	41	6	3	241
Area (ha)	6,652	10,416	2,950	494	43	3	20,558
Low							
Number of sites		21	261	248	103	42	675
Area (ha)		2,676	5,625	3,180	576	110	12,168
Total number of sites	**20**	**96**	**396**	**289**	**109**	**45**	**955**
Total area (ha)	**33,336**	**15,800**	**8,914**	**3,675**	**619**	**113**	**62,456**

The sites assessed in this study can be grouped into six broad ecosystem types: terrestrial, freshwater wetland, estuarine wetland, sand dune, island, and multiple (Table 23). Sites classified as 'multiple' include two or more of the 'terrestrial', 'freshwater wetland', 'estuarine wetland', 'sand dunes', or 'islands' ecosystem types. Of the 955 sites assessed in this study, 776 were classified as primarily terrestrial, 81 were classified as primarily freshwater wetland, 17 were classified as primarily estuarine wetland, five were classified as primarily sand dune, and one was classified as an island ecosystem. The remaining 75 sites were classified as 'multiple'.

Table 23: Number, area, and significance levels of sites within each ecosystem type in the Otorohanga District.

Significance Level	Number of Sites	Area (ha)
Terrestrial Vegetation (excluding sand dunes, and islands)		
National	14	30,719
Regional	72	14,286
Local	278	8,114
Likely	260	3,471
Indeterminate	107	615
Not Significant	45	113
Total	**776**	**57,319**
Wetland - Freshwater		
National	1	8
Regional	5	75
Local	53	173
Likely	20	42
Indeterminate	2	4
Not Significant		
Total	**81**	**302**
Wetland - Estuarine		
National		
Regional	1	7
Local	16	35

Significance Level	Number of Sites	Area (ha)
Likely		
Indeterminate		
Not Significant		
Total	**17**	**42**
Sand Dune		
National		
Regional	1	316
Local	4	33
Likely		
Indeterminate		
Not Significant		
Total	**5**	**348**
Island		
National		
Regional		
Local	1	1
Likely		
Indeterminate		
Not Significant		
Total	**1**	**1**
Multiple		
National	5	2,609
Regional	17	1,116
Local	44	557
Likely	9	161
Indeterminate		
Not Significant		
Total	**75**	**4,443**
Grand Total	**955**	**62,456**

Table 24: Numbers of ecologically significant sites and levels of relative significance in Otorohanga District tabulated by Ecological District (as evaluated using Waikato Regional Council criteria).

Ecological District	Significance Level			Likely to Meet One or More Waikato Regional Council Criteria	Do Not Meet Any Waikato Regional Council Criteria (Not Significant)	Insufficient Information to Evaluate the Criteria (Indeterminate)
	National	Regional	Local			
Kawhia	10	53	199	143	31	59
Kawhia/Waitomo	0	1	2	4	1	1
Pureora	3	7	22	18	2	3
Pureora/Ranginui	1	3	4	6	0	0
Pureora/ Ranginui/Tokoroa	0	1	1	0	0	0
Ranginui	3	22	120	97	8	40
Ranginui/Tokoroa	0	1	1	0	0	0
Ranginui/Waipa	0	0	5	0	0	1
Waipa	0	2	33	3	1	3
Waipa/Kawhia	0	0	0	1	0	0
Waitomo	3	6	5	15	2	2
Waitomo/Waipa	0	0	4	2	0	0
Total	**20**	**96**	**396**	**289**	**45**	**109**

8.2 Limitations of the assessment

It is probable that some natural areas of significant ecological value have not been identified during this desk-top exercise. Sites most likely to have been missed are those that contain special features that are too small to have been captured by existing databases or in previous surveys (i.e. smaller than 0.5 ha), or those areas that have been misclassified from aerial photography (in particular indigenous scrub and shrubland which may have been classified as exotic scrub and shrubland).

A lack of records for Threatened, At Risk, or other important species or distinctive features does not necessarily indicate their absence.

9. CONCLUSIONS

This report provides the background to, and summary of, a baseline inventory, assessments of significance, and ranking of significant natural areas (SNA) of terrestrial, wetland, sand dune, and island ecosystems in the Otorohanga District. The report accompanies an SNA data set that forms part of a comprehensive inventory of SNA throughout the Waikato Region. SNA in rivers and lake ecosystems are being assessed as part of separate projects and will be published in separate reports and data sets. SNA that contain karst features are included in the current project, although karst features will also be the focus of the separate, more detailed, project. When complete, the full set of inventories will provide a regional context for biodiversity assets and priority sites for management and monitoring.

Five hundred and twelve (512) SNA were identified within the Otorohanga District. These areas cover *c.*58,050 ha, or 28% of the District. In addition to these, 45 sites were identified as not significant (covering *c.*0.05% of the District) and a further 398 sites (covering *c.*2.1% of the District) were evaluated as likely to be significant or of indeterminate significance. Therefore, of the 62,456 ha of land evaluated, *c.*93% (58,050 ha) was able to be determined as significant or not significant, based on available information. Despite this, the age and quality of information was highly variable. There was a high confidence in the information and assessment of 39 sites, a medium confidence level for 241 sites, and a low confidence level for 675 sites.

Of the *c.*58,050 ha identified within SNA, *c.*38,002 ha (*c.*65%) are protected (land administered by DOC, Otorohanga District reserves, QEII covenants, or sites with Ngā Whenua Rāhui land management agreements), leaving some *c.*20,048 ha (*c.*35%) of SNA on private unprotected land.

Most Threatened, At Risk, and other notable flora and fauna have been recorded on or near Mount Pirongia, Kawhia Harbour, the Rangitoto Range, and the forested areas around Te Toi Stream. Other records are from 1980s survey data, such as the Sites of Special Wildlife Interest (SSWI) and Wetlands of Ecological and Representative Importance (WERI) inventories, or are assessments of potential habitat based on the occurrence of species in nearby areas. Future surveys and improved detection methods will improve our knowledge of Threatened, At Risk, and other notable species' distributions within Otorohanga District.

10. RECOMMENDATIONS

Specific recommendations have been identified for each Ecological District (ED). These recommmendations are partly drawn from Harding (1997), but have also been derived from analysis of the SNA data from this project.

10.1 Kawhia Ecological District

The most severely depleted ecosystem in Kawhia ED is dense podocarp forest; although this was always a minor component of the original vegetation, only *c.*6.4% of its former extent remains. Prior to human settlement, almost the entire Kawhia ED (*c.*95%) would have been covered in rimu-tawa forest. Today only *c.*17.2% remains unlogged, most of which is located within the DOC-administered Pirongia Forest Park. Some examples of secondary forest, logged forest, secondary scrub and shrubland, freshwater and estuarine wetland, and duneland are also present, contributing to a total cover of *c.*36% of indigenous vegetation in the Kawhia ED (Leathwick *et al.* 1995). Most natural areas within the Kawhia ED are surrounded by farmland and therefore are potentially at risk of clearance and stock incursions. Pest animals such as possums, goats, deer, and pigs are present, and pest plants such as grey willow and wilding radiata pine are also widespread. In general, sites in the middle of Kawhia ED are of higher ecological value, whilst in the west and east, where the topography is gentler, pastoral development has substantially reduced the extent and relative significance of natural areas.

There are several opportunities for restoration and protection of indigenous vegetation in the Kawhia ED outside of DOC-managed areas, including indigenous forest in the southwest of the ED, particularly around Te Toi Stream, and in the numerous forest patches that buffer DOC land. A few of these are protected within QEII or Ngā Whenua Rāhui covenants, but most have no formal protection status and are probably threatened by domestic stock browse and trampling. However, little opportunity remains for further protection of dense podocarp forest, with only one very small, unprotected remnant east of Kawhia Harbour remaining (Harding 1997). A few medium to large wetland areas near the Kawhia Harbour are also worthy of restoration and/or protection. These currently have no formal protection status and are probably threatened by domestic stock browse and trampling, and potential future drainage.

The best remaining ecological corridor from the larger indigenous forest tracts on Mount Pironga to Kawhia Harbour is via the Te Kauri Park Scenic Reserve and contiguous forest and scrub/shrubland areas. Another important ecological corridor runs southwest to northeast linking large tracts of forest outside the Otorohanga District with Mount Pironga. Parts of this corridor are discontinuous and fragmented, but the majority is relatively well connected. This corridor contributes to the Karioi-Herangi Forest Sequence, which contains ecological sequences ranging from coastal through to montane environments and is an important place for biodiversity in the Waikato Region (Department of Conservation 2008). Protection and enhancement of these areas, including the creation of new ecological linkages between them, would greatly benefit indigenous biodiversity within Kawhia ED.

Mangroves reach their southern, natural distributional limit within the Kawhia ED, and kauri is at its naturally occurring southern limit in Te Awaiti Stream Forest. The Waikato endemic *Veronica scopulorum* 'Awaroa' is restricted to the Kawhia ED and is known from only a handful of sites on limestone outcrops. Limestone and karst landscapes and their unique

plant and animal assemblages are an important and distinctive part of the Kawhia ED that warrant further protection and careful management.

10.2 Waipa Ecological District

Indigenous vegetation in the Waipa ED has been reduced from the pre-European (1840) baseline to the present day by 98.9% through the combined efforts of logging, land clearance, drainage, and fire (Leathwick *et al.* 1995). Most of the Ecological District is now covered in high-producing grassland (Ministry for the Environment 2004), and exotic plants are naturalised throughout. Remaining indigenous vegetation comprises small areas of logged podocarp-broadleaved species forest, small areas of secondary forest, scrub and shrubland, and narrow, discontinuous wetlands located along streams. These areas are threatened by the impacts of pest animals such as possums, goats, deer, and pigs, and pest plants such as grey willow and wilding radiata pine. No large tracts of forest are present within the portion of the Waipa ED located within the Otorohanga District; and the largest protected site (OT0334- Mangamahoe Road Scenic Reserve), located near the Waipa and Kawhia ED boundaries, northwest of Otorohanga township, is less than 10 hectares in area.

Opportunities for protection and restoration of natural areas in Waipa ED are limited. Only eight of the 53 natural areas with most of their area located within the part of Waipa ED that is within the Otorohanga District are greater than 10 ha in area. Restoration and protection opportunities are limited to small, fragmented remnants scattered within farmland and along small streams (including the Puniu River). Small areas of wetland (likely induced) are present on the western boundary with Kawhia ED, but these are likely to be heavily invaded by willow species.

The best opportunity for protection would be to link, enlarge, and protect the remnants around Puketawai Road, which would extend the corridor of habitat extending north and west from Pureora Forest Park.

10.3 Ranginui Ecological District

Prior to European settlement (*c*.1840), Ranginui ED was dominated by rimu-tawa forest, with montane podocarp-broadleaved species forest at higher altitudes (Harding 1997; Leathwick *et al.* 1995). It is now almost entirely farmed, although extensive areas of indigenous vegetation remain on the Rangitoto Ranges. Remaining indigenous vegetation is dominated by tawa forest (Harding 1997), with smaller areas of secondary scrub/shrubland and freshwater wetland also present. The most severely depleted ecosystems in the ED are rimu-mataī-broadleaved species forest, with <1% remaining. Rimu-tawa forest has also been dramatically reduced in extent, although an extensive, intact area is protected within the DOC-managed Pureora Forest Park (Harding 1997). The main threat to indigenous vegetation in the Ranginui ED is intensification of land use, grazing and pugging by domestic cattle, and pest animal and pest plant invasion. In general, sites in the southeast of the ED are larger and more intact, and are of higher ecological value, whilst in the north and west, where the topography is gentler, pastoral development has substantially reduced the extent and condition of remaining natural areas.

Opportunities for restoration and protection of podocarp forest in the Ranginui ED outside of DOC-managed estate are limited to small remnants along the Mangatutu Stream south of Korakonui, and in Mangare Stream and the upper Owairaka Stream east and north of Arohena. However, there are also numerous large areas of unprotected forest that are contiguous with or adjacent to the conservation estate which, if protected and enhanced,

would significantly benefit the indigenous biodiversity and long term viability of indigenous vegetation in the Ranginui ED.

There are some very important opportunities for protecting corridors of indigenous forest in this ED, particularly areas along the Waipa River to link Pureora Forest Park with Otoru Scenic Reserve (OT0797), areas north and west of the Rangitoto Range to link Mangatutu Ecological Area (part OT0814) with outliers to the north, potential corridors around Ngaroma to link outliers of Pureora Forest Park, and potential riparian linkages along the Mangaokewa River.

10.4 Pureora Ecological District

The Pureora ED is the least modified of all the EDs within the Otorohanga District, with 31% of the pre-European (1840) extent of primary forest remaining (Leathwick *et al.* 1995). Forty-nine percent of the ED is still covered with indigenous vegetation, with most of the remainder split between plantation forest and high producing grassland (Ministry for the Environment 2004). Pureora ED has the most extensive remaining areas of dense podocarp forest and podocarp-dominated forest in the Waikato Region, and possibly in the entire North Island, the majority of which are protected in the conservation estate. These forests contain significant populations of Threatened, At Risk, and uncommon indigenous plants and animals and contain some of the least modified wetlands and mires remaining in the North Island.

Consequently, opportunities for further protection of indigenous vegetation are limited to the unprotected areas of shrubland and secondary forest that buffer Pureora Forest Park. Protection and enhancement of these areas would contribute to the long term viability of the Forest Park and would reduce edge effects, particularly in the northeast and northwest of the site where the park margins are convoluted.

10.5 Waitomo Ecological District

Only 3.3% of the Waitomo ED is within the Otorohanga District and this is located on moderately steep hills north of Waitomo Valley. This part is defined by scattered, small- to medium-sized remnants of indigenous forest and shrubland of moderate quality. Prior to human settlement, rimu-tawa forest dominated the Waitomo ED and minor areas of wetland were present at lower altitude. The most depleted ecosystems in the Waitomo ED are the dense podocarp forests and rimu-tawa-beech forests, with *c.*2% of original cover of dense podocarp forest remaining (Leathwick *et al.* 1995).

Opportunities for protection and enhancement of indigenous vegetation in the ED exist in the myriad of remnants scattered through the pastoral landscape. Of particular importance are those remnants that are contiguous with or adjacent to the Te Raumauku Caves Scenic Reserve. These remnants are small and vulnerable to pest plant and pest animals, but their protection and enhancement would add to the values found in the Scenic Reserve, contribute to the long term viability of these characteristic areas, and benefit the biodiversity of the ED.

Enhancement and protection of several remnants along Turitea Stream and Whakariawaka Stream would provide an important ecological corridor between larger indigenous areas outside the Otorohanga District and the smaller fragments within the Otorohanga District.

In particular, joining up of these remnants would link the relatively large Turitea-Whakariawaka forest (OT0290) with Turitea Remnants C.

10.6 Tokoroa Ecological District

Only a very small part of the Tokoroa ED (0.13%, 140 ha) lies within the Otorohanga District. This part of the ED is located almost entirely on the flood plains and banks of the Waikato River. Most of the remaining natural areas in this small section of land are already protected in reserves administered by DOC (Pureora Forest Park and Arapuni Scenic Reserve). These sites comprise both logged and unlogged indigenous podocarp-broadleaved species forest. The areas are threatened by the impacts of pest animals such as possums, goats, deer and pigs, and pest plants.

Opportunities for protection and enhancement of indigenous vegetation within the portion of the Tokoroa ED located within the Otorohanga District are confined to Lake Waipapa-Waipapa River riparian margins. This site provides a limited buffer to Pureora Forest Park, but has value in reducing edge effects.

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APPENDICES

APPENDIX I: KEY NATURAL AREAS DATA AND LITERATURE FOR THE OTOROHANGA DISTRICT

Sourced from Waikato Regional Council

Archaeological Sites database

Biodiversity Vegetation 2007 GIS layer

Clean Streams Assets database

Community Restoration Projects database

Estuarine Vegetation and Harbours database

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River Environments Classification (REC) Fish Probability Predictions database

Regional Animal Pest Control Areas database

Regional Pest Management Strategy 2008-2013

Resource Consents Applications Database (RUAMS)

Waikato Regional Aerial Photography Syndicate Digital Orthophotos 2007 (WRAPS)

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DOC Biodiversity Information Management System (BIMS) database

DOC Bioweb threatened plants database

DOC GIS data for conservation units and Ngā Whenua Rāhui kawenata

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APPENDIX II: CRITERIA FOR THE ASSESSMENT OF SIGNIFICANCE OF NATURAL AREAS

CRITERIA FOR THE ASSESSMENT OF SIGNIFICANCE AND REASONS FOR WHY A SITE IS SIGNIFICANT

Note: The following criteria are derived from Appendix 3 of the previous Waikato Regional Policy Statement "Criteria for Determining Significant Indigenous Vegetation and Significant Habitats of Indigenous Fauna" and a technical guide on application of the criteria (WRC and Wildland Consultants 2002). Since the formulation of these criteria a new threat classification system for New Zealand has been developed and published (Townsend *et al.* 2008), and new threat classification lists using this system have been published for bird species (Robertson *et al.* 2017), plant species (de Lange *et al.* 2013), fresh water fish species (Goodman *et al.* 2014), reptile species (Hitchmough *et al.* 2016), bats (O'Donnell *et al.* 2018), and frog species (Newman *et al.* 2013). These changes affect Criterion 3. Alternative text for Criterion 3 is the subject of Wildland Consultants Contract Report No. 2190 "Updated System for Evaluation of Ecological Significance in the Waikato Region, Based on Townsend *et al.* (2008)" (WRC Docs # 1496182).

PREVIOUS REGIONAL POLICY STATEMENT

Criteria for the Assessment of Significance of Natural Areas

Previously assessed site	
1	It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Ngā Whenua Rāhui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.
2	The assessment of criterion 2 of the significance criteria in Appendix 3 of the Operative RP": "It is indigenous vegetation or habitat recommended for protection by the Nature Heritage Fund, or Nga Whenua Rahui committees, or the Queen Elizabeth the Second National Trust Board of Directors, unless the site can be shown to meet none of Criteria 3-"1."
Ecological values	
3	The assessment of criterion 3 of the significance criteria in Appendix 3 of the Operative RP": "It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: · classed as threatened or at risk, or · **endemic** to the Waikato region
4	The assessment of criterion 4 of the significance criteria in Appendix 3 of the Operative RP": "It is indigenous vegetation or a habitat type that is under-represented (*10% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally. Note: * the threshold value will be changed to 20% in the new Regional Policy Statement. In addition, the 20% threshold was used by Kessels Ecology during the assessments.
5	The assessment of criterion 5 of the significance criteria in Appendix 3 of the Operative RP": "It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, Chenier plain, or karst ecosystems."
6	The assessment of criterion 6 of the significance criteria in Appendix 3 of the Operative RP": "It is wetland habitat for indigenous plant communities and/or indigenous fauna communities that has not been created and subsequently maintained for or in connection with:

	waste treatment; or wastewater renovation; or hydro electric power lakes; or water storage for irrigation; or water supply storage; unless in those instances they meet the criteria in Whaley *et al.* (1995).
7	The assessment of criterion 7 of the significance criteria in Appendix 3 of the Operative RP": "It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato Region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type."
8	It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.
9	It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because: · its structure, composition, and ecological processes are largely intact; and · if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. stock, discharges, erosion, sediment disturbance), can maintain its **ecological sustainability** over time.
10	It is an area of indigenous vegetation or habitat that forms part of an **ecological sequence**, that is either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type.
Role in protecting ecologically significant area	
11	It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse effects.

Table 1: Criteria for the Assessment of Significance and Reasons for Why a Site is Significant

Site Name: **Area (ha):** **Ecological District:**

Land Tenure:

Location (grid reference and general location):

General Description:

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
SITE PROTECTED OR ASSESSED PREVIOUSLY				
1 It is indigenous vegetation or habitat that has been specially set aside by statute or covenant for protection and preservation, unless the site can be shown to meet none of Criteria 3-11.	This may include sites protected under the Conservation Act, Resource Management Act, or with QEII or NWR. The assumption inherent in this criterion is that legally protected areas have been assessed and deemed worthy of protection. Therefore such sites are assumed to be significant unless challenged, in which case the challenger would have to show that the site does not meet Criteria 3-11.	DOC, WRC, NWR, QEII, TA.	Y / N / NS	What type of legally protected area is it? e.g. Scenic Reserve, National Park, QEII Covenant. _____ _____

[1] CE = Consultant Ecologist, CRI= Crown Research Institute e.g. Landcare Research or National Institute of Water and Atmospheric Research (NIWA), DOC = Department of Conservation, EW = Environment Waikato, NHF = Nature Heritage Fund, NWR = Nga Whenua Rahui, P = Published reports or maps, QEII = QEII National Trust, TA= Territorial Authority (District or city council), UW = University of Waikato.

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
2 It is indigenous vegetation or habitat recommended for protection by the Nature Heritage Fund or Nga Whenua Rahui committees, or the Queen Elizabeth the Second National Trust Board of Directors, unless the site can be shown to meet none of Criteria 3-11.	Assumption is as above.	NHF, NWR, QEII	Y / N / NS	What type of legal protection has been recommended? _____ _____ _____
RARE / DISTINCTIVE FEATURES				
3 It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are; • threatened with extinction, or • endemic to the Waikato Region	Species that are threatened with extinction are indigenous species that have been evaluated and placed within any of the "Threatened" categories under the New Zealand Threat Classification System[1]. Endemic to the Waikato Region, means currently only occurs naturally within the Waikato Region.	CE, CRI, DOC, WRC	Y / N / NS	List the threatened species and their threat category, e.g. Nationally Critical, Serious Decline, Range Restricted. _____ _____ _____ _____ List any threatened species that use the site which are international migrants. _____ _____ List any regionally endemic species _____ _____

[1] Molloy, J. B. Bell, M. Clout, P. de Lange, G. Gibbs, D. Given, D. Norton, N. Smith, T. Stephens. 2001. Classifying species according to threat of extinction. A system for New Zealand. Biodiversity Recovery Unit, Department of Conservation, Wellington, NZ.

A. Criteria		B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
4	It is indigenous vegetation or habitat type that is under-represented (10% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.	Maps of ecological districts and regions (McEwen 1987) are available from DOC or WRC. A "type" of indigenous vegetation or habitat could refer to a broad unit such as podocarp/tawa-dominant forest, or a more detailed classification and mapping unit such as harakeke (*Phormium tenax*) flaxland. Definitions (and examples) of vegetation/habitat structural classes and vegetation types are provided in Atkinson (1985) and, for wetlands, Clarkson *et al.* (2002). Vegetation types for non-wetland vegetation in the Waikato Region are described in Leathwick *et al.* 1995. Comparison with known or likely original extent may require analysis (e.g. using a Geographic Information System) of current extent and previous extent. Leathwick *et al.* 1995 mapped and described the extent of indigenous vegetation types in 1840 and 1995. Vegetation types are not directly comparable and many vegetation types need to be grouped for comparison with the estimated 1840 extent. Future analysis using frameworks such as Land Environments may enable comparison with vegetation patterns prior to human occupation. In the meantime comparison with the 1840 datum will provide useful information for most vegetation classes.	CE, CRI, DOC, WRC, P	Y / N / NS	List under-represented vegetation/habitat type(s) and state whether rare at the national, regional, or ecological district scale? _____ _____ _____ _____
5	It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon, such as geothermal, Chenier plain, or karst ecosystems.	Geothermal habitats can include geysers, springs, sinter terraces, and hydro-thermally altered soils. They provide habitat for geothermally-influenced vegetation, and heat-tolerant bacteria. Chenier plain is a plain comprising shell ridges with infilled muds and	CE, CRI, DOC, WRC	Y / N / NS	Type of feature: _____ _____ _____ Area: _____

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
	other sediment between the ridges. An extensive area at Miranda provides habitat for international wader migrants. Karst ecosystems are limestone systems, providing habitat for specialist limestone plants (e.g. *Asplenium cimmeriorum, Gymnostomum calcereum*) and fauna (e.g. cave weta). Note that these three examples are not a comprehensive list of nationally uncommon vegetation or habitat types.			Condition: _____ _____ _____ _____
6 It is wetland habitat for indigenous plant communities and/or indigenous fauna communities[1] that has not been created and subsequently maintained for or in connection with: (a) waste treatment; or (b) wastewater renovation; or (c) hydro electric power lakes[2]; or (d) water storage for irrigation; or (e) water supply storage; unless in those instances they meet the criteria in Whaley *et al.* (1995).	Wetlands have been severely depleted nationwide, and are recognised as a rare habitat type. The RMA definition of a wetland is: "Wetland" includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions. Wetlands may have fluctuating water levels and the edge of a wetland may be difficult to define but will generally be where wetland plant species (e.g. raupo) are replaced with dryland species (e.g. kanuka). Note that manuka can occur in wetland and dryland habitats.	CE, CRI, DOC, WRC, P Copies of Whaley *et al.* (1995) can be obtained from WRC.	Y / N / NS	Type of wetland habitats/indigenous communities present: _____ _____ _____ _____ Origins of wetland (natural, artificial): _____ _____ Area (ha): _____

1 Does not include exotic rush/pasture communities.

2 Does not include Lake Taupo.

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
	All artificially-created wetlands listed in Criterion 6a-e should also be evaluated using the criteria in Whaley *et al.* (1995), as well as criteria 1-5 and 7-11 in Table 1.			
7. It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato Region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type.	This criterion is not intended to select the largest single example of a habitat type in the Waikato Region. Refer to vegetation maps (e.g. Leathwick *et al.* 1995), to determine which other parts of the Region have similar habitat, and the size of those examples. Refer to natural area inventories (e.g. report by Wildland Consultants Ltd and EPRO Ltd 1999), DOC compilations of Sites of Special Wildlife Importance (SSWI), DOC Conservation Management Strategies for Waikato, Bay of Plenty, Wanganui, Auckland, and Tongariro/Taupo Conservancies, Protected Natural Area Programme reports (e.g. Coromandel PNAP) to help determine the species that are typical of each habitat type.	CE, CRI, DOC, WRC	Y / N / NS	Broad habitat types present: _____ _____ Area (ha) Notable flora or fauna: _____ _____ How does the size compare with other similar habitat types in the Region? *e.g. the site is part of one of the largest examples of similar habitat types in the Region.* _____ _____

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
8 It is aquatic habitat that is a portion of a stream, river, lake, wetland, intertidal mudflat or estuary, and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato Region and which contains healthy, representative populations of that species.	Excluding artificial water bodies, except those created for the maintenance and enhancement of biodiversity or as mitigation for a consented activity. Critical means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas, and migratory pathways. It is likely that sound technical advice will need to be obtained from an appropriately qualified and experienced aquatic ecologist.	CE, CRI, DOC, WRC, UW	Y / N / NS	Catchment: _____ _____ Area (ha) or length of habitat: _____ Breeding species present: _____ _____ _____
REPRESENTATIVE EXAMPLES				
9 It is an area of indigenous vegetation or habitat that is a healthy, representative example of its type because: • its structure, composition, and ecological processes are largely intact, and • if protected from the adverse effects of plant and animal pests and of adjacent landuse (e.g. stock, discharges, erosion), can maintain its ecological sustainability over time.	Fencing and pest control would be required for most mainland sites in the Region (irrespective of habitat type). Ecological sustainability means a site's ability to continue to exist as an area of indigenous vegetation or habitat for indigenous fauna when taking into account its size, shape, buffering from external effects, connection to other natural areas, and likely threats. It may change naturally into a different habitat but indigenous species will be prominent or dominant and it will retain a natural character. Ecologists assessing this criterion should take into account the site's size, shape, buffering from external effects, and connection to other natural areas. Other	CE, CRI, DOC, WRC, P This criterion will require the input of an experienced and qualified ecologist. Good information will be required, and, in most instances, a field visit will be necessary.	Y / N / NS	Rank the following factors High (H), Medium (M) or Low (L): • structural intactness ____ • ratio of indigenous:exotic species ____ • connectivity to other natural areas ____ • size of the area in the context of the relevant ecological District ____ • degree of protection from likely threats (e.g., fenced, buffered) ____ • species diversity ____ List no. of responses to the above questions: H _____ M _____ L _____

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
	factors to be considered include indigenous regeneration (presence of fruit, seedlings, nests, juvenile animals etc), structural tiers (layers), hydrological processes in wetlands, invasive weeds, pest animals, domestic stock, threat management, management history. Representative areas are sites that are the best examples of sites that form a network covering the full range of landforms, soil sequences, vegetation and fauna communities within an ecological district (*c.f.* Shaw 1994). The reality for many landscapes, particularly throughout much of the Waikato, is that a 'representative example' will be the larger and most diverse remaining examples of indigenous vegetation and habitats.			Indicate overall ecological quality of the site. _____ Would you consider this to be among the best examples of its type nationally (Y/N), in the Waikato Region (Y/N), or in a particular ecological region/ district (Y/N)? Provide justification. _____ _____

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
10 Is it an area of indigenous vegetation or habitat that forms part of an ecological sequence that is either not common in the Waikato Region or an ecological district, or is an exceptional, representative example of its type.	**Ecological sequence** means a series of two or more connected ecosystem or vegetation types that retain natural transition zones along an environmental gradient. Ecological sequences that are not common in the Waikato Region include, but are not restricted to, indigenous dune vegetation through to coastal scrub or forest, lake margins or geothermal systems to indigenous forest, coastal to montane or alpine vegetation. Such sequences should be largely intact (e.g. perhaps bisected by roads but not by large tracts of non-indigenous land cover), such that they can be traversed by the majority of indigenous species that are reliant on such sequences for the completion of part or all of their life-cycles (e.g. by movement of key fauna or dispersal of propagules such as seed). It will probably be necessary to provide or obtain a map(s) of the sequence and the main vegetation types and habitats that it comprises. GIS analysis using a vegetation map and an appropriate evaluation framework (e.g. ecological district boundaries) may demonstrate if a sequence is uncommon or one of the better examples. An exceptional, representative sequence will be one of the best examples of its type, taking into account its intactness, composition, and ecological processes.	CE, CRI, DOC, WRC, P	Y / N / NS	Does the site include or is it part of one of the best or only examples of this type of ecological sequence nationally (Y/N), regionally (Y/N), or in the relevant ecological district (Y/N)? Location: _____ Key elements of sequence: _____ _____ _____ _____ _____ Justification: _____ _____ _____ _____ _____ _____ _____ _____
ROLE IN PROTECTION OF ECOLOGICALLY SIGNIFICANT AREA				
11 It is an area of indigenous	This also includes riparian vegetation	CE, CRI, DOC,	Y / N / NS	Key ecological function(s) of site (buffer,

A. Criteria	B. Definitions and Further information	C. Likely Information[1] Sources	D. Response (Yes? No? Not Sure?)	E. If Yes, provide the information requested below to justify your decision and to assist with determining level of significance
vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor, and which is necessary to protect any site identified as significant under Criteria 1-10 from external adverse effects.	that protects a significant aquatic habitat, e.g. a freshwater fishery.	WRC, P		ecological linkage, other): _____ _____ Which site(s) does this area provide a buffer or linkage for? _____ _____ Which of criteria 1-10 does the buffered or linked site comply with? _____ _____ Justification: _____ _____ _____

WAIKATO REGIONAL COUNCIL CRITERIA FOR THE ASSESSMENT OF RELATIVE ECOLOGICAL SIGNIFICANCE OF INDIGENOUS VEGETATION AND HABITATS OF INDIGENOUS FAUNA

Note: The following criteria are derived from Appendix 3 of the previous Waikato Regional Policy Statement "Criteria for Determining Significant Indigenous Vegetation and Significant Habitats of Indigenous Fauna" and on a technical guide on application of the criteria (Waikato Regional Council and Wildland Consultants 2002). Since the formulation of these criteria a new threat classification system for New Zealand has been developed and published (Townsend *et al.* 2008), and new threat classification lists using this system have been published for bird species (Robertson *et al.* 2017), plant species (de Lange *et al.* 2013), fresh water fish species (Goodman *et al.* 2014), reptile species (Hitchmough *et al.* 2016), bats (O'Donnell *et al.* 2017), and frog species (Newman *et al.* 2013). These changes affect Criterion 3. Alternative text for Criterion 3 is the subject of Wildland Consultants Contract Report No. 2190 "Updated System for Evaluation of Ecological Significance in the Waikato Region, Based on *Townsend et al.* (2008)" (WRC Docs # 1496182).

Table 2: Relative Importance of a Significant Area of Indigenous Vegetation or Habitat of Indigenous Fauna

In Column A, circle the criteria numbers for which you scored a 'Yes' in Table 1. Then consider the factors to be assessed, and complete column D, using your answers in Table 1 Column E to justify your response.

A. RPS Criteria met (*see Table 1 above*)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
	<u>INTERNATIONALLY SIGNIFICANT</u> A site is Internationally Significant if you respond 'YES' to any of the questions in this section:	**Internationally significant** natural areas have usually been identified in previous assessments. These sites are so important that some of them are already protected by international conventions. For example, the Tongariro National Park is a World Heritage Area, and there are three wetlands in the Waikato listed as Wetlands of International Importance under the international RAMSAR Convention (Whangamarino Swamp, Kopouatai Peat Dome, and the Firth of Thames estuary). Other natural areas may be internationally significant if they contain high quality vegetation or habitat that is unique in the world - for example, geothermal systems at Waiotapu and Orakeikorako. Internationally significant sites are likely to attract the interest of overseas and NZ scientists, and be a primary attraction for international and national tourists, e.g. Miranda bird sanctuary, Tongariro National Park.	
1	Has it been recognised under international legislation or convention as an internationally significant area (e.g. as a World Heritage Site or a RAMSAR site)?		Y / N / NS

A. RPS Criteria met (*see Table 1 above*)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
2	Has it been recommended for protection as a World Heritage Site or Wetland of International Importance (RAMSAR site) by QEII or NWH, or NHF?		Y / N / NS
3	Is it currently habitat for an indigenous species which is threatened with extinction (in the categories Nationally Critical, or Nationally Endangered or Nationally Vulnerable) and endemic to the Waikato Region?		Y / N / NS
3	Is it a key habitat for the completion of the life cycle of species that migrate internationally and that would be threatened if these habitats weren't sustained?	An example of key habitat for international migrants is the Firth of Thames.	Y / N / NS
If meets several of 4 ***&*** 9 or 5 ***&*** 9 or 6 ***&*** 9 or 7 ***&*** 9 or 8 ***&*** 9 or 10 ***&*** 9	Is the site the best or only remaining large representative example in New Zealand of a **suite** of relatively intact indigenous ecosystems and ecological sequences e.g. a wetland/forest complex with altitudinal sequences?	This would need to be justified by several well-qualified and experienced ecologists.	Y / N / NS

A. RPS Criteria (*see Table 1 above*)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
	<u>NATIONALLY SIGNIFICANT</u> The site is **at least** Nationally Significant if you can answer 'YES' to any of the questions in this section.	**Nationally Significant** natural areas includes sites that contain healthy populations of threatened species (such as kokako and kaka habitat at Pureora), or are very good examples of nationally rare habitat or vegetation (such as the large wetlands in the northern Waikato). They also include sites that are the only location where certain species occur, such as the hooded orchid at Whangamarino, or the Mercury Islands tusked weta. Nationally significant sites tend to attract the interest of scientists, technical specialists, and/or tourists from other parts of New Zealand.	
1, 2	Is it protected, or recommended for protection, under the Conservation Act 1987 (as an Ecological Area, or Forest Sanctuary), National Parks Act 1980, Marine Reserves Act 1971, or Reserves Act 1977 (as a Nature Reserve or Scientific Reserve).	In the Waikato Region these include: Tongariro National Park, Waihaha Ecological Area, Waipapa Ecological Area, Mangatutu Ecological Area, Rapurapu Ecological Area.	Y / N / NS
3	Is it habitat for an indigenous species which is under serious threat in the categories Nationally Critical, Nationally Endangered, Nationally Vulnerable, Serious Decline, or Gradual Decline?		Y / N / NS
4 ***&*** 9 or 5 ***&*** 9 or 6 ***&*** 9	Is it indigenous vegetation or habitat for indigenous species that is under-represented nationally (10% or less remains), or nationally uncommon (including wetland) that is a good quality example that is representative of its type?	Good quality examples would receive mostly highs or mediums for Criterion 9 in Table 1(taking into account size, presence of plant and animal pests, stock damage, other damaging effects). For the definition of vegetation types refer to Criterion 4 in Table 1 above - Column B, Definitions and Further Information.	List no. of responses to criterion 9 in Table 1: H _____ M _____ L _____ Y / N / NS

A. RPS Criteria (*see Table 1 above*)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
	<u>REGIONALLY SIGNIFICANT</u> The site is **at least** Regionally Significant if you can respond 'YES' to any of the questions in this section:	**Regionally significant** natural areas include the best examples in the Waikato Region of habitats that may be common elsewhere in New Zealand - for example, our best dune systems or largest mangrove-filled estuaries, or large examples of more common vegetation types. They may also include examples of nationally rare features that are not in good condition.	
1	Is it protected under the Reserves Act 1977, as a Wildlife Management Reserve, Wildlife Refuge, Scenic Reserve, Nga Whenua Rahui Kawenata, or for any conservation purpose under the Conservation Act such as a Conservation Area or Conservation Park, with significant fauna and/or flora values.		Y / N / NS Status: _____ Recommended Status: _____
1	Is it protected under the Queen Elizabeth the Second National Trust Act 1977 as an Open Space Covenant for any purpose other than those outlined for sites of international or national significance?		Y / N / NS
2	Is it a site that has been recommended for protection by NHF, NWR, or QEII?		Y / N / NS
3	Is it currently habitat for an indigenous species that is threatened, in the categories Sparse or Range Restricted, or endemic to the Waikato Region?	Species currently known to be endemic to the Waikato Region (defined as currently only occurs naturally within the Waikato Region) include: *Sporadanthus ferrugineus*, Mercury Is. Tusked weta, Te Aroha stag beetle, Moehau stag beetle, Hebe 'Awaroa', *Corybas carsei*	Y / N / NS Species: _____ Threat Status: _____

A. RPS Criteria (*see Table 1 above*)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
4 ***&*** 9	Is it indigenous vegetation or habitat for indigenous species that is under-represented regionally (i.e. within relevant ecological regions and Districts) and which is a good quality example that is representative of its type (taking into account size, plant and animal pests, stock damage, other damaging effects)?	Good quality examples would receive highs or mediums for Criterion 9 in Table 1. Assessment must be justified by a well qualified and experienced ecologist.	List no. of responses to question 9 in Table 1: H _____ M _____ L _____ Y / N / NS
4, 5, or 6	Is it a relatively large example of indigenous vegetation or habitat for indigenous species that is under-represented nationally, or nationally uncommon (including wetlands), but which is degraded in quality (taking into account presence of plant and animal pests, stock damage, other damaging effects)?	Assessment must be justified by a well qualified and experienced ecologist. Use the results from Criterion 9 in Table 1 to determine the relative quality of the site.	Y / N / NS
4	Is it the Regions' only remaining representative example (irrespective of its size) of a particular indigenous vegetation type or indigenous species habitat that is degraded in quality?	Representative areas are the best examples of indigenous vegetation and habitats that comprise a network covering the full range of landforms, soil sequences, vegetation and fauna communities within an ecological district (c.f. Shaw 1994). The reality for many landscapes, particularly throughout much of the Waikato, is that a 'representative example' will be the largest and most diverse remaining examples of indigenous vegetation and habitats. Degraded sites would receive mostly Low scores for the factors listed in Criterion 9.	List no. of responses to question 9 in Table 1: H _____ M _____ L _____ Y / N / NS
9 or 8 ***&*** 9 or 10 ***&*** 9	Is it one of the best representative examples in the Waikato Region of indigenous vegetation or habitat for indigenous fauna or an ecological sequence?	Assessment must be justified by a well qualified and experienced ecologist.	Y / N / NS

A. RPS Criteria (*see Table 1 above*)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
7 ***&*** 9	Is it a good quality example of indigenous vegetation or habitat for indigenous species representative of the ecological character typical of the Waikato Region?	This may include examples of indigenous vegetation that are large or moderately large relative to other similar habitats in the region or within the relevant ecological district. They should be relatively intact and retain the main elements of their original composition structure. Examples would include relatively large tracts of indigenous forest and habitats on the Hakarimata Range and Kaimai Range.	Y / N / NS
11	Is it a buffer (or a key part of a buffer) to a site that is of international or national significance?	The site buffered must have first been shown to be of national or international significance using relevant sections above in Table 2.	Y / N / NS
All	**LOCALLY SIGNIFICANT** The site is **at least** of Local Significance if you answered "Yes" to at least one criterion in Table 1 but did not answer "Yes" to any of the questions above in Table 2.	**Locally significant** natural areas are healthy examples of relatively common vegetation and habitat types. They are often small areas, but large enough to enable key ecological processes to occur, such as regeneration of seedlings or reproduction of indigenous fauna. These sites may not be particularly significant in their own right, but nevertheless play an important part in a network of natural areas. For example, a locally significant site might be important as a seasonal feeding or breeding area. It might also act as a stepping stone between other natural areas, allowing indigenous fauna to move in search of food or mates. Such sites are likely to provide representative examples of common or typical vegetation types or habitat for common indigenous species. They will not be among the best examples in the Region but will meet criterion 9 as healthy, functioning, and ecologically viable sites.	Y / N

A. RPS Criteria (*see Table 1 above*)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
HOW SIGNIFICANT IS THE SITE?		Circle the highest level for which you allocated at least one "Yes" response in Table 2. This indicates the relative importance of the site.	International, National, Regional, Local

Summary

Crit.	Reason for Significance*	Significance Levels*		
		International	National	Regional
1	Legally protected	RAMSAR or WHS	Ecological Area, Forest Sanctuary, National Park, Marine Reserve, Nature Reserve, Scientific Reserve	Other Reserves Act or Cons. Act. or a QEII covenant
2	Recommended for protection	As a RAMSAR or WHS	As an Ecological Area, Forest Sanctuary, National Park, Marine Reserve, Nature Reserve, Scientific Reserve	As another reserve type under Reserves Act or Cons. Act. or a QEII covenant
3	Threatened species Waikato Endemic species	Acutely threatened species that are endemic to the Waikato	Acutely or chronically threatened species	At risk threat category, range restricted or sparse
		International migrants that would be threatened if habitat was lost		Non-threatened Waikato endemic
4	Under-represented ecosystem	Best*** or only remaining, large example of a suite or sequence of ecosystems. (*For criteria 4, 5, 6, and 10, sites in this category would also be likely to meet a number of other criteria and form a complex of ecosystems.*)	Good quality example of nationally under-represented site (must also meet Crit. 9)	Good quality example of regionally under-represented site (must also meet Criterion 9)
				Relatively large but degraded example of nationally under-represented site
				Degraded, but Region's only remaining example (of any size)
5	Nationally uncommon ecosystem	Best*** or only remaining large example in NZ of a suite of ecosystems	Good quality example of a nationally rare vegetation type (must also meet Crit. 9)	Relatively large but degraded example
6	Wetland habitat	Best*** or only remaining large example in NZ of a wetland type	Good quality example (must also meet Crit. 9)	Relatively large but degraded example
7	Large example of wildlife habitat **	*See notes below***	*See notes below***	Good quality representative example (must also meet Criterion 9)
8	Aquatic habitat **	*See notes below***	*See notes below***	The Region's best or only example of a good quality example (must also meet Criterion 9)
9	Representative example**	*See notes below***	*See notes below***	One of the Region's best

Crit.	Reason for Significance*	Significance Levels*		
		International	National	Regional
				examples
10	Uncommon or exceptional ecological sequence	Best*** or only remaining large example of a suite or sequence of ecosystems	Good quality example of a nationally rare ecological sequence (must also meet Crit. 9)	One of the Region's best examples (must also meet Criterion 9)
11	Buffer	-	-	Buffers a site that is of national or international significance

Notes for Table

If a site is not of international, national, or regional significance, but meets one of the 11 criteria, it is locally significant.

* Levels of significance are applicable to any site that is part of a larger area that qualifies under any criterion.

** A site that is significant as a large area of wildlife habitat, aquatic habitat or a representative example of its type, will only be of greater than regional significance if it also meets one of the other criteria for which national or international levels apply. For instance, if the site was **also** habitat for acutely threatened species, it would be assessed using Criterion 3 as well as Criteria 7, 8, or 9.

*** Sites that are the 'best' example of their type will also meet Criterion 9. For international significance such sites will also be likely to meet a number of other criteria and must form a complex of ecosystems.

UPDATED SYSTEM FOR EVALUATION OF ECOLOGICAL SIGNIFICANCE IN THE WAIKATO REGION, BASED ON TOWNSEND *et al.* (2008)

INTRODUCTION

Since the formulation of the Waikato Regional Council ecological significance criteria and their publication in the Waikato Regional Policy Statement, followed by publication of a technical guide on application of the criteria (Waikato Regional Council and Wildland Consultants 2002), a new threat classification system for New Zealand has been developed and published (Townsend *et al.* 2008), and new threat classification lists using this system have been published for bird species (Robertson *et al.* 2017), plant species (de Lange *et al.* 2013), fresh water fish species (Goodman *et al.* 2014), reptile species (Hitchmough *et al.* 2016), bats (O' Donnell *et al.* 2017), and frog species (Newman *et al.* 2013). Changes to the criteria in order to update them to the new threat classification system are presented below.

For species that have not been reclassified in the above lists should continue to be used within the original criteria set.

SUGGESTED CHANGES TO TABLE 1 (WAIKATO REGIONAL COUNCIL AND WILDLAND CONSULTANTS 2002)

***Old Text*:**

It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are:

- threatened with extinction, or
- endemic to the Waikato Region

***New Text*:**

It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are:

- classed as 'Threatened' or 'At Risk' in New Zealand Threat Classification System, or
- classed as 'Data Deficient' in New Zealand Threat Classification System, or
- endemic to the Waikato Region.

Or

It is habitat of importance for the conservation of a regionally threatened, or regionally at risk species (or genetically distinct population) within the Waikato Region.

SUGGESTED CHANGES TO TABLE 2 (WAIKATO REGIONAL COUNCIL AND WILDLAND CONSULTANTS 2002)

Changes below relate to rows of the table where Criterion 3 is referred to in the left-hand column.

Internationally Significant

***Old Text*:**

Is it habitat for an indigenous species which is threatened with extinction (in the categories Nationally Critical, Nationally Endangered, or Nationally Vulnerable) and endemic to the Waikato Region?

***New Text*:**

It is habitat for an indigenous species (or genetically distinct population) threatened with extinction (in the categories 'Nationally Critical', 'Nationally Endangered', or 'Nationally Vulnerable') and is endemic to the Waikato Region.

or

It is a key habitat for the completion of the life cycle of species (or genetically distinct population) that migrate internationally and that would be threatened if these habitats were not sustained.

Qualifying Thresholds:

For a site to meet the criterion for international significance it must comprise significant habitat for a species (or genetically distinct population) on an international basis. This may include key sites for sustaining populations of international migrants. It must also provide natural habitat (see natural habitat definition below) for the species (or genetically distinct population), and/or the genetic entity must be indigenous to the site.

<u>Nationally Significant</u>

***Old Text*:**

Is it habitat for an indigenous species which is under serious threat in the categories Nationally Critical, Nationally Endangered, Nationally Vulnerable, Serious Decline, or Gradual Decline?

***New Text*:**

It is habitat used on a regular basis by an indigenous species (or genetically distinct population) in the threat categories 'Nationally Critical', 'Nationally Endangered', or 'Nationally Vulnerable'.

or

It is one of the best quality examples, on a national basis, of habitats used on an ongoing basis by a species (or genetically distinct population) in the At Risk category in the New Zealand Threat Classification System (specifically 'Declining', 'Recovering', 'Relict', or 'Naturally Uncommon')[23].

or

It is a key habitat for the completion of the life cycle of a species (or genetically distinct population), in one of the threat categories above, that migrate nationally and that would be threatened if these habitats were not sustained.

[23] Until such time as new threat classification lists are published for all taxa, existing threat classifications (Hitchmough *et al.* 2007), based on the Molloy *et al.* 2002 system, will have to be considered. Therefore this criterion would also apply to the best quality examples, on a national basis, of habitats used on a regular basis by a species in the 'Serious Decline' or 'Gradual Decline' categories of the Molloy *et al.* 2002 system.

Qualifying Thresholds:

Sites where low numbers are present on only a few occasions (and are unlikely to be important for the long-term viability of the species) do not meet this criterion. For a site to meet this criterion for national significance, it will be of importance for the viability of the species (or genetically distinct population) on a national basis. The site will provide natural habitat for the species (or genetically distinct population), and it will either be used on an ongoing basis, or be important for sustaining a population on a seasonal basis for key components of its lifecycle (e.g. feeding site), or be an important migratory site, breeding site, or over-wintering site.

Regionally Significant

***Old Text*:**

Is it currently habitat for an indigenous species that is threatened, in the categories 'Sparse' or 'Range Restricted', or endemic to the Waikato Region?

***New Text*:**

It is habitat of considerable importance for the conservation of an indigenous species (or genetically distinct population) in the 'At Risk' ('Declining', 'Recovering', 'Relict', and 'Naturally Uncommon') category, or is important habitat for a species that is endemic to the Waikato Region[24].

or

It is habitat of importance for the conservation of regionally threatened, or regionally at risk species (or genetically distinct population) within the Waikato Region, although the species is secure elsewhere. Assessment of whether a species is classified as at risk or threatened in the Waikato Region would have to be justified by several well qualified and experienced ecologists familiar with the species and ecology of the Waikato Region.

or

Habitat considered (by several qualified and experienced ecologists) to be of importance for the sustainability of a 'data-deficient' species on a regional basis.

Qualifying Thresholds:

Sites where low numbers are present on only a few occasions and it is unlikely to be important for long-term viability of the species (or genetically distinct population) do not meet this criterion. For a site to meet this criterion for regional significance, the site will be of importance for the viability of a particular species (or genetically distinct population) on a regional basis. The site will provide natural habitat for the species (or genetically distinct population), and it will either be used on an ongoing basis, or be important for sustaining a population on a seasonal basis for key components of its lifecycle (e.g. feeding site), or be an important migratory site, breeding site, or over-wintering site. Small populations of threatened plants, not significant on a national basis, but in the categories Nationally Critical, Nationally Endangered, Nationally Vulnerable, may be placed in this category.

[24] Until such time as new threat classification lists are published for all taxa, existing threat classifications (Hitchmough *et al*. 2007), based on Molloy *et al.* 2002 system, will have to be considered. Therefore this criterion would also apply to the 'Sparse' or 'Range Restricted' categories of the Molloy *et al.* 2002 system.

Locally Significant

Data Deficient species will now trigger Criterion 3 in Table 1, therefore some sites, other than those that qualify as being regionally significant (see above), may now be locally significant as a result of providing habitat for Data Deficient species. Otherwise, no changes are necessary for the text of Table 2.

DEFINITIONS FOR WAIKATO RPS CRITERIA

Natural Habitat: Indigenous vegetation or habitats similar to the pre-human environment(s) where the species (or genetically distinct population) was found for key components of its lifecycle. In most instances the site will have undergone adverse changes (e.g. as a result of invasive species, logging, reduction in size or loss of connectivity) but key elements of natural character will remain (site condition may also have improved as a result of intensive control of pest plants and animals). Natural habitat can, in some situations, move across a landscape over time due to natural changes (e.g. volcanism, active dunes, landslides, and geothermal manifestations).

Ongoing Basis: A species (or genetically distinct population) utilises a site for key components of its lifecycle. For fauna, this includes habitats that comprise a key component for its survival, as a food source, breeding ground, roosting site, hibernating site, or site for other key natural behaviours for the species. For plants this would include a site where a species is well-established (i.e. a population is maintained over several years), but it would not include a site where there is only one record of a species which is unlikely to have established permanently at a site. Old records may be important for some biota as many species may only be conspicuous during a particular season or not in every year.

Indigenous to a Site*:* Naturally occurring at the site or reintroduced to a site where it formerly occurred naturally.

ACKNOWLEDGMENTS

An initial draft of this report was compiled by Wildland Consultants, this was then refined by Wildlands based on discussions with Waikato Regional Council, who also facilitated input from Kessels and Associates.

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APPENDIX III: OPERTATIVE CRITERIA FOR THE ASSESSMENT OF SIGNIFICANCE OF NATURAL AREAS

This appendix contains Chapter 11 of the previous Waikato Regional Policy Statement (RPS) (Waikato Regional Council, 2016) followed by tables from Waikato Regional Council Technical Report No. 2002/1: "Areas of Significant Indigenous Vegetation and Habitats of Indigenous Fauna in the Waikato Region: Guidelines to Apply Regional Criteria and Determine Level of Significance" (Waikato Regional Council and Wildland Consultants, 2002).

At the start of the Otorohanga SNA project, the significance criteria were under review and became operative per 20 May 2016 (during the project). The set of criteria remained the same for the most part, but Criteria 1 and 2 were changed to merge Criterion 2 into Criterion 1 and change Criterion 2 to include the recognition of Coastal Marine Areas. As part of this investigation, these updates have been incorporated into the Master Dataset. Criterion 4 was also amended, changing the required percentage of under-represented indigenous vegetation, habitat, or ecosystem types present in an Ecological District, Ecological Region, or nationally from 10% to 20%. This appendix outlines the RPS criteria used to assess the SNA for this project.

Since the formulation of these criteria and guidelines, a new threat classification system for New Zealand has been developed and published for herpetofauna (Hitchmough *et al.*, 2016). These changes affect the assessment guidelines related to RPS criterion 3.

Regional Policy Statement - Chapter 11A

Criteria for Determining Significance of Indigenous biodiversity

Previously assessed site	
1	It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Ngā Whenua Rāhui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.
Ecological values	
2	In the Coastal Marine Area, it is indigenous vegetation or habitat for indigenous fauna that has reduced in extent or degraded due to historic or present anthropogenic activity to a level where the ecological sustainability of the ecosystem is threatened.
3	It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: · classed as threatened or at risk, or · **endemic** to the Waikato region, or · at the limit of their natural range.
4	It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.
5	It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, chenier plain, or karst ecosystems, hydrothermal vents or cold seeps.
6	It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities) that has not been created and subsequently maintained for or in connection with: · waste treatment; · wastewater renovation; · hydro electric power lakes (excluding Lake Taupō);

	· water storage for irrigation; or · water supply storage; unless in those instances they meet the criteria in Whaley *et al.*. (1995).
7	It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type. Note this criterion is not intended to select the largest example only in the Waikato region of any habitat type.
8	It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.
9	It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because: · its structure, composition, and ecological processes are largely intact; and · if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. stock, discharges, erosion, sediment disturbance), can maintain its **ecological sustainability** over time.
10	It is an area of indigenous vegetation or habitat that forms part of an **ecological sequence**, that is either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type.
Role in protecting ecologically significant area	
11	It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse effects.

APPENDIX IV: TYPES OF LEGAL PROTECTION IN THE OTOROHANGA DISTRICT

This appendix lists the possible legal mechanisms, or types of legal protection that have been applied to protect natural areas within the Otorohanga District. The list is split into two categories: those types that are reasonably expected to have been originally applied for protecting biodiversity values, and those considered indeterminate as to whether they were originally applied for protecting biodiversity values. This is based on the interpretation of RPS Criterion 1, which assumes that the biodiversity values of a protected site have been previously assessed and deemed worthy of protection.

1. Legal protection types that, for the purposes of this SNA assessment, were considered reasonably expected to be originally applied for the protection of the biodiversity values of a site. Sites with these legal protected types were assessed as meeting RPS Criterion 1:

Legislative Source	Description
Conservation Act	Conservation Covenant - s.27 Conservation Act 1987
	Conservation Park - s.19 Conservation Act 1987
	Ecological Area - s.21 Conservation Act 1987
	Ngā Whenua Rāhui Kawenata - s.27A Conservation Act 1987
	Wilderness Area - s.20 Conservation Act 1987
	Wildlife Management Area - s.23B Conservation Act 1987
	Easements that are not part of another Conservation Unit
Fisheries Act 1983	Faunistic Reserves - cl.68 Freshwater Fisheries Regulations - FA' 83
Land administered by DOC	Land administered by DOC - s.17 Land Act Regulations Land Act 1948
Marine Mammals Protection Act 1979	Marine Mammals Sanctuary - s.22 Marine Mammals Protection Act 1979
	Marine Reserve - s.3 Marine Reserves Act 1971
National Parks Act 1980	Amenities Area - s.15 National Parks Act 1980
	National Park - s.4 National Parks Act 1980
	Specially Protected Area - s.12 National Parks Act 1980
	Wilderness Area - s.14 National Parks Act 1980
Reserves Act 1977	Conservation Covenant - s.77 Reserves Act 1977
	Government Purpose Reserve - s.22 Reserves Act 1977
	Ngā Whenua Rāhui Kawenata - s.77A Reserves Act 1977
	Local Purpose Reserve - s.23 Reserves Act 1977
	National Reserve - s.13 Reserves Act 1977
	Nature Reserve - s.20 Reserves Act 1977
	Protected Private Land - s.76 Reserves Act 1977
	Scenic and Historic Reserve - Reserves Act 1977 (temporary)
	Scientific Reserve - s.21 Reserves Act 1977
	Scenic Reserve - s.19(1)(a) Reserves Act 1977
	Scenic Reserve - s.19(1)(b) Reserves Act 1977
	Reserve, Secondary Use - s.191 Public Works Act 1981
	Wilderness Area - s.47 Reserves Act 1977
Wildlife Act 1953	Wildlife Refuge - s.14 Wildlife Act 1953
	Wildlife Management Reserve -s.14A Wildlife Act 1953
	Wildlife Sanctuary - s.9 Wildlife Act 1953

2. Legal protection types for which there was a lower confidence of being originally for the protection of the biodiversity values of a site. Sites with these legal protection types may

have been assessed as "indeterminate" for RPS Criterion 1 if protection could not be established:

Legislative Source	Description
Conservation Act	Amenity Area - s.23A Conservation Act 1987
	Administration Purpose - s.60 Conservation Act 1987
	Management Agreement - s.29 Conservation Act 1987
	Marginal Strip - s.24c Conservation Act 1987
	Sanctuary Area - s.22 Conservation Act 1987
	Stewardship Area - s.25 Conservation Act 1987
	Watercourse Area - s.23 Conservation Act 1987
Reserves Act 1977	Historic Reserve - s.18 Reserves Act 1977
	Recreation Reserve - s.17 Reserves Act 1977
	Recreation Reserve (Racecourse) - s.16(11) Reserves Act 1977

APPENDIX V: CONFIDENCE RATINGS FOR SITE EVALUATIONS AND SIGNIFICANCE LEVELS

Confidence Rating	Definition
High	High level of confidence in assessment. Ecological information about the site is: • Comprehensive • Reliable • Applicable and/or recent • Site specific Sites with a high confidence rating include: • Relatively large, well-studied, protected areas, e.g. Whareorino Forest • Protected areas that are well-known as habitats for threatened species, e.g. Mahoenui giant weta Scientific Reserve, Mapara Scenic Reserve (a habitat for kokako). • Unprotected sites that have been identified as recommended areas for protection in a protected natural areas survey. • Other sites that have been the subject of fauna and/or flora surveys and the information is comprehensive, reliable, recent and site-specific. Sites with a high confidence ranking have a low requirement for field survey.
Medium	Moderate level of confidence in assessment. Ecological information about the site is: • Relatively comprehensive • Reliable • Not entirely applicable/recent • More likely to be general than site-specific, e.g. the information applies to a larger tract of indigenous vegetation, of which the site is a relatively small part. Sites with a moderate confidence rating include: • Sites where the assessment is based on ecological information that does not meet all of the criteria for a high confidence ranking. • Sites that are contiguous with a site that has a high confidence ranking, and information about the contiguous site is assumed to be applicable to the site that is being assessed. • Sites that have been assessed as nationally or regionally significant on the basis of a record of a single species (such as kereru) without meeting other criteria for national or regional significance.

Confidence Rating	Definition
	• Sites for which incomplete ecological information exists, and for which targeted surveys may result in records of threatened species. Sites with a medium confidence ranking have a requirement for field survey.
Low	Low level of confidence in the assessment Ecological information about the site is not available or is: • Not comprehensive • Unreliable • Out-dated • General Sites with a low confidence rating include: • Very small protected sites e.g. marginal strips • Unprotected sites within ecological districts where a protected natural areas survey has not been undertaken. • Sites that have met criteria for national significance, solely on the basis of a record of a species (e.g. kiwi, kokako) that is probably extinct at the site. Sites with a low confidence ranking have a high requirement for field survey.

APPENDIX VI: METADATA FOR THE SIGNIFICANT NATURAL AREAS OTOROHANGA DISTRICT DATA SET

IDENTIFICATION INFORMATION

Data Set Name:

Significant Natural Areas (SNA) - Otorohanga District PROVISIONAL
Please note: This metadata and the SNA GIS layer and attributes may be updated or reconfigured with time as more information becomes available, and as the region's SNA layers become fully standardised between districts.

Data Set Ids:

1291.06@WAIKATOREGION.GOVT.NZ
DOCS# 2122957

Data Set Abstract:

This is a provisional desktop based inventory and assessment of the significance of areas of indigenous vegetation and/or habitats of indigenous fauna in terrestrial vegetation, wetland, island (both inshore and offshore), sand dune and shingle beach ecosystems in the Otorohanga District as at 2007. SNA are commonly referred to as "sites" and one site may consist of a collection of polygons with boundaries derived from vegetation extent and/or cadastral and covenant data depending on the protection status. This SNA data set was originally intended for use in Waikato Regional Council (the Council) regional biodiversity management prioritisation, but is available for other Council projects. It may also be used by the Otorohanga District Council for their planning purposes and by other parties if deemed appropriate. **PLEASE NOTE THE DISCLAIMERS under the "Distribution Information" section of this metadata**.

Content of Data Set:

Layers:
SNA_OTOROHANGA (955 single or aggregated features (sites))
SNA_OTOROHANGA_EXT (external supply version of the above layer)

Attributes:

The name and format (in brackets) of each attribute are followed by a short name (if applicable), and complete description. It is mandatory for all attributes to be assessed but 'Can not be NULL'/'Can be NULL' is also recorded (in the brackets) to indicate where NULL is a feasible value due to a lack of data/information.

A number of GIS calculated attributes have been amended to the spatial dataset by WRC in order to provide additional site-level information. These attributes are used to assist in ranking of sites.

Attribute Definition

[1] = attributes followed by this number were derived and/or completed by Waikato Regional Council.
[2] = attributes followed by this number were derived and/or completed by an Ecologist contractor.
[3] = attributes followed by this number are available for restricted internal use only and can not be supplied to external parties without written permission being granted from the Council first.

SITE_NUMBER[1] (Text, 255 characters, can not be NULL)

A unique identifier for each site made using the SNA naming convention where the first two characters refer to the territorial authority (OT in the case for Otorohanga district) followed by four numbers ordered to follow an approximate geographical sequence from north-west to south-east through the local district. Numbers for sites assessed and added to the data set at a later stage of the SNA assessment process may not follow the north-west to south-east sequence. A number of the SNA are named to so as to retain a spatial relationship between a major site and one or more ecologically related “sub-sites”, e.g. a single continuous block of indigenous forest that is primarily on a Department of Conservation (DOC) park or reserve (major), but with smaller contiguous or nearby parts on land that is not legally protected (sub-sites). Sub-sites are numbered with a two digit numerical suffix (e.g. .01) at the end of the site number to indicate the ecological connection or relationship to a contiguous or nearby "parent" site. This attribute is not the primary key but is a unique value.

SITE_NAME[2] (Text, 255 characters, can be NULL):

A name for a site:

- If the site is on public conservation land, then the site name may include or be derived from the DOC name for the area;
- If the site is on land that is a reserve administered by a Territorial Authority, the site name may include or be derived from the name of the reserve area;
- If the site is on land that is legally protected as a Nga Whenua Rahui Kawenata covenant, QEII Trust covenant, or other covenant or private protected area, then the site name may include a common name and the general ecosystem or vegetation type of the area, and also the word 'protected';
- If the site is a sub-site then the site name may include the term ‘Extension to [name of legally protected site]' if deemed relevant;

Otherwise, the site name may be a known common name for the area, or a logical description based on surroundings, or the site name may be Null (i.e. “<null>”).

SITE_DESCRIPTION[2] (Memo, can not be NULL)

This is a brief summary or synopsis of the key characteristics or features of a site. This may include:

- the geography, ecosystem(s) and/or primary type(s) of vegetation in a site;
- whether any significant or important flora and/or fauna are known or likely to occur at a site (particularly threatened species - **NB:** no species names are included, only threat status);
- any other distinct, special or significant features of a site;
- the relationship (if any) of a site to other sites (SNA or other) in the same Territorial Authority, or Ecological District(s), or the Waikato Region.

ECOSYSTEM_TYPE[2] (Text, 255, can not be NULL)

The primary type, or types, of ecosystem(s) that the site is considered to represent. Further information for this attribute is provided in DOCS# 1690354.

- 'Indeterminate' = the ecosystem type(s) that comprise a site could not be determined from the data available.
- 'Island' = the site comprises ecosystems on inshore or offshore islands;

- 'Multiple' = the site comprises two or more main ecosystem types. The ecosystem types may be listed in order from the most to least dominant type by area (e.g. 'Multiple - Terrestrial Vegetation; Wetland - Freshwater; Wetland - Estuarine');
- 'Sand Dune' = the site comprises coastal sand dune ecosystems;
- 'Shingle Beach' = the site comprises small areas of coastal beach habitat typically utilised by shorebirds for nesting;
- 'Terrestrial Vegetation' = the site comprises permanently or intermittently dry areas with emergent vegetation dominated by forest, scrub and/or shrubland, or tussock land;
- 'Wetland - Estuarine' = the site primarily comprises permanently or intermittently wet areas with vegetation emergent over shallow or subsurface water directly associated with tidally influenced areas. This does not include floating plants. This could include a mixture of saline and freshwater components.
- 'Wetland - Freshwater' = the site primarily comprises permanently or intermittently wet areas with vegetation emergent over shallow or subsurface freshwater not directly associated with tidally influenced areas (e.g. swamps or bogs). This does not include floating plants. Freshwater wetlands with a canopy dominated by exotic willow species, generally called "willow wetlands", may also be included as these often contain predominantly indigenous understorey freshwater wetland vegetation (Beard, 2010).

SIGNIFICANT_FLORA[2, 3] (Memo, 4000, Can be NULL)

A list of threatened, at risk, or notable flora species compiled and assessed by the ecological contractors as being known to occur at a site. Species names are generally followed by the Department of Conservation (DOC) threat classification and by a reference if available. The threat classification listings for many species are likely to be outdated. Please refer to the most current DOC threat classification manual and listings for particular species.

LIKELY_ FLORA[2, 3] (Memo, 4000, Can be NULL)

A list of threatened, at risk, or notable flora species compiled and assessed by the ecological contractors as being likely to occur at a site. Species names are generally followed by the Department of Conservation (DOC) threat classification and by a reference if available. The threat classification listings for many species are likely to be outdated. Please refer to the most current DOC threat classification manual and listings for particular species.

SIGNIFICANT_FAUNA[2, 3] (Memo, 4000, Can be NULL)

A list of threatened, at risk, or notable fauna species compiled and assessed by the ecological contractors as being known to occur at a site. Species names are generally followed by the Department of Conservation (DOC) threat classification and by a reference if available. The threat classification listings for many species are likely to be outdated. Please refer to the most current DOC threat classification manual and listings for particular species.

LIKELY_ FAUNA[2, 3] (Memo, 4000, Can be NULL)

A list of threatened, at risk, or notable fauna species compiled and assessed by the ecological contractors as being likely to occur at a site. Species names are generally followed by the Department of Conservation (DOC) threat classification and by a reference if available. The threat classification listings for many species are likely to be outdated. Please refer to the most current DOC threat classification manual and listings for particular species.

OTHER_FEATURES[2, 3] (Memo, 4000, Can be NULL)

This is a list and description of any other distinctive features known about a site, with a reference included where available. This could include:

- if a site occurs on or overlaps a Site of Special Wildlife Interest (SSWI), a Wetland of Ecological and Representative Importance (WERI), or other designated site of ecological importance;
- if a site contains, overlaps, or lies near an archaeological site, a historic site, a pa site, etc.;
- or if a site contains any distinct, special, or important geographical, geological or other type(s) of feature(s).

CRITERION_1[2] (Text, 255, Can not be NULL):

The assessment of criterion 1 of the significance criteria in Appendix 3 of the previous RPS: "It is indigenous vegetation or habitat for indigenous fauna that has been specially set aside by statute or covenant for protection and preservation, unless the site can be shown to meet none of Criteria 3-11."
Possible values: 'Indeterminate', 'No' or 'Yes'.

CRITERION_2[2] (Text, 255, Can not be NULL):

The assessment of criterion 2 of the significance criteria in Appendix 3 of the previous RPS: "It is indigenous vegetation or habitat recommended for protection by the Nature Heritage Fund, or Nga Whenua Rahui committees, or the Queen Elizabeth the Second National Trust Board of Directors, unless the site can be shown to meet none of Criteria 3-11."
Possible values: 'Indeterminate', 'No', or 'Yes'.

CRITERION_3[2] (Text, 255, Can not be NULL):

The assessment of criterion 3 of the significance criteria in Appendix 3 of the previous RPS: "It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are:

- threatened with extinction; or
- are endemic to the Waikato Region."

Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_4[2] (Text, 255, Can not be NULL):

The assessment of criterion 4 of the significance criteria in Appendix 3 of the previous RPS: "It is indigenous vegetation or a habitat type that is under-represented (10% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally."
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_5[2] (Text, 255, Can not be NULL):

The assessment of criterion 5 of the significance criteria in Appendix 3 of the previous RPS: "It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, Chenier plain, or karst ecosystems."
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_6[2] (Text, 255, Can not be NULL):

The assessment of criterion 6 of the significance criteria in Appendix 3 of the previous RPS: "It is wetland habitat for indigenous plant communities and/or indigenous fauna communities that has not been created and subsequently maintained for or in connection with:

- waste treatment; or
- wastewater renovation; or
- hydro electric power lakes; or
- water storage for irrigation; or
- water supply storage;

unless in those instances they meet the criteria in Whaley *et al.* (1995)."
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_7[2] (Text, 255, Can not be NULL):

The assessment of criterion 7 of the significance criteria in Appendix 3 of the previous RPS: "It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato Region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type."
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_8[2] (Text, 255, Can not be NULL), short name = CRIT_8:

The assessment of criterion 8 of the significance criteria in Appendix 3 of the previous RPS: "It is aquatic habitat that is a portion of a stream, river, lake, wetland, intertidal mudflat or estuary, and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato Region, and which contains healthy, representative populations of that species."
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_9[2] (Text, 255, Can not be NULL):

The assessment of criterion 9 of the significance criteria in Appendix 3 of the previous RPS: "It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because:

- its structure, composition, and ecological processes are largely intact; and
- if protected from the adverse effects of plant and animal pests and of adjacent land use (e.g. stock, discharges, erosion), can maintain its ecological sustainability over time."

Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_10[2] (Text, 255, Can not be NULL):

The assessment of criterion 10 of the significance criteria in Appendix 3 of the previous RPS: "It is an area of indigenous vegetation or habitat that forms part of an ecological sequence that is either not common in the Waikato Region or an ecological district, or is an exceptional representative example of its type."
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERION_11[2] (Text, 255, Can not be NULL):

The assessment of criterion 11 of the significance criteria in Appendix 3 of the previous RPS: "It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally

occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor; and which is necessary to protect any site identified as significant under Criteria 1-10 from external adverse effects."
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

CRITERIA_YES[1] (Text, 255, Can be NULL):

This is a comma separated list of the number(s) of the RPS Significance Criteria (Appendix 3 of the previous RPS) that are known to be met at a site. This attribute will be empty (i.e. NULL) for sites where no RPS criteria are 'Yes'.

CRITERIA_LIKELY[1] (Text, 255, Can be NULL):

This is a comma separated list of the number(s) of the RPS Significance Criteria (Appendix 3 of the previous RPS) that are likely to be met at the site. This attribute will be empty (i.e. NULL) for sites where no RPS criteria are 'Likely'.

CRITERIA_INDETERMINATE[1] (Text, 255, Can be NULL)

This is a comma separated list of the number(s) of the RPS Significance Criteria (Appendix 3 of the previous RPS) for which it could not yet be determined if they are known or likely to be met at a site. This attribute will be empty (i.e. NULL) for sites where no RPS criteria are 'Indeterminate'.

SIGNIFICANCE[2] (Text, 255, Can not be NULL):

This indicates the significance of a site as determined from the assessment of the 11 RPS significance criteria. This consists of one of the following for each site:

- The level of significance of a site that is considered to meet one or more of the 11 RPS significance criteria. Possible levels for significant sites are: 'Local', 'Regional', 'National', or 'International'. These significance levels are applied using the guidelines outlined in Waikato Regional Council Technical Report TR2002/15: "Areas of Significant Indigenous Vegetation and Habitats of Indigenous Fauna in the Waikato Region: Guidelines to apply Regional Criteria and Determine Level of Significance";
- Or identifies the significance of a site as 'Likely' where one or more of the 11 RPS significance criteria are assessed as 'Likely' and no criteria are assessed as 'Yes';
- Or identifies the significance of a site as 'Indeterminate' where one or more of the 11 RPS significance criteria are assessed as 'Indeterminate' and no criteria are assessed as 'Yes' or 'Likely';
- Or identifies a site as 'Not Significant' where all 11 RPS criteria are assessed as 'No'.

SIGNIFICANCE_JUSTIFICATION[2] (Memo, 4000, Can be NULL):

A brief explanation and/or justification for the level of significance given to a site, including justification for any of the 11 RPS significance criteria known to be met; or an explanation/justification for why a site was identified as 'Likely' to be significant or not significant.

CONFIDENCE_LEVEL[2] (Text, 255, Can not be NULL):

This is an assessment of the level of confidence in the information available for a site and the assessment of the significance of a site. This also indicates the need for a field survey prior to any decisions being made about a site, such as consent processing, plan schedule development, or funding allocations. Possible values are: 'Low', 'Medium', or 'High'. Sites with 'Low' confidence are considered to have the highest need for field survey. The definitions and factors that are considered when applying a confidence level are provided in DOC# 2164814 Confidence rating for site evaluations and significance rankings. It is important to note that a site of low confidence should be considered no less significant than other sites of higher confidence, but of the same significance, unless other information proves otherwise. This attribute is only applied to sites known to be locally, regionally, nationally or internationally significant or known to be not significant.

PEST_ANIMAL_ISSUE[2] (Text, 255, Can not be NULL):

This is used to indicate whether any pest animal (as defined in Waikato Regional Pest Management Strategy) management issues are known or likely to exist at a site.
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

PEST_PLANT_ISSUE[2] (Text, 255, Can not be NULL):

This is used to indicate whether any pest plant (as defined in Waikato Regional Pest Management Strategy) or other weed management issues are known or likely to exist at a site.
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

STOCK_ISSUE[2] (Text, 255, Can not be NULL):

This is used to indicate whether any stock management issues are known or likely to exist at a site, such as a lack of stock proof fencing or the presence of stock.
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

DEVELOPMENT_ISSUE[2] (Text, 255, Can not be NULL):

This is used to indicate whether any development management issues are known or likely to exist at a site, such as proposed or operational subdivision, wind farms, clearance, land use change or power pylons.
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

OTHER_ISSUE[2] (Text, 255, Can not be NULL):

This is used to indicate whether any other management issues not covered by the above categories are known or likely to exist at a site.
Possible values: 'Indeterminate', 'Likely', 'No', or 'Yes'.

ISSUE_JUSTIFICATION[2] (Memo, 4000, Can be NULL):

This provides a brief explanation or justification for the result of the assessment of management issues at a site, particularly for management issues that are known or likely to exist at a site. **NB:** This attribute may be empty if the site has no issues.

REFERENCES[2] (Memo, 4000, Can be NULL):

This is a list of citations, delimited by semi-colon, that refer to the primary sources of information used in the assessment of a site. This may include spatial data sets, databases, various types of reports and surveys, and personal observations. A bibliography of the information sources cited in this attribute is provided in either a separate document or MS Excel worksheet.

BOUNDARY_CHANGE[1] (Text, 255, Can be NULL)

Formerly used by Council for internal logging of boundary changes when required.

VEG_CHANGE[1] (Text, 255, Can be NULL)

Formerly used by Council for internal logging of vegetation classification changes when required.

ASSESSMENT_NOTES[2] (Memo, 4000, Can be NULL):

This contains any additional relevant notes or information about a site that could not be recorded appropriately in any of the other attributes described above.
ID (Autonumber, 10, Can not be NULL):
The unique identifier automatically assigned to the site. This is the primary key.

Metadata link:

http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:11765733306908::NO::P12_METADATA_ID:462

Key Words:
Biodiversity, Significant, Ecology, Ecosystem, Ecological, Valuable, Native, Natural, Indigenous, Inventory, Rare, Sites, Areas, SNA, Terrestrial, Vegetation, Wetland, Threatened, Endangered, Flora, Fauna, Otorohanga, Protected, Criteria, RPS, Sand Dune, Island.

Resource:
Land, GIS

Data Set Ids:
1291.06@WAIKATOREGION.GOVT.NZ
DOCS# 2122957

Metadata Date:
21 March 2012

CONTACT DETAILS

Contact Organisation:
Waikato Regional Council (WRC)

Contact Position:
GIS Officer - Biodiversity

Programme:
Spatial Information

Contact Address:
401 Grey St., Hamilton East. Ph.: (07) 859 0999, Fax: (07) 859 0998
Email: inforeq@waikatoregion.govt.nz

Data Owner:
Waikato Regional Council
(but note District Council and Wildlands stake and other restrictions on supply below, Section 6)

SPATIAL INFORMATION

Geographic Extent:
Various locations throughout the Otorohanga District of the Waikato Region, New Zealand.

Positional Accuracy:
The boundaries of the SNA_OTOROHANGA data set are derived from other data sets, which are listed in the "Related Information" section of this metadata. The positional accuracy of SNA_OTOROHANGA is thus dependent on the positional accuracy of these other data sets. The accumulated positional accuracy of SNA_OTOROHANGA could potentially be as much as +/-30 metres, although it will usually be much less than this.

Other:
The data have been captured at scale(s) of 1:10,000 or smaller and it is advised not to use the data at scales greater than this (such as 1:5,000). The specified minimum mapping unit was 0.5 hectares. However, where the contractor believed that a site smaller than 0.5 hectares is an outstanding or exceptional site when assessed against the criteria provided, then the Council agreed on the inclusion of these.

DATA ACQUISITION HISTORY

Period and Frequency of Record:
The derivation of SNA_OTOROHANGA relied heavily on a "desktop" exercise using the 2007 WRAPS Aerial Photography (i.e. most sites were not inspected in the field). Except with small areas of the SNA data layer have been updated using WRAPS 2012 as part of the incorporation of DOC/Wildlands review.- In general, it can be regarded as a “point in time” data set representing the state of indigenous terrestrial vegetation and wetland ecosystems as at 2007.
Further information used for the inventory and assessment of SNA was obtained from other existing GIS data, literature and/or reports.
It is expected the data set will be reviewed or updated at regular intervals depending on the availability of new aerial or satellite imagery. However, due to the large amount of work involved with such an inventory, this may only be in 5-10 year intervals.

Data Acquisition Method(s):
Summary:
This significant natural areas (SNA) data set was derived primarily from a "desktop" analysis of the WRAPS 2007 aerial photography and Biodiversity Vegetation (BIOVEG) (2007) spatial data, along with other relevant spatial data, literature and information, where available. Most areas were not inspected in the field. The significance of each site was evaluated using the 11 Waikato Regional

Policy Statement (RPS) significance criteria (Appendix 3 of the previous RPS). Up to five types of management issues were also assessed at each site. Data related to the "Ecosystem-based Ranking" of sites with a significance of 'International', 'National' or 'Regional' may be appended at a later stage.
Detail:

1. The Council provided contract specifications (DOCS# 1663431) and datasets were provided to Wildlands Consultants (hereafter "Wildlands") as per the following (list may not be exhaustive):

Waikato Regional Council Data supplied by Waikato Regional Council

- Extract of "GIS_PHOTOS.WRAPS07_5K" from the Aerial Photography - WRAPS 2007 - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1410510/ - **WRC Metadata Document Number 1410510**) for the Otorohanga District area.
- Extract of "GIS_ALL.AUTHORISATIONS", "GIS_ALL.AUTH_SURFACE_WATER_TAKE", and "GIS_ALL.AUTH_APPLICATIONS_RECENT" from the Authorisations (RUAMS) - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/742462/ - **WRC Metadata Document Number 742462**) for the Otorohanga District Area.
- Bioclimatic Zones - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1086812/ - **WRC Metadata Document Number 1086812**).
- Extract of Biodiversity Vegetation (BIOVEG) - GIS Layer (2002) (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1172690/ - **WRC Metadata Document Number 1172690**) for the Otorohanga District area (also Otorohanga and South Waikato Districts if needed).
- Extract of Biodiversity Vegetation (BIOVEG) - GIS Layer (2007) (**WRC Metadata Document Number 1652753**) for the Otorohanga District area (also Otorohanga District area if needed).
- Extract of Biosecurity - Regional Animal Pest Control Areas - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/884786/ - **WRC Metadata Document Number 884786**) for the Otorohanga District Area.
- Copy of the report: “Natural Heritage of Otorohanga District” (Wildland Consultants Ltd contract report no. 1530), **WRC Document Number 926184**.
- Extract of "GIS_ALL.RACS_CLNSTRM_APPLICANT", "GIS_ALL.RACS_CLNSTRM_COMPARTMENT" and "GIS_ALL.RACS_CLNSTRM_FENCE" from the RACS Clean Streams Assets GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1065967/ - **WRC Metadata Document Number 1065967**) for the Otorohanga District Area.
- Extract of "GIS_ALL.RACS_SOILCON_COMPARTMENT" and "GIS_ALL.RACS_SOILCON_FENCE" from the RACS Soil Conservation Assets GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1216544/ - **WRC Metadata Document Number 1216544**) for the Otorohanga District Area.
- Rivers SNA - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1470535/ - WRC Metadata Document Number 1470535) and associated Technical Report: “Identification of High Value Rivers and Streams in the Waikato Region: Final Report” - **WRC Document Number 1460478**.

- Copy of the report: Scoring and Ranking of Lake Ecosystems in the Waikato Region for Biodiversity Management (Wildland Consultants contract report no. 2091a), **WRC Document Number 1573861**.

- Significant Natural Areas (SNA) data and reports (if available) for the Hauraki (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1466611/ - **WRC Metadata Document Number 1466611**), South Waikato, Thames-Coromandel and Waitomo http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1325570/ - **WRC Metadata Document Number 1325570**) Districts.

Data supplied by the New Zealand Archaeological Association (NZAA)

- Extract of Archaeological Sites GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/881908/ - **WRC Metadata Document Number 881908**) for the Otorohanga District Area.

Data supplied by the Department of Conservation - *Te Papa Atawhai*

- Extract of DoC Waikato Conservancy - Biodiversity Information Management System (BIMS) spatial data and reports available for the Otorohanga District Area.

Conditions of Use, Acknowledgements, Copyright Statements, Disclaimers: None known, but acknowledgement should be given as "DoC (year)" (see BIM report for correct year) if information in BIMS reports is used to derive outputs of the Project.

- Extract of DOC - Wetlands of Ecological and Representative Importance (WERI) - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1021377/ - **WRC Metadata Document Number 1021377**) for the Otorohanga District Area.

- Extract of Ecological Regions and Districts - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/881153/ - **WRC Metadata Document Number 1021377**).

- Extract of Department of Conservation - Public Conservation Land GIS Data (available for free from koordinates.com - please download metadata, copyright notice(s) and related documentation from the website).

- Extract of Department of Conservation BIOWEB GIS Layer for the Otorohanga District.

Data derived from Land Information New Zealand LandOnline Data and Territorial Authority District Valuation Roll

- "GIS_ALL.CRS_PROPERTY_OTOROHANGA" from the Properties - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/888036/ - **WRC Metadata Document Number 888036**).

Data supplied by Land Information New Zealand (LINZ)

- Extract of "GIS_ALL.NZTM_MAP_GRID" from the Topographic Map Grids GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/915250/ - **WRC Metadata Document Number 915250**) for the Otorohanga District area (also freely available from LINZ).

- Extract of "NZTopo Lakes", "NZTopo Ponds" and "NZTopo Rivers" from 2009 LINZ NZTopo data, for the Otorohanga District area. Relevant metadata - **WRC Metadata Document Number**

885309 (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/885309/).

- Extract of "GIS_ALL.GEOGRAPHIC_PLACE_NAME_EW" from the Geographic Place Names - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/881334/ - **WRC Metadata Document Number 881334**) for the Otorohanga District area.

Data supplied by Landcare Research - *Manaaki Whenua* and co-owned by Waikato Regional Council)

- Extract of Regional Indigenous Vegetation Inventory (RIVI) (**WRC Metadata Document Number 881138**) spatial data that overlap the Otorohanga District.

Data supplied by QEII National Trust

- Extract of QEII National Trust Covenants - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/881117/ - **WRC Metadata Document Number 881117**) for the Otorohanga District area (note: WRC does not have biodiversity information for QEII covenants, contact QEII National Trust for this information).

Data supplied by Statistics New Zealand

- Extract of "GIS_ALL.POL_2009_TERR_AUTHORITY_EW_L1" from the Political Boundaries - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/883529/ - **WRC Metadata Document Number 883529**) for the Otorohanga District area (also freely available from LINZ).

Data supplied by Terralink International Ltd

- Extract of "GIS_PHOTOS.WRAPS02" from the Aerial Photography - WRAPS 2002 - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/881411/ - **WRC Metadata Document Number 881411**) for the Otorohanga District area.

Data supplied by Terralink International Ltd based on Land Information New Zealand LandOnline Data

- Extract of "GIS_ALL.CRS_PARCEL" from the CRS - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/871640/ - **WRC Metadata Document Number 871640**) for the Otorohanga District.

Data supplied by the Waikato Biodiversity Forum

- Extract of Biodiversity Community Restoration Projects - GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/992959/ - **WRC Metadata Document Number 992959**) for the Otorohanga District area.

Data supplied by the Otorohanga District Council

- Extract of "GIS_ALL.DIST_PLAN_WPDC_RES" from the District Planning Zones GIS Layer (http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1062713/ - **WRC Metadata Document Number 1062713**) for the Otorohanga District area.

Other data sets freely supplied under no license

- Subset of NZTOPO50 Topographic Maps (DOCS# 1562505) for Otorohanga District
- Subset of LANDCOVER_DATABASE2 (DOCS# 933628) for Otorohanga District
- Subset of Land Environments New Zealand (LENZ) (DOCS# 881554) for Otorohanga District
- Subset of DOC_NGA_WHENUA_RAHUI_COVENANT (DOCS# 1215463) for Otorohanga District
- Subset of ECOLOGICAL_DISTRICT (DOCS# 881153) for Otorohanga District
- Subset of BIOCLIMATIC_ZONE (DOCS# 1086812) for Otorohanga District
- Subset of DoC BIMS GIS data and accompanying reports for Otorohanga District
- Scanned copies of 1993 WRAPS for the Otorohanga District if required
- Subset of BIOSEC_TB_VECTOR_SECTOR (DOCS# 882824) for Otorohanga District
- Sites of Special Wildlife Interest (SSWI) for Otorohanga District
- Simplified version of CRS_PROPERTY_OTOROHANGA (DOCS# 888036) with the following attributes only:
  LEGAL_DESC1
  AREA_SQM
  CAP_VALUE
  LAND_VALUE
  IMPROVEMENTS
  LAND_USE_COD
  ZONE_CODE
  VNZ_CAT_CODE

2. Details of the methodology used by Wildlands for identifying, evaluating and creating the SNA_OTOROHANGA attribute and spatial data are provided in the following documents: Contract for Services: Inventory and ranking of significant natural areas of Otorohanga District (DOCS# 1663431), and Waikato Regional Council Technical Report 2012/XX "Significant Natural Areas of the Otorohanga District: Terrestrial and Wetland Ecosystems" (DOCS# 2197922 - Still to be published). The main steps in the methodology are broadly summarised below:

1) Carried out literature review and compilation of relevant reports, field surveys and other data sets for Otorohanga District.

2) Reviewed boundaries and classification (i.e. LCDB2_NAMEattribute) of BIODIVERSITY VEGETATION_2007 (hereafter "bioveg") GIS data for Otorohanga District. Revised boundaries of bioveg polygons where boundaries were deemed inaccurate based on interpretation of 2007 WRAPS imagery, Google Earth imagery or LCDB2 data. Where existing classification was deemed inaccurate, Wildlands revised this based on interpretation of 2007 WRAPS imagery, Google Earth imagery, LCDB2, or other data or reports where possible.

3) BIOVEG polygons classified as exotic vegetation were removed, except for those with the "Deciduous Hardwoods" LCDB2_NAME that were also identified as wetlands. The resulting data set was named "INDIGENOUS_VEGETATION".

4) Council GIS staff intersected INDIGENOUS_VEGETATION with spatial data of protected land areas (i.e. DoC, QEII, NWR, and OTOROHANGA Reserves and Covenants) to split the geometry into that which is on protected land and that which is not. The resulting data was kept as one data set with the addition of "PROTECTION_STATUS" and “PROTECTION_DETAIL” attributes to record this.

5) Council GIS staff aggregated tenure information from CRS_PROPERTY data into the "INDIGENOUS_VEGETATION" data set. The resulting data was kept as one data set with the addition of a "TENURE_STATUS" and “TENURE_DETAIL” attributes.

6) GIS processing was carried out on INDIGENOUS_VEGETATION to remove slivers and undersized polygons (usually under 0.5ha) that resulted from the above split and also to merge “paper roads” and “queens chain” land into the most obvious contiguous sites. This processing was carried out by council GIS staff.

7) The geometry of INDIGENOUS_VEGETATION was used as the base layer from which to derive the SNA_OTOROHANGA data set (hereafter "SNA") using the guidelines in Waikato Regional Council technical report TR2002/15 by Wildland Contractors Ltd and EW, 2002: "Areas of Significant Indigenous Vegetation and Habitats of Indigenous Fauna in the Waikato Region. Guidelines to apply Regional Criteria and Determine Level of Significance". The SNA data required some boundary revisions, splitting and merging of polygon geometries depending on the circumstances. Only the SITE_NO attribute was directly recorded into the spatial data. All other attributes were recorded for each site in an MS Excel spreadsheet, using drop-down lists where relevant, to be joined to the spatial data at a later stage.

8) Wildlands incorporated a revised methodology of assessing the significance of SNA based on previous RPS Criterion 3, developed by Wildland Consultants Ltd in consultation with Waikato Regional Council and Wildlands Consultants, and based on newly released threat classification systems (Townsend *et al.* 2008) for vascular flora (de Lange *et al.* 2009) and avifauna (Miskelly *et al.* 2008). Details of this revised methodology are provided in DOCS# 1496182.

9) A ranking assessment was also applied to internationally, nationally and regionally significant sites based in the specifications in the following document: Contract for Services: Inventory and ranking of significant natural areas of Otorohanga District (DOCS# 1663431). This task was jointly carried out by Wildland Consultants and Waikato Regional Council.

10) Draft SNA data and report were provided to the Council for review. The Council proceeded to validate, quality assure and check logical consistency of the geometry and attributes of the data, and the associated report, and provided feedback with recommended changes to Wildlands. This step and step 11 were repeated a number of times until the outputs were deemed satisfactory by the Council.

11) Wildlands revised and updated Bioveg and SNA data sets as deemed necessary in negotiations with the Council.

12) The resulting spatial data was refined to remove geometry errors (Geomedia validate geometry function and associated fix geometry function), manual deletion of non-relevant holes less than 0.1 ha (mainly intersection slivers derived from unknown earlier processing steps), followed by snapping to vertices of the Waikato Regional Council CRS layer GIS_ALL.CRS_PARCEL with a 1m tolerance to align SNA vertices to CRS vertices where they occur within 1m separation (FME- AnchoredSnapper function).

13) The attribute set was cleaned to remove non-printing ASCII characters (e.g. line returns), trimmed to remove leading and trailing spaces, and a course level of typological correction (e.g. internal double spaces, punctuation inconsistencies). All attributes derived by Council were calculated using geoprocessing routines constructed in FME (seeDOC#2154912).

14) Metadata was written by the Council and the data was made corporate as GIS_ALL.SNA_OTOROHANGA.

15) A draft of this report and the accompanying ranking spreadsheet and GIS layer was provided to the Waikato Regional Council and the Department of Conservation, Waikato Conservancy for comment. The Waikato Regional Council made some changes to the geometry of the GIS layer. Department of Conservation staff collaborated to produce comments, critique, and valuable additional information on the draft of the report and data files.

16) After Wildland Consultants had reviewed Regional Council and Department of Conservation feedback, a meeting was held between Wildlands, Waikato Regional Council, and Department of Conservation staff. All issues raised during the review process were resolved and addressed at this meeting, and the agreed points from the DOC review document were incorporated into the report, ranking spreadsheet, and GIS layer.

Ecosystem Scoring

Processing is described in WRC DOCS#1663434

DATA QUALITY INFORMATION

Data Quality:
In terms of geometry, the data set is only as accurate as the data sets it was derived from (see section 3 above for a list of these and more information on positional accuracy). The data set repeatedly had its geometry and connectivity validated and fixed at 1m tolerance throughout the process of development. While the geometry is considered sound, some connectivity errors (such as vertices within 1m of each other) may still exist as a result of the intersection of different data sets used to create this SNA data set, and also due to these errors being inherent in some of the source data sets.

Attribute Accuracy:
Many of the attributes will also be only as accurate as the data sets they were derived from. Whether land is protected or not is dependent on the accuracy of QEII, DoC and Otorohanga District Council Reserve and Covenant data sets; whether vegetation is indigenous or exotic, is primarily based on the accuracy of the classification used in the Bioveg data set, which tends to be around 80% accurate. However, many attributes were recorded based on expert ecological knowledge of the area by Wildland Consultants, with additional information from existing literature and reports.

The 11 criteria that the significance of sites was assessed against are found in appendix three of the Council's previous Regional Policy Statement. Wildland Consultants were provided with these criteria and they understood how to objectively assess them in a desktop exercise based on Waikato Regional Council Technical Report TR2002/15: "Areas of Significant Indigenous Vegetation and Habitats of Indigenous Fauna in the Waikato Region: Guidelines to apply Regional Criteria and Determine Level of Significance" (DOCS# 791472).

The "CONFIDENCE_LEVEL" attribute was used by Wildland Consultants to indicate their confidence in the accuracy of the significance they have allocated to a site. This is dependent upon the availability, accuracy, currency and completeness of ecological information for a site, and Wildland Consultants confidence in the information. The definitions and factors that are considered when applying a confidence level are provided in DOC# 2164814 Confidence rating for site evaluations and significance rankings.
While the data has been repeatedly and thoroughly checked for errors, including spelling and grammar, it is likely that some minor errors will still be present.

Completeness:

The dataset is subject to the limitations of a desktop study with limited field validation. There may be modifications to this original data set or a revised version of the data set should more information become available or should feedback, including that from Otorohanga District Council, DoC and/or other sources, including private landowners and field observations necessitate it. A number of attributes are yet to be populated and the provisional data could change significantly in some places.

Some attributes will be empty for some sites as null values are allowed for in some attributes.

Users of the data can question the accuracy of it and recommend changes to the data set owner but the data set owner will decide whether or not to implement those changes at their own discretion.
It is impossible to achieve 100% accuracy with the creation of data sets such as this as individual land use and ecosystem units are likely to change faster than such data sets can be mapped region-wide, and some

areas are impossible to check in the field unless the data set creator had unrestricted access to all areas, including inaccessible areas, along with a limitless budget and ample time. The completeness of this SNA_OTOROHANGA data set is also subject to the limitations of the data sets it was derived from.

The data is considered a provisional inventory, ranking and scoring of SNA within Otorohanga District initially compiled in 2007. It is to be used in subsequent analyses and community consultation to help with validating and finalising the SNA of the Otorohanga District.

Future amendments to either the spatial or attribute data require a change request to be logged with Inforeq (inforeq@waikatoregion.govt.nz) and a Spatial Information programme member will apply those changes to the data either in an ad hoc or bundled manner depending on the number of changes coming in at that time.

Logical Consistency:
The data have been captured at scale(s) of 1:10,000 or smaller. It is strongly advised the data not be used at scales greater than this (such as 1:5,000) without detailed field survey.

This data set has been derived from several other data sets and the logical consistency with these data sets is considered sound as the Council was extremely careful in the planning and implementation of quality checking procedures such as geometry and connectivity validation and fixing. Attributes were thoroughly checked for any spelling errors or inconsistencies.

DISTRIBUTION INFORMATION

Data Form:
Digital GIS files (Oracle Spatial, MS Access (GeoMedia), Shapefiles, MapInfo files), MS Excel files, hard copy printed and digital (pdf, jpeg, tiff) GIS map outputs at a range of scales, technical report in PDF, KML for Google Earth.

Digital Format:
The spatial data was captured and edited in ArcGIS and GeoMedia Professional, and was quality checked GeoMedia Professional. Attribute data was derived and aggregated to the spatial data, which was also cleansed, using Feature Manipulation Engine (FME) and Oracle Spatial databases. All provisional spatial and attribute data are stored in Oracle as read-only but live attribute data. Future amendments to either the spatial or attribute data require a change request to be logged with Inforeq (inforeq@waikatoregion.govt.nz) and a Spatial Information programme member will apply those changes to the data either in an ad hoc or bundled manner depending on the number of changes coming in at that time.

A master version of the data will be maintained by Waikato Regional Council. Users of the data can question the accuracy of it and recommend changes to the Council but appropriate Council staff will decide whether or not to implement those changes at their own discretion. Any changes required of the data set must only be carried out on this master data set by Council staff. Waikato Regional Council holds no responsibility for any copies or derivatives of the data set that are edited by other parties.

Applications:
The data set was primarily created for Waikato Regional Council's "Prioritising Natural Areas for Biodiversity Management" project (DOCS# 1122331, 1123720, and 1204845). However other Council groups, such as River and Catchment services and Biosecurity, can also use the data to assist in their operations. Otorohanga District Council will be using the data for its own planning, prioritisation and consultation purposes.

The data is considered a provisional inventory and ranking of SNA of the Otorohanga District as at 2007. It is to be used in subsequent analyses and community consultation to help with the validation and finalisation of a list of SNA of the Otorohanga District.

PLEASE NOTE THE DISCLAIMERS BELOW.
The first report to be derived directly from the data set will be the Wildland Consultants contract report, "Significant Natural Areas of the Otorohanga District: Terrestrial and Wetland Ecosystems".

Data Set Availability:
The data was initially available only to Waikato Regional Council and Wildland Consultants staff to be used strictly for internal purposes. The spatial data, the "Significant Natural Areas of the Otorohanga District" report, and a spreadsheet of all attribute and ranking data can be made available to Otorohanga District Council for internal planning purposes upon the completion of a license agreement. This license can expire, be cancelled or be superseded depending on when circumstances require it.

The provisional data will be made freely available online to other parties under a Creative Commons license pending permission being granted from Otorohanga District Council planning staff and Waikato Regional Council Natural Areas / Biodiversity Prioritisation Project staff.

Access to the data in the SIGNIFICANT_FLORA, LIKELY_FLORA, SIGNIFICANT_FAUNA, LIKELY_FAUNA and OTHER_FEATURES attributes is restricted to Wildland Consultants and Waikato Regional Council staff and their contractors only. Requests for this data must be submitted to appropriate Council Significant Natural Areas / Biodiversity Prioritisation Project staff for consideration and approval. A restrictive license agreement between any user and Waikato Regional Council will be required to be signed should any request for this data be approved.

Acknowledgements:

- If the data is used in analyses or used to create derivatives, or if derivatives of the data are used in digital or hard copy outputs then the following acknowledgement must be used:
  Derived from Waikato Regional Council Provisional Significant Natural Areas data, 2007. Copyright Reserved.

- If the data is used in digital or hard copy outputs the following acknowledgment must be used (this acknowledgement must not be used for derivatives of the data):
  Provisional Significant Natural Areas data sourced from Waikato Regional Council, 2007. Copyright Reserved.

Disclaimers:
The following disclaimers must be included with outputs, as indicated, that contain any part of this "Provisional Significant Natural Areas of the Otorohanga District (2007)" data set:

- Full disclaimer (must be included in reports and any data outputs other than maps):
  The "Provisional Significant Natural Areas of the Otorohanga District: Terrestrial and Wetland Ecosystems" data are derived from analysis and interpretation of aerial photography along with information from ecological reports and data (where available), local ecological knowledge and limited field surveys. The data comprises an extensive yet provisional inventory and ranking of SNA of terrestrial and wetland ecosystems of the Otorohanga District. It may be subject to

revision through consultation with the Otorohanga District Council or other appropriate sources. The Waikato Regional Council strongly advise that the data be used only in conjunction with subsequent field surveys, especially if the data will be used to help with decisions on resource consents, the development of district plan and regional plan schedules, or funding priorities. The data have been captured at scales of 1:10,000 or smaller and it is recommended it not be used at greater scales (e.g. 1:5,000) without detailed field survey. The absence of an existing natural terrestrial or wetland ecosystem area from the "Provisional Significant Natural Areas of the Otorohanga District: Terrestrial and Wetland Ecosystems" data does not imply that such an area is not, or cannot be considered, a significant natural area, a significant area of indigenous vegetation or significant habitat for indigenous species. Such areas should be assessed when and if required.

- Short disclaimer (must be included in maps that display SNA boundaries and/or attributes):
  Provisional Significant Natural Areas data are derived from interpretation of aerial photography along with information from ecological reports and data (where available), local ecological knowledge and/or limited field surveys. The data are provisional and should be used for indicative purposes only. The data have been captured at scales of 1:10,000 or smaller and it is recommended it not be used at greater scales (e.g. 1:5,000) without detailed field survey.

- The standard Waikato Regional Council disclaimer must also be included in any maps or other data outputs produced by Waikato Regional Council:
  While Waikato Regional Council has exercised all reasonable skill and care in controlling the contents of this information, Waikato Regional Council accepts no liability in contract, tort or otherwise howsoever, for any loss, damage, injury or expense (whether direct, indirect or consequential) arising out of the provision of this information or its use.

STATUS INFORMATION

Data Status:
The dataset is subject to the limitations of a desktop study with limited field validation. There may be modifications to this original data set or a revised version of the data set should more information become available or should feedback, including that from Otorohanga District Council, DoC and/or other sources, including private landowners and field observations necessitates it.

It is expected the data set will be reviewed or updated by Waikato Regional Council at regular intervals depending on the availability of new aerial or satellite imagery. However, due to the large amount of work involved with such an inventory, this may only be in 5-10 year intervals.
Future amendments to either the spatial or attribute data require a change request to be logged with Inforeq (inforeq@waikatoregion.govt.nz) and a Spatial Information programme member will apply those changes to the data either in an ad hoc or bundled manner depending on the number of changes coming in at that time.

FURTHER METADATA INFORMATION

Related Information:

Boundary source data sets:

The following data sets were used for deriving the boundaries of the SNA_OTOROHANGA data set, and should be cited in the BOUNDARY_SOURCE attribute of the data set. Each data set listed below includes the format of the citation in the BOUNDARY_SOURCE attribute, followed by the full name of the data set, and DOCS numbers for relevant metadata if available.

CRS_PARCEL_OTOROHANGA (2010): "GIS_ALL.CRS_PARCEL_OTOROHANGA" from CRS - GIS Layer, based on data supplied in 2010 (metadata: DOCS# 871640)

DoC (2010): "GIS_ALL.DOC_CONSERVATION_LAND_EW" from DoC - Conservation Boundaries, based on data supplied in 2010 (metadata: DOCS# 881142)

DoC (2010): DoC - Nga Whenua Rahui Kawenata (Covenant), based on data supplied in 2010 (metadata: DOCS# 1215463)

QEII Covenant Layer (2010): QEII National Trust Covenants - GIS Layer, based on data supplied in March 2010 (metadata: DOCS# 881117)

Otorohanga DC Reserves (2011): Otorohanga District Council Reserves spatial data, reserves subset of GIS_ALL.DIST_PLAN_ODC_ZONE where ZONE='Reserve'.

WRAPS (2007): Aerial Photography - WRAPS 2007 - GIS Layer (metadata: DOCS# 1410510)

WRC Bioveg (2007): Waikato Regional Council Biodiversity Vegetation 2007 GIS Layer (metadata: DOCS# 1652753)

Bibliography of primary information sources:

The following is a list of data sets, databases, reports, other literature, and personal observations that are cited in the REFERENCES attribute as the primary information sources (other than WRAPS (2007) and BIOVEG (2002)) used in the assessment of sites in the SNA_OTOROHANGA data set.

This section is still to be completed, but the list given below, based on the Waipa SNA layer, will be indicative of information sources used to compile the SNA inventory.

Other Related Information:

The following is a list of references cited in the text of this metadata.

de Lange PJ, Norton DA, Courtney SP, Heenan PB, Barkla JW, Cameron EW, Hitchmough R Townsend AJ 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61-96.

Leathwick JR, Clarkson BD, Whaley PT 1995. Vegetation of the Waikato Region: current and historical perspectives. Landcare Research contract report LC9596/022, prepared for Waikato Regional Council. Hamilton, Maanaki Whenua - Landcare Research.

Miskelly CM, Dowding JE, Elliott GP, Hitchmough RA, Powlesland RG, Robertson HA, Sagar PM, Scofield RP, Taylor GA 2008. Conservation status of New Zealand birds, 2008. Notornis 55: 117-135.

Molloy J, Bell B, Clout M, de Lange P, Gibbs G, Given D, Norton D, Smith N, Stephens T 2002. Classifying species according to threat of extinction. A system for New Zealand. Threatened Species Occasional Publication 22. Wellington, Department of Conservation.

Townsend AJ, de Lange PJ, Duffy CAJ, Miskelly CM, Molloy JM, Norton DA 2008. New Zealand Threat Classification System manual. Wellington, Department of Conservation.

General Notes:
This data set may be appended with SNA data sets of other districts or ecosystem types to form one region-wide SNA data set.

Document Links:
The following documents are closely associated with this data set and provide further detail on the background and methodology behind the assessment and inventory of significant natural areas in the Waikato Region.
Contract for Services: Inventory and ranking of significant natural areas of Otorohanga District (WRC DOCS# 1663431).

Waikato Regional Council, Wildland Consultants Ltd 2002. Areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region: Guidelines to apply regional criteria and determine level of significance. Waikato Regional Council Technical Report TR2002/15. (DOCS# 791472).

Leathwick JR, Clarkson BD, Whaley PT 1995. Vegetation of the Waikato Region: current and historical perspectives. Landcare Research contract report LC9596/022, prepared for Waikato Regional Council. Hamilton, Maanaki Whenua - Landcare Research (DOCS# 1485592).

Whaley KJ, Clarkson BD, Leathwick JR 1995. Assessment of criteria used to determine 'significance' of natural areas in relation to section 6(c) of the Resource Management Act (1991). Landcare Research Contract Report: LC9596/021, prepared for Waikato Regional Council. Hamilton, Maanaki Whenua - Landcare Research (DOCS# 1694029).

WWW Links:
None.

Need More Help?
Email the Dataset Administrator:
inforeq@waikatoregion.govt.nz

APPENDIX VII: SCIENTIFIC NAMES OF PLANT SPECIES MENTIONED IN THE TEXT

Adiantum sp.	maidenhair fern
Agathis australis	kauri
Ammophila arenaria	marram grass
Asplenium bulbiferum	hen and chicken fern
Asplenium cimmeriorum	
Asplenium lyallii	Lyall's spleenwort
Asplenium trichomanes	
Avicennia marina subsp. *australasica*	mangrove
Beilschmiedia tawa	tawa
Coprosma acerosa	sand coprosma
Coprosma arborea	māmāngi
Coprosma grandifolia	kanono
Coprosma spathulata	
Corynocarpus laevigatus	karaka
Dacrycarpus dacrydioides	kahikatea
Dacrydium cupressinum	rimu
Dactylanthus taylorii	pua o te reinga; wood rose
Dracophyllum subulatum	monoao
Dracophyllum traversii	
Dysoxylum spectabile	kohekohe
Elaeocarpus dentatus	hīnau
Elatostema rugosum	parataniwha
Fuchsia excorticata	kōtukutuku, tree fuchsia
Veronica scopulorum "Awaroa"	Awaroa hebe
Hoheria sexstylosa	lacebark; houhere
Isachne globosa	swamp millet grass
Ixerba brexioides	tāwari
Knightia excelsa	rewarewa
Laurelia novae-zelandiae	pukatea
Leionema nudum	mairehou
Leptospermum scoparium	mānuka
Leucopogon fraseri	pātōtara
Litsea calicaris	mangeao
Lupinus arboreus	tree lupin
Melicytus ramiflorus subsp. *ramiflorus*	māhoe
Metrosideros robusta	northern rātā
Metrosideros species	rātā
Myrsine salicina	toro
Nothofagus truncata	hard beech
Ophioglossum petiolatum	stalked adder's tongue
Phormium cookianum	whararikī; mountain flax
Phyllocladus alpinus	mountain toatoa
Pinus radiata	radiata pine
Poa cita	silver tussock
Prumnopitys ferruginea	miro

Prumnopitys taxifolia	mataī
Quintinia serrata	tāwheowheo
Rhabdothamnus solandri	taurepo
Rhopalostylis sapida	nīkau
Salix cinerea	grey willow
Schefflera digitata	patē
Spinifex sericeus	spinifex
Urtica ferox	ongaonga, tree nettle
Vitex lucens	pūriri
Weinmannia racemosa	kāmahi

APPENDIX VIII: GLOSSARY

At Risk:

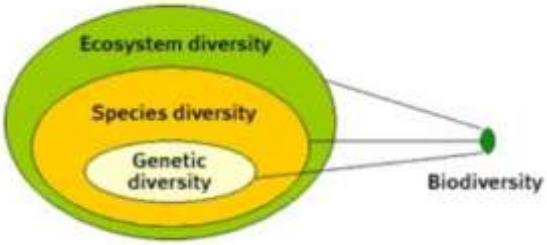
This means a species that, although declining and with small populations and/or small areas of occupancy, is not facing imminent extinction. In the New Zealand Threat Classification list this includes the categories Declining, Recovering, Relict and Naturally Uncommon.

Biodiversity (or biological diversity)**:**

Section 2 of the Resource Management Act 1991 (RMA) provides a definition for biodiversity: "the variability among living organisms, and the ecological complexes of which they are a part, including diversity within species, between species, and of ecosystems"; and/or is simply a way of defining the variety of life on Earth. This includes the different:

- types of animals, birds, fish, insects, plants, bacteria and other species;
- characteristics within a species, for example, how one giant skink differs from another;
- ways species live together, for example, how wood pigeons help to sow seeds;
- types of places species live together, for example, kauri forest or streams;
- ways in which species interact with their environment; the composition and abundance of species and communities in an ecosystem; and,
- 'engines' that makes ecosystems work e.g. the energy links that drive the interactions between trees, insects, birds and fish.

Biodiversity can be represented at three different levels as shown below:



(from MfE web site 2003)

Biodiversity is also about New Zealand's biological wealth. Much of our economy is based on the use of biological resources and we benefit from the "services" provided by healthy ecosystems. These include providing raw materials, purifying water, decomposing waste, cycling nutrients, creating and maintaining soils, and regulating climate.

Bioveg:

The short name for a Waikato Regional Council data set called "Biodiversity Vegetation". Information about this data set can be viewed at this web address: http://www.waikatoregion.govt.nz/Environment/Environmental-information/REDI/1652753/

Ecology:

(from Greek: οἶκος, oikos, "house, household, housekeeping, or living relations"; -λογία, -logia, "study of") Ecology is the interdisciplinary scientific study of the interactions between organisms and the interactions of these organisms with their environment.

Ecological District:

A local part of New Zealand where the features of geology, topography, climate and biology, plus the broad cultural pattern, inter-relate to produce a characteristic landscape and range of biological communities unique to that area. In New Zealand, 268 Ecological Districts have been identified and mapped (at 1:500,000 scale).

Ecosystems:

Communities of living things (animals, plants, fungi, bacteria and other micro-organisms) that interact with each other and their physical environment (soil, rock, minerals, air, water, temperature, salinity). The roles of the animals and plants, and their abundance, are inseparably bound up with the numbers of other organisms and the amounts of materials available, and with the kinds of physical forces acting at any time. There are ceaseless exchanges of materials, and of energy between living things and their environment, following cyclic pathways which are perpetually repeated, for example the carbon and nitrogen cycles. These cycling systems are characteristic of ecological systems, or ecosystems for short; and/or an interacting system of living and non-living parts such as sunlight, air, water, minerals and nutrients. Ecosystems can be small and short-lived, for example, water-filled tree holes or rotting logs on a forest floor, or large and long-lived such as forests or lakes.

Endemic species:

A species that exists naturally in a particular environment or location (e.g. New Zealand), and does not exist naturally anywhere else.

Exotic species:

A species that has been brought to New Zealand by humans, either by accident or design. A synonym is 'Introduced species'.

Habitat:

An ecological or environmental area that is inhabited by a particular animal and plant species. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and is utilized by) a species population.

Indeterminate:

Not able to be determined, defined or described accurately due to a lack of information.

Indigenous species:

A species that occurs naturally without the assistance of humans in New Zealand but which may be found in other countries. A synonym is 'native'.

Indigenous vegetation:

Any local indigenous plant community containing, throughout its growth, the complement of native species and habitats normally associated with that vegetation type or having the potential to develop these characteristics. It includes vegetation with these characteristics that has been regenerated with human assistance following disturbance, but excludes plantations and vegetation that have been established for commercial purposes.

Protected Natural Area (PNA)**:**

This is defined as an area of land that has formal legal status intended to protect indigenous ecosystems, vegetation, habitats, or species. Within the PNA network, different types of legislation provide different levels of protection.

Protected:

This means the site is on private and/or public land and/or water that is legally protected by statute or covenant (e.g. under the Conservation Act 1987, Reserves Act 1977, etc.) and/or other type of legal protection. A list and categorisation of protection types that were applied for the Otorohanga SNA is included in Appendix III.

SNA:

The short term for Significant Natural Areas. SNA means "...areas of significant indigenous vegetation and significant habitats of indigenous fauna" as defined in (Section 6(c) of RMA). Waikato Regional Council is identifying at the regional scale areas that meet one or more of the criteria in the previous Waikato Regional Policy Statement Appendix 3 as Significant Natural Areas.

Terrestrial ecosystems:

Terrestrial ecosystems can be defined in the most general terms as the various communities of organisms that inhabit the land in interaction with their environment. In the context of this project, terrestrial ecosystem types are permanently or intermittently dry areas with emergent vegetation dominated by forest, scrub and/or shrubland, or tussockland, excluding sand dunes, shingle beaches, and islands.

Threatened Species:

A species that faces a very high risk of extinction in the wild. Includes Nationally Critical, Nationally Endangered and Nationally Vulnerable species as identified in the New Zealand Threat Classification System lists (Townsend *et al.* 2008).

Threat Status:

National threat classification ranking for a species as identified in the New Zealand Threat Classification System lists (Townsend *et al.* 2008). Categories include: Nationally Critical, Nationally Endangered, Nationally Vulnerable, Declining, Recovering, Relict, Naturally Uncommon, Not Threatened, Migrant, Vagrant, and Coloniser.

Unprotected:

A site located on private and/or public land and/or water where there is no legal protection status.

Wetland:

Permanently or intermittently wet areas, shallow water and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions (Resource Management Act 1991). The vegetation may be exotic and/or indigenous woody plants such as willows or mānuka, and/or herbaceous plants such as sedges, rushes, raupo, or mosses such as sphagnum. "Willow wetlands" are wetland areas with a canopy dominated by exotic willows, but often contain indigenous vegetation beneath the willows.

Definitions are primarily sourced from:

Ministry for the Environment. 2000. *The New Zealand Biodiversity Strategy*. Ministry for the Environment. New Zealand.

Ministry for the Environment & Department of Conservation. 2011. *Proposed National Policy Statement on Indigenous Biodiversity.* Retrieved from http://www.mfe.govt.nz/publications/biodiversity/indigenous-biodiversity/proposed-national-policy-statement/index.html

Resource Management Act 1991.

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